Frontispiece. Miniatures from a 15TH century manuscript of Galen's works in the Saxon National Library in Dresden, Germany. The original is in color and the artist, as was customary, has portrayed the garb and pharmaceutical equipment of his own rather than of Galen's time. (*Adapted from Chemist and Druggist, Special Issue, 1927.*)

HISTORY OF PHARMACY

A Guide and a Survey

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PREFACE

THE organization and plan of this "History of Pharmacy" go beyond the merely chronological order which is so common in books of this kind. Facts and events have been grouped in accordance with their organic relationships, thus presenting an integrated picture of the development of all parts of the history of pharmacy.

The problems and difficulties involved in writing the book have been of two general types. First: the material available for the book, while extensive, tends to be scattered and partial. Pharmaceutical histories of several European countries were available as well as many detailed and highly specialized studies. The authors have been faced with the persistent problem of selecting, rejecting, subordinating, and co-ordinating this mass of material with particular reference to the needs of American students. Insofar as space permitted the authors have briefly included the background of cultural and political history which is the essential framework in which we must place the history of pharmacy.

Second: it has been necessary constantly to keep in mind the varying pedagogic demands to be made on the book. For this reason the material has been organized so that it may be used in conjunction either with a course of lectures or for topical studies. As will be readily apparent from examination of the book, it may be used for courses of different lengths by omitting certain chapters or portions of chapters.

Much study was required to accomplish this, and it has been necessary to eliminate from the chapters details not essential to the development of the subject. However, the book would have fallen short as a text if it had ignored details, and therefore these are supplied as compactly as possible in a glossary. For the sake of ready reference, these details are arranged in alphabetic order. Inasmuch as the glossary items are provided with numerous original references, they will greatly assist students in research.

For years the senior author has had the desire and intention of writing a history of pharmacy. Well-meaning friends have prodded him on to the task. The fact that the author was so long in getting to the work must be ascribed to lack of the time and energy necessary for such a project rather than to any lack of willingness. The manifold and insistent duties of the author's teaching work left little leisure for the sustained effort necessary. Moreover, much detailed study and collecting of materials has been essential in preparing such a history of pharmacy. The collecting and co-ordination of source material has been a primary interest to the author during his entire professional life. This collection has been char-

acterized as unique in the United States and not often equalled in Europe. It may therefore be permissible to consider Madison, Wisconsin, "the" natural birth-place of the history of American pharmacy.

The effective stimulus leading to the actual writing of the book was the presence and help of a colleague, Dr. George Urdang, whose entire time could be devoted to the work. The general plan and organization of the book are the senior author's, while the actual composition, documentation, etc., have been done by Dr. Urdang, to whom full credit should be given for the manner in which this difficult and arduous task has been performed.

The history of pharmacy is replete with inspiration for the youthful disciple who is preparing to devote his life to the service of mankind. This alone ought to make its study worth while. Important as this aspect may be, it is perhaps equally important that the pharmaceutical practitioner knows the past in order that he may understand the present and plan intelligently for the future.

That this book may aid him to accomplish this, is the hope of its authors.

E. K.

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PART ONE

EARLY BACKGROUNDS IN THE OLD WORLD

I

ANCIENT CIVILIZATIONS

BABYLON AND ASSYRIA

EUROPEAN pharmacy, and later the American, rose with the development of Western culture. As for the immediate predecessors, only the Near East, as the so-called "cradle of civilized mankind," offered any direct influence. Ancient Egypt, especially, contributed greatly to the progress of medicine, pharmacy and chemistry in Greece and hence in Rome. China and India followed the separate destinies of the Far East.

In dealing with "remedies" and their use by human beings, the first question, naturally, concerns the place, time and explanation of its origins. Many different opinions have been offered. Most historians of medicine and pharmacy now agree in the statement, "that neither empiricism nor magic stand at the beginning of the internal employment of remedies by men but the animal function, the instinct."[1]

This should not be interpreted as meaning that empiricism and magic have not played their important respective roles in the finding and employment of remedies. Medicine for a long time came within the compass of magic and was its inevitable companion, and empiricism confirmed or denied the actions of instinct. With systematization and the use of inductive and deductive reasoning, empiricism became the foundation of our medical and pharmaceutical "science." On the other hand, magic dominated, in the medical practice of the ancient Babylonians and Assyrians, as it does to this day among primitive peoples. It was also of the highest importance in ancient Egyptian medicine and we find traces of it in Greek medicine, in the medicine of the Middle Ages and even in that of modern times.

We have to bear in mind that the practice of medicine during antiquity in Babylonia and Assyria, in Egypt, and for a long time in Greece was one of the duties of a distinct class of priests especially educated in that art. Jastrow[2] characterizes the Babylonian-Assyrian medicine as follows:

> The net result of the bearings of divination on medicine may be summed up in the statement that as a consequence of the persistent hold maintained by the belief in signs of all kinds, disease became primarily an omen, the interpretation of which on the part of the priest as diviner supplemented the efforts of the priest as exorciser;

while the priest as healer availed himself of both these aids to supplement his efforts in the direct treatment of the disease. These three aspects of Babylonian-Assyrian medicine—exorcism, divination and medical treatment—blend together to form a composite picture in which it is not always possible to distinguish the different strains.

Illness was a divine punishment and healing a purification. With this, medicine had its fixed place in the religious ideology, in the eternal change between pollution through sin and purification through penance, called "catharsis." It may be mentioned that the concept of catharsis, going through the religions, found its most famous expression in the sacrifice of Jesus Christ, who gave his life to purify sinful mankind. The fact that medicine in antiquity, i.e., in Babylonia-Assyria, Egypt and partly in Greece, was determined by the ideology of catharsis characterizes it, according to Owsei Temkin,[3] as "archaic" medicine.

This is of specific pharmaceutic interest, because it explains the real meaning of the Greek word "pharmakon,"[4] and the old Egyptian word "ph-ar-maki," respectively, from which the term "pharmacy"[4] and its derivatives originate. It was from the religious ideology of catharsis, that the word and the concept "pharmakon" and later the word "purgans"[4] (purgative) derive.

Ancient cultures have always to be considered from the standpoint of their time, i.e., from the outlook on life afforded by their own spiritual, religious, geographic and economic conditions. There is always a beginning, a culmination and a decline or decadence (sometimes even manifold ups and downs). These facts are fundamental in any study of the cultures of antiquity. Yet we must look to that middle period, to the culmination and flowering of the culture, if we are to secure a picture of its most representative character.

The history of the old two-stream country, Mesopotamia, extends over at least three millenniums and embraces three different peoples, the Sumerians, the Babylonians and the Assyrians. Schelenz[5] gives a chronologic table of the history of Babylon and Assyria. The points to be considered are whether there were characteristic features during the entire period and which stage of development gave the most impressive proofs of these features and thus caused them to influence later periods and other cultures.

Thus it would be unfair to accept as proof of an "unscientific" spirit the fact that Babylonian-Assyrian, ancient Egyptian, and the early part of the Greek medicine contained a great deal of "magic." For these peoples, magic was systematized "science." It went hand in hand with empirical discoveries. Furthermore, magic was utilized by these peoples in their practice.[6]

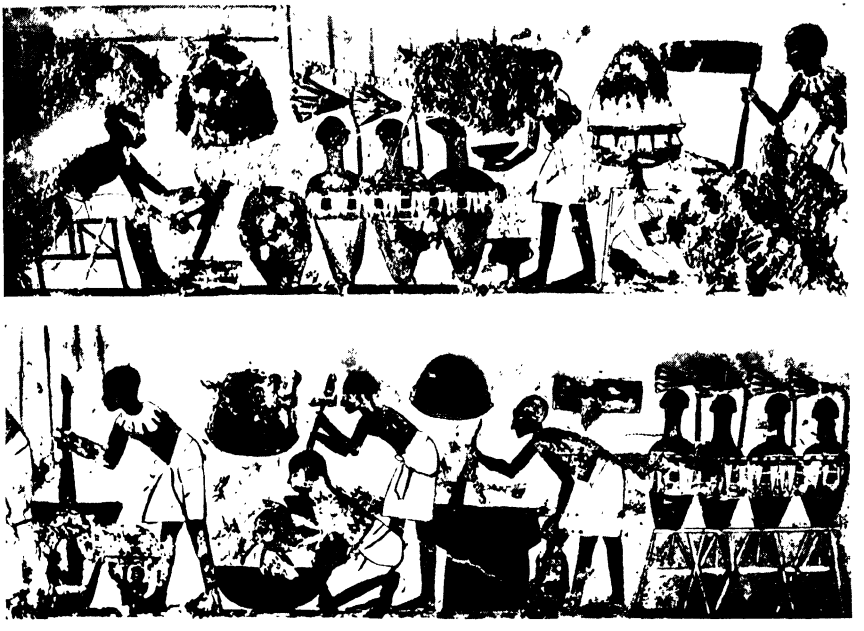


FIGURE 1. Egyptian Ointment Kitchen as portrayed in a tomb painting of the 18TH dynasty. The time is before 1400 B.C.

(*The original which filled a long, narrow panel is here divided, the upper plate being the left half of the original and the lower being the right half.*)

For want of any inscription the interpretation of the picture is not entirely certain. That it is no common kitchen can be seen by comparison with other contemporary paintings. Taking the finished product, the container filled with ointment on the small table, as a starting point and using classical representations of ointment kitchens for comparison the following interpretation is presumably correct: In truncated mortars three men crush oil fruits such as may be seen in baskets. The workman near the table with the ointment container is comminuting a drug, possibly frankincense or myrrh. The ointment cook melts it with the animal fat (suet), which imparts the proper consistency, in the kettle on the hearth, and finally a man shapes the cooled salve in round lumps. The treatment of wine with rosin, the rosinizing, seems also to be illustrated. Two of the three jugs to the left are closed with clay stoppers and on the third a bowl is placed. Unfortunately the damaged wall does not show what the cooper is doing with the bowl. In his left hand he seems to hold a sieve, unskillfully drawn—the liquid flowing into the container underneath leads to this assumption—with which he perhaps strains the rosin added to the wine in order to give it the peculiar taste which even today is appreciated in the countries of the eastern Mediterranean. The four jugs to the right are placed on their stand ready for the table. The part of the man to the extreme left hewing a log or plug is quite unintelligible. Before him are two baskets the contents of which cannot be determined—nor can the purpose of the two long mats be explained. (Walter Wreszinski: Atlas zur altaegyptischen Kulturgeschichte, Plate 356.)

As a matter of fact, we find a very comprehensive materia medica in these times of "archaic" medicine. Campbell Thompson[7] has compiled a list of 250 vegetable drugs employed in ancient Babylonian-Assyrian medicine to which a smaller number of drugs of animal and mineral origin is to be added.[8] A shorter list is found in Schelenz.[9] Excrements of animals and man were used, a custom met again and again among all peoples and during all ages. As to the modes of administration, we find mention of medicated wines, draughts, mixtures, ointments, embrocations, cataplasms, enemas, poultices, plasters, lotions, infusions, decoctions, and fumigations. According to a letter written by v. Oefele to Schelenz, there were a class of preparers of remedies and cosmetics, called "pasisu." We find no details about the time of their documentary appearance and their position within and in relation to medicine.

The most important contribution of ancient Babylon to human culture seems to have been its invention of a system of weights and measures. This is considered the basis for the weights and measures of all later times and peoples.[4]

EGYPT

Our knowledge of ancient Egyptian medicine and pharmacy is based on the writings of the old historians, especially the Egyptian Monethos, the Greek Herodotus (480-425 B.C.) and the Roman Pliny (1st century), the inscriptions on old Egyptian buildings and monuments, and the finding and deciphering of old medical treatises, written on rolls of papyrus and, therefore, called papyri. These papyri have thrown new light on Egyptian medicine of antiquity. In 1930, James Henry Breasted, who started his career as an American pharmacist, published and commented on the so-called "Edwin Smith Papyrus." This papyrus was discovered by an American, Edwin Smith, and now is the treasured property of the New York Historical Society. It has been and still is the subject of discussion and controversy among historians of medicine throughout the world. This controversy was inspired, however, only in an attempt to evaluate the scientific accuracy and significance of this papyrus as a representation of Egyptian medicine, as compared with other previously known papyri.

As previously stated, there is a close relationship between Babylonian-Assyrian and ancient Egyptian culture. Both have a theocratic foundation and the geographical position of the respective countries brought them into contact with Persia, India and even the farther East, i.e., with the products, the cultures, and the ideologies of those countries. Since Egypt was nearer to Europe, however, its classical medical empiricism played a

much greater role in Europe than did Babylonian-Assyrian medicine in which magic dominated. This made Egypt and not Babylonia-Assyria the precursor of European medicine and pharmacy.

The papyri which have thus far been translated, edited and commented upon have been listed by Owsei Temkin[10] in the following order:

Kahun gynecological papyrus. Kahun veterinary fragment.	Written about 1900 B.C.
Edwin Smith surgical papyrus.	Written about 1550 B.C.
Papyrus Ebers. Papyrus Hearst.	Written about 1500 B.C.
London papyrus. Papyrus Berlin 3038. Papyrus Brugsch minor.	Written approximately between 1350 and 1100 B.C.

Considered from a pharmaceutical point of view, the Papyrus Ebers (bearing the name of the German egyptologist Georg Ebers, who purchased the document in 1872 at Luxor in Egypt and brought it to the knowledge of the scientific world), is the most important, because it contains the greatest number of prescriptions and drugs. In the Papyrus Ebers as well as in the Edwin Smith papyrus and also in the other mentioned papyri, the text is, in all probability, of far greater age than the time of the copies which have come down to us. According to the thorough analysis of the entire material begun by the Berlin egyptologist Hermann Grapow[11] in 1935,—the Kahun manuscript mentioned above represents an old book on gynecology, the Edwin Smith papyrus a similar book on wounds, whereas the Papyrus Ebers contains remnants of many different books on vessels, ophthalmology, diseases of the stomach, etc. The papyri Ebers, Hearst, and Berlin 3038 are three large compilations of which the first is the best and the last is the poorest.

The Papyrus Ebers contains not less than 811 prescriptions and mentions more than 700 drugs from the mineral, vegetable and animal kingdoms. As in Babylonia-Assyria, excrements of men and beasts are found in the materia medica.[11a] The urine of children and that of adults are differentiated as to medicinal effect, a distinction maintained as long as excrements were official, i.e., until the 18th century. In an article announcing his translation of the papyrus into English, v. Klein[12] states that:

> a large portion of the diseases known to modern medical science are carefully classified and their symptoms minutely described . . . seventy-four prescriptions pertain to hair washes, dyes, oils, and depilatories.

The same author writes about the administration of remedies according to the Papyrus Ebers as follows:

> Medicines are directed to be administered internally in the form of decoctions, infusions, injections (meaning clysters), pills, tablets, troches, capsules, powders, potions, and inhalations; and externally as lotions, ointments, plasters, etc. They are to be eaten, drunk, masticated, or swallowed, to be taken often once only—often for many days—and the time is occasionally designated: to be taken mornings, evenings, or at bedtime. Formulas to disguise bad tasting medicaments are also given.

To this list fumigations, anal packs and suppositories are to be added. As others have pointed out before him, L. E. Warren[13] states that "some of the drugs (in the Papyrus Ebers) are disguised under fanciful names and many cannot now be identified."

In this connection it is noteworthy that there exists a Greek papyrus of about 200 B.C., which contains an interpretation of plants named after divine persons by the holy writers of holy books. It was published by Dieterich in 1888.[14]

The opinion has been expressed frequently that there were not many indigenous medicinal plants in ancient Egypt due to the topographical peculiarity of the country, bounded on the east by the Arabian desert, on the west by the Libyan desert, thus restricting the populace to the limits of the valley inundated by the Nile. This hypothesis seemed very probable. On the other hand, it is noteworthy that Theophrastus (4th century B.C.), quoting the verses of Homer, praises the many and efficient medicinal plants of ancient Egypt, and Dioscorides (1st century) mentions the Egyptian origin of 80 vegetable drugs described by him in his famous materia medica. In his "Studies in Ancient Materia Medica," Dawson[15] states that the pomegranate was not originally indigenous to Egypt but must have been extensively cultivated in Egypt at the time of the twentieth dynasty, i.e., about 1100 B.C. Hence, we may suppose that the ancient Egyptians cultivated many plants, originally not indigenous to their country, and used them medicinally.

As we have seen, there were in ancient Babylonia-Assyria a group of preparers of medicine, of whom we have no detailed knowledge and who by no means played any important part in the development of pharmacy and medicine. The variety of preparations used in Egyptian medicine requiring a high professional skill points to a more definitely distinguished group of preparers of medicine, and we find, indeed, that such a group existed.

Herodotus relates that the art of healing, at least in his time (5th century B.C.), was highly specialized in Egypt: "each physician is a

physician of one disease and of no more." H. Junker[16] was able to confirm all branches mentioned by Herodotus for a much earlier period. If we agree with Owsei Temkin[17] "that Egyptian medicine had sprung from various specialized practices taught by the father to his son or by the master to his pupil"—and the usual heredity of professions in the old Orient makes this opinion very probable—then we would have in old Egypt the art and science of pharmacy as a special branch of the art and science of medicine, practiced by a medical representative of the priesthood.

Basing his statements on Duemichen and the Ebers glossary, Schelenz[18] reports as follows: "The work of the pharmacist devolved upon the *pastophor* who, in his quality as preparer of remedies, was designated 'Urma'. . . . The profession had a high repute, the priestly physician-pharmacist himself was venerable."

A special room in the temple, the so-called *asi-t*, was provided for his work. "In this room the different drugs were preserved in cases not very different from the modern display cases, and in earthenware or glass containers, the shape of which has been reproduced frequently and is being copied in modern handicraft." It is significant that this institution has found its place also in Egyptian mythology. Anepu, whom the Greeks called Anubis, was the keeper of the divine house of medicines and the chamber of embalmment and may be regarded therefore as the apothecary of the gods of Egypt.[19]

We know that the vegetable drugs of ancient Egypt were used either fresh, or dried under the influence of direct sunlight or in the shade, according to their nature and the assumed better effect. Mortars for comminution purposes, hand mills for grinding, sieves and so on were in common use. It is very significant of the high standard of sanitation that we find a kind of house or travelling medicine (or cosmetic) chest. Such a chest, originating about 1780 B.C. has been found at Thebes in the tomb of the Queen Mentuhotep and is now preserved in the Egyptian Museum at Berlin.

According to Winkler[20] Egyptian weights were based on the decimal system. However, other systems were also in use.[21]

As in other countries governed or influenced by the theocratic rule of all early peoples, medicine in Egypt was supposed to have originated with some mythological deities of the country. In Egypt notably Thoth, Osiris, Isis, Horus, and Imhotep play this role. Gradually Imhotep became more and more the divine representative of medicine in Egypt. Imhotep was a real personage, one of the earliest of known physicians, who lived about 3000 B.C. and was deified 2500 years after his death. According to Breasted[22] the Greeks, who called him Imouthes, recognized in Imhotep their own Asklepios. According to Egyptian mythology

it was Isis, the wife of Osiris, who, in revealing to her son Horus the secret of pharmacy, provided an allegory of the origin of the profession. Before pharmacy became a distinct profession of its own, women and priests prepared and administered the medicines required in sickness. Thoth, frequently portrayed with the head and the wings of an ibis, is named "Ph-ar-maki" (warrant of security) under a picture showing him as pilot.[23] Here, according to Schelenz, we find for the first time the expression from which later such words as "Pharmacy" and similar terms were derived. As has been stated in explaining Babylonian-Assyrian medicine, it had its origin in the "archaic-magic" spirit (see p. 5). The technical skill of the ancient Egyptians in pharmaceutical practice is shown in their industrial use of many chemical processes and in their art of embalming, in which, with the use of their knowledge of preservatives and methods of preservation, they surpassed all other nations.[24] In this connection it may be mentioned that some historians derive the word "Chemie" (chemistry) from "Kemi,"[25] the ancient name of the Egyptian country. They are of the opinion that the art and science of chemistry had their origin on Egyptian soil.

According to Hermann Grapow[26] ancient Egyptian medicine, revealing a scientific character, reached its full development and was completed before 1600 B.C. and in the time of the new kingdom it degenerated into sorcery.

GREECE AND ROME

Pharmacy in ancient Greece and Rome shows very few differences, as the Romans adopted most of their customs from the Greeks and from them largely drew their ideas regarding medication.[27]

The Greeks, living on both sides of the Aegean sea and in the islands thereof, received many outside stimuli from both Mesopotamia and the Nile valley. Hence, if we compare the drugs and the forms of medication used by the ancient Egyptians and later on by the Greeks we find that the differences are neither very great nor important. The rise of the oldest and best known medical schools of Kos and Knidos on the main highways of traffic to the Orient is further proof of the connection between ancient Egyptian and Greek medicine. We are interested to ascertain the special character of ancient Greek civilization which impressed itself so indelibly on the western world and created what we call European culture.

The Greeks, in striking contrast to the ancient Oriental peoples with their disregard of the individual, based their entire culture, art, and science on individuality. "They thought as individuals, not as a people;

and the science they inherited from antiquity, from being anonymous,* became, in their hands, eponymous,† a character which it has ever since retained."[28] It should be mentioned that modern natural philosophy had its origin in ancient Greece. In addition it should be pointed out without further comment that Greek medicine and Greek natural philosophy, arising from the same root, were sometimes practised by the same men, thereby fructifying each other.

Hence, with the appearance of famous physicians upon the scene, different opinions were presented by the several schools. These varying viewpoints were defended in public. As a result, secrecy and mystery were gradually replaced by communication and discussion.

Thus it came about that the transition from the priest-medicineman to the independent physician took place without difficulty. There were several deities and demideities, to whom healing qualities were attributed, e.g., Apollo, Hephaistos, Herakles, Prometheus, who was especially named as preparer of remedies; the centaur Chiron, who was reputed to have been the teacher of pharmacy of Asklepios; and since the 7th century before Christ, above all others, Asklepios himself.[29] Sanctuaries devoted to Asklepios and to the healing of sick persons were erected all over the country. Life and therapeutic treatment at these places were quite similar to those in the places of pilgrimage of today. But beside this ecclesiastical medical practice, a lay medical profession developed and it is characteristic that these professional men traced their origin back to the deified priest-physician Asklepios, calling themselves Asklepiades. It seems, indeed, that in the early centuries of professional Greek medicine these physicians were members of one family.

So it is not surprising that Hippocrates, the so-called "father of medicine," the man whose fame and name overshadowed all his predecessors and successors is considered a member of this old Asklepedian family. There was indeed, in all probability, a physician with the name Hippocrates born in 460 B.C. in Kos who died in 377 B.C. in Larissa in Thessaly. But "nowadays scholars have given up the use of the word Hippocrates as denoting an historical person who was the author of at least some of the books that are contained in the Hippocratean Corpus."[30] L. Edelstein[31] has shown that not a single book in this Corpus, collected at Alexandria during the 5th and the 4th centuries B.C., can be associated definitely with the Hippocrates mentioned by Plato. What is important is the fact that this collection is evidence and proof of the high scientific and ethical level, not of an individual physician, but of Greek medicine during this period.

The fundamental principle which is here announced for the first time

* Not associated with the names of individuals.

† The opposite.

and which has been forgotten and repeatedly rediscovered and which gave rise to the slogan "back to Hippocrates," is the Hippocratean statement, that diseases cannot be isolated and considered as entities, but that the sick person is the entity to be treated according to the conditions of his nature. The Hippocratean theory of the "four humours," in the form given to it by Galen, was the medical gospel for more than 1,500 years.

Although the regulation of diet occupies the most important place in the Hippocratean Corpus, we find in it many drugs, mainly of vegetable origin. Wootton[32] gives a list of 195 drugs, other sources record as many as 400. The pharmaceutical processes mentioned in the Corpus are manifold and include the preparation of the following modes of administration, viz., fomentations, poultices, gargles, pessaries, pills, ointments, oils, cerates, collyria, looches (lohochs), troches, and inhalations. Narcotics are known and used: the juice of the poppy, also that of henbane seeds, and mandragora. The frequent references to purgatives, sudorifics, emetics, and enemas are due to the Hippocratean theory that the first requirement of medical treatment has to be the purification of the body from illness-producing humours.

This purification represented a bodily catharsis and involved a change in the concept of the word "pharmakon" from the original meaning of a charm whether a healing or a poisonous one. The word "pharmakon" in the Hippocratean Corpus means a purifying remedy and has since then become the general designation for remedy.

We have seen that Hippocrates is, as v. Wilamowitz-Moellendorff[33] called it, "a name without written records" or, more correctly expressed, a name for various written records by different authors. It may be well, therefore, to enquire about the famous "oath of Hippocrates,"[34] the first known rule of medical ethics, quoted, used and imitated through the ages. It is a later conception added to the Hippocratean Corpus by unknown authors. According to Singer,[35] the oath had its origin in the time of the early Roman Empire, from the desire of Greek physicians practising in Rome to maintain and secure the old Greek relation of pupil to master. "Despite the Ionic-Greek dress in which the formula is known to us, there is evidence that it is of Imperial date and of Roman rather than of Greek origin."

Famous as were the name of Hippocrates and the significance of the Hippocratean Corpus, their direct influence upon the development of western medicine and pharmacy was small as compared with the deep and lasting effect of the teachings of Dioscorides (1st century), Pliny (A.D. 23-79) and Galen (A.D. 131-201).

Pedanios Dioscorides of Anazarba was the author of a materia medica, which became the basis for European materia medica for many cen-

turies up to modern times. Naturally, he was not without predecessors. Tschirch[36] mentions many of them: philosophers, physicians, and rhizotomoi. The rhizotomoi were, according to Tschirch, the best experts in medicinal plants in the time before and shortly after Hippocrates:

> The *rhizotomoi* were erudite pharmacobotanists whose writings, if they had come to us, would probably fill the niche between Homer and Hippocrates and would show where the representatives of the Hippocratean period got their knowledge of medicinal plants. The fragments, which we know, are not less valuable than the writings of Dioscorides and contain the very earliest descriptions of medicinal plants.

The rhizotomoi collected the indigenous vegetable roots and sold them. In addition they themselves often practised medicine. Probably the most important representative of these rhizotomoi was Diocles of Karystos (4th century before Christ). He is considered to be the source of all Greek pharmacologic treatises from Theophrastus to Dioscorides. Another famous rhizotomist was Krateus (1st century B.C.) to whom we are indebted for the first illustrated herbal and whose drawings are in part contained in the famous Vienna Dioscorides Codex, once the possession of Juliana Anicia, daughter of Anicius Olybirius, Emperor of the Western Roman Empire (5th century). Theophrastus (372-285 B.C.) the so-called "father of botany" is of interest primarily only as far as the science of botany is concerned. He is, however, probably the first who mentions Filix and its effect and the use of the waterbath. All historians agree in the opinion that the herbal of Theophrastus does not belong to the sources used by Dioscorides.

It is not certain whether or not Dioscorides practised medicine. However, it is known that he accompanied the Roman armies through Asia Minor and also traveled in Italy, Greece, Gaul, and Spain. The fact that he not only described the drugs of his time and explained their effect but arranged his descriptions systematically made him the first teacher of materia medica and his treatise the most important and most used source in this field. The attempts of many later authors, up to the 17th century, to identify the plants in their native countries according to the description given by Dioscorides for Mediterranean plants have caused many mistakes. They are, however, the best proof for the high authority accorded Dioscorides.

Dioscorides' "De materia medica libri quinque" were translated into English in 1655. In this translation, not published until 1934,[37] the contents of the five books are arranged as follows:

book I: Aromatics, oils, ointments, trees; book II: living creatures, milk and dairy products, cereals and sharp herbs; book III: roots, juices, herbs; book IV: herbs and roots; book V: vines and wines, metallic ores.

To the translation, which is embellished with copies of the plant illustrations taken from the Viennese Dioscorides Codex, is added a comprehensive list of identifications of the plants of Dioscorides, which were suggested by Charles Daubeny in 1857. Another list we find in Tschirch.[38] Singer[39] gives a summary of the results of recent studies of the treatise of Dioscorides.

Dioscorides knew the formation of leadplaster from fats and lead oxide: He mentions the preparation of purified woolfat;' also that of extracts by the maceration process followed by evaporation, e.g., extracts of glycyrrhiza; and also the process of expressing the fresh juice of plants and concentrating it by exposure to the sun. He knew the difference between various gums: acacia, the gums of cherry, plum and almond, and tragacanth. He explained the usual adulterations and suggested means for discovering them. His remarks on the collection of drugs are excellent. His directions for their storage, being the first known and forming the basis for many later ones, may be quoted.

> Flowers and sweet-scented things should be laid up in drug boxes of lime wood. But there are some herbs which do well enough if wrapped up in paper or leaves for the preservation of their seeds. For moist (liquid) medicines some thicker (impermeable) material such as silver, or glass, or horn will agree best. Yes, and earthenware if it be not thin (permeable) is fitting enough and so is wood, particularly if it be box-wood. Vessels of brass will be suitable for eye-medicines and for liquids and (especially) for all that compounded of vinegar or of liquid pitch or of cedria but fats and marrows ought to be put up in vessels of tin (Translation by John Goodyear).

Between Dioscorides, Greek scientist by nature and study and Pliny, Roman general, admiral, and diplomat with a passion for collecting and compiling the entire scientific knowledge of his time there is no other connection than the fact that they were contemporaries, who wrote in part on the same subjects and often used the same sources. While Singer[40] gives Dioscorides full credit, stating that he has "practically determined modern plant nomenclature both popular and scientific" he characterizes Pliny as follows:

> Pliny is the compiler par excellence, the learned collector who will put down anything he is told or can read without verification. Scientifically the work is, therefore, worthless. Read throughout the

ages, alike in the darkest as in more enlightened periods, copied and re-copied, translated, commented on, extracted and abridged, a large part of Pliny's work has gradually passed into folkkeeping.

Nevertheless, the work of Pliny is of greatest value because most of the books which Pliny used—he himself speaks of more than 2,000—are lost. Tschirch says "Pliny's natural history represents to us an entire lost library."

Lists of the plants mentioned by Pliny we find in the German translation by Wittstein[41] and Fée's "Commentaires."[42] Recently Kenneth C. Bailey published two volumes on "The Elder Pliny's Chapters on Chemical Subjects."[43]

As far as known Pliny was the first to record the tannin-iron reaction recommended by him to ascertain whether verdigris had been adulterated with calcanthum (ferrous sulfate) or not.

As personified by Hippocrates, Greek medicine of the 5th and 4th century B.C. gave the world the spirit of real medicine; to Dioscorides it is indebted for its fundamental materia medica; and to Pliny for a summary of ancient knowledge. What entitles Galen to be added to this illustrious group? Galen was born in Pergamon A.D. 131, practised and taught medicine extremely successfully in Rome and died A.D. 201, in his native town. He created that fundamental system which ruled western medicine for 1,500 years. He himself claims to have continued and fulfilled the mission of Hippocrates and it was, indeed, "essentially in the form of Galenism that Greek medicine was transmitted to after ages."[44] The importance of Galen for pharmacy lies in the fact that in his works he paid so much attention to pharmacy. Hence his name remained connected with the preparation of "composita" by mechanical means, the so-called "galenicals," up to the present time.

Galen was the first physician if not the first scientist to explain that observation and experiment are the principal sources of knowledge and to act accordingly. The Hippocratean humoral pathology is the theory that health is a state of harmony of the four humours: blood, phlegm, yellow bile, and black bile. According to this theory, blood has the qualities moist and warm, phlegm those of moist and cold, yellow bile those of warm and dry, and black bile those of cold and dry. Galen made this concept the leading medical theory throughout the ages. He stated that drugs should be differentiated according to the predominance of one or more important therapeutic characteristics such as simples, compounds, or entities. The last were assumed to be efficient by their "whole substance," such as emetics, purgatives, poisons and antidotes. It should be recalled that his theory of the efficiency of drugs supplemented his humoral pathology. Besides the drugs considered by him as specifically

efficient, the simples and compounds had, in their turn, the qualities warm, cold, moist, and dry or combinations of them and could, therefore, be used to counteract deficiency or excess of one of the humours.

Galen prepared his medicaments himself and had a very high opinion of the efficiency of well chosen and prepared remedies. He had not only an "iatreion," the usual room of the Greco-Roman physicians for the preparation of remedies, but also an "apotheca" or storeroom. He described 473 drugs of vegetable, animal and mineral origin. In addition, a profusion of prescriptions is to be found in his medical treatises. Three remedies in particular, though in use before Galen, gained a world wide reputation for a millennium and a half because of his recommendation, viz. hiera picra (holy bitter), terra sigillata (seal earth) and theriaca (treacle).[45] The formula for a cold cream, essentially similar to the official Unguentum Aquae Rosae, has Galen as originator. It is of great pharmaceutical interest that Galen complains of the increasing practice, on the part of physicians, of leaving the preparation of medicaments to others instead of preparing these themselves. We know that there were among the Greeks as well as the Romans several groups of people collecting, preparing and selling drugs, medicaments, and cosmetics.[46] In Greece these people were known as *rhizotomoi, migmatopoloi, pharmakopoeoi, pharmakopoloi, myropoeoi* and *myripsoi*; in Rome as *pharmacopoli, circumforanei, sellularii, seplasiarii, unguentarii, pharmacopoei, medicamentarii, pharmacotritae, pharmacotribae,* and *pigmentarii.* (For explanations, see the Glossary.)

The very fact that these different groups existed shows that during Greek and Roman antiquity there was no distinct profession or class comparable with the apothecary of later periods.

With Galen the Greco-Roman epoch of medicine and pharmacy reached its climax. For a long time it was essentially his treatises and the materia medica of Dioscorides which in innumerable copies, commentaries, and extracts, under his name or disguised, disseminated medical and pharmaceutical wisdom throughout the western world.

Besides the names of these two great representatives of Greco-Roman antiquity it will be necessary to mention those of a few others of that period since their treatises survived and became important for medieval western medicine and pharmacy.

Chronologically the first is that of Aulus Cornelius Celsus. Like his greater successor Pliny, he was in all probability not a physician but a learned and medicinally experienced encyclopedist. As part of a large encyclopedic work, he wrote the book "De Medicina." The great influence which his treatise has had since the time of the renaissance (15th century) is due on the one hand to an accident and on the other hand to two distinguishing qualities. The accident was that Pope Nicholas V

found the entirely forgotten treatise among ancient manuscripts bought by him, and that he had it printed at a time (1478) when no other classical book on medicine or medicaments was available in printed form. The two qualities distinguishing the book were the excellent Latin in which it was written and the fact that Celsus had translated very many Greek medical terms into Latin and so offered not only a list of synonyms but a Latin medical nomenclature which has been widely adopted. W. G. Spencer[47] gives a list of the medicaments used by Celsus and an enumeration of his weights and measures converted into the metric system.

The first dispensatory, i.e., a collection of formulas for immediate practical use similar to the later pharmacopoeias, which has come down to our times is the "compositiones" of the Roman physician Scribonius Largus, written about A.D. 43.[48] It may be mentioned that a great part of the preface of this dispensatory is devoted to the defense of a thorough and plentiful use of medicaments and to the fight against medical nihilism, which existed even in those early days. Scribonius Largus says:

> We have to condemn all those who intend to deprive medicine of the use of remedies, the name, "medicine" being derived not from healing (a medendo) but from the power and efficiency of the medicament (medicamentum). All those should be praised who try whatever is possible to save the sick patient.

The formulary of Scribonius Largus contains only a few simples (simplicia), most of his formulas representing compounded medicaments (composita) with many ingredients. Scribonius describes the preparation and gives the first definition of opium, insisting on the use of immature poppy capsules as the source of opium and reserving the designation of "meconium" for the inspissated juice of the poppy leaves. He warns against the substitution of the juice of the leaves for the juice of the unripe capsules "as the pigmentarii prepare it in order to make a profit."[49]

The list of the Greco-Roman medical authors is closed chronologically with Paulos Aegineta (7th century) whose "9 books on medicine"[50] represent essentially a critically selected compendium with commentary composed of the writings of earlier authors, principally Dioscorides, Galen and Oribasios of Pergamon who in his turn toward the end of the 4th century, under the title "Synagogai," composed a famous collection of extracts from previous medical writers.

It is noteworthy that Paulos Aegineta, living at Alexandria at the time in which the Arabs took possession of this old stronghold of Greek science, remained there under the Arabian government and hence obviously represents, with his person as well as with his activity, the transmission of Greco-Roman medical wisdom to the Arabs.

2

THE ARABS AND THE EUROPEAN MIDDLE AGES

THE ARABS

THE triumphal conquest of the ancient civilized world by a group of Semitic tribes, called Arabs, in the 7th and 8th centuries is one of the miracles of history. Suddenly this primitive people became the heir and administrator of the remnant of the Greco-Roman culture. It must be admitted that it fulfilled the task imposed on it by destiny.

The story of the destruction by the Arabs of the famous Alexandrian library in 643 has been proved to be a "malevolent legend."[1] In reality it was brought about by the strife of fanatic pagans and equally fanatic Christians. The treasures which the Arabs found in Alexandria, and the translations of Greek manuscripts into Syrian produced by Nestorians in their schools in Nisibis, Edessa, and Gondêschâpûr were the basis of the so-called Arabic civilization.

"The Arabic civilization was at bottom the Hellenized Aramaic and the Iranian civilizations as developed under the aegis of the caliphate and expressed through the medium of the Arabic tongue."[2] The academies of the Arabians were true imitations of the famous Greek school of Alexandria.[3] The bulk of the medical literature which the western world received from the Arabs contained, therefore, the ancient wisdom, sometimes corrupted but sometimes also enriched, and it can be said that pharmacy in particular was essentially enriched by the Arabs. Not only was the ancient medicine which found its way to the European world through the medium of the Arabian language to a large extent devoted to pharmacology, but also the Arabian medical authors paid the greatest attention to the science and art of pharmacy. Persian and Indian drugs such as senna, camphor, sandalwood, rhubarb, musk, cassia, tamarind, ambergris, cloves, cubebs, and nutmeg, hitherto unknown to Europe, were described in the Arabian medical treatises by authors who were not infrequently of Persian origin. New methods of composing remedies were introduced. A series of preparations with sugar or honey, such as confections, conserves, juleps, and lohochs came into fashion. The more the materia medica increased and the more complicated became the pharmaceutical technic, the more the existence of skilled preparers of remedies became a necessity. It was in Bagdad, according to Kopp,[4] that

the first public pharmacy was founded in the eighth century. Several passages in the books of Arabian authors prove that there was a distinct pharmaceutical profession and that there were schools of pharmacy. Among the men of note the attribute *Ibn el-attar*, son of the apothecary, occurs not infrequently. The apothecaries were also known as "Sandalani," i.e. dealers in sandalwood.

According to Tschirch,[5] "the Apotheke is a specific Arabian creation . . . and it is very doubtful whether pharmacy would have developed in the way in which it did, if European medicine had remained free from Arabian influence."

But, was this influence, coming from authors writing in the Arabian language, strictly an Arabic influence? Campbell[6] answers this question as follows:

> The term Arabian does not necessarily imply an Arab, for the Persians and Nestorians in the East, and the Spaniards and Jews in the West took the principal part in the development of medicine which was expressed in the Arabic language during the dominancy of the Empire of Islam; the only prominent Arabic writer of pure Arabic stock was al-Kindi, who was known to the European scholastics as Alkindus . . . Arabic was the language of the learned in the Empire of Islam just as Latin was the linguistic medium of the educated in Western Europe.

The first medical scientist of importance, Jûhannâ Ibn Mâsswaihi, called Johann Mesuë Senior (777-857), one of the earliest physicians who wrote in Arabic, was a Nestorian Christian. He is known less for his "Selecta Artis Medicinae," a formulary which has not come down to us, than for the abuse of his name by the so-called Mesuë Junior.[6] The work of the Persian Abu Bekr-el Razi called Rhazes (865-925) was very important and much used in the European world.[7] His "Liber Continens," translated in the 13th century into Latin under the title "Continens Rhazes," represents a comprehensive view of ancient Greek medicine and of early Arabic knowledge, which was further increased by the results of the author's own experience. An antidotarium is attributed to him, which, if genuine, would be the oldest formulary after the antidotarium of the Roman Scribonius Largus. The historians of medicine, however, consider it an extract from the "Continens," prepared by Spanish physicians during the 13th or 14th century.

> Rhazes describes the most effective as well as most palatable methods of administering medicaments—in which preference is given to the pill form—and gives recipes, many of them very complicated, against specified diseases. In these mention is made for the first time of brandy, and arrack.[8]

FIGURE 2. The top illustration shows the preparation of a liquid remedy and the lower the preparation of theriac. Illustrations from a 13TH century Arabic manuscript of Galen's works. The unknown artist has portrayed costumes and equipment of his own rather than Galen's time. (*Adapted from Chemist and Druggist, Special Issue, 1934.*)

According to Campbell,[9] Rhazes was instrumental in introducing the extensive use of mercurial ointment both among the Arabians and in the Western world. He is said to have been the first to introduce chemical preparations into the practice of medicine.[10] According to Ruska,[11] Rhazes is the man to whom we are indebted for the beginnings of scientific chemistry. His writings departed from the merely symbolic and allegoric, to serve as a model for all chemical treatises of a practical and factual nature. Ruska has definitely shown that not the Greeks but the Arabs brought alchemy to the knowledge of the Latin West and that the Arabs owe their wisdom to the Syro-Persian learned world, in which Hellenistic and Oriental science had met. Unfortunately alchemy in Islamic Egypt during the centuries from the 9th to the 13th, i.e., after Rhazes, lost the factual character it had achieved through experiment and observation. Hence the contents of the alchemistic writings of that period are more or less fanciful literary inventions. On European soil these outgrowths became perfect nonsense as they passed through the hands of generations of ignorant copyists.

It may be mentioned that:

> the Arabic words *al-kimiya* and *al-iksir* were originally synonymous and each was used to denote the agent by which the baser metals could be transmuted into silver or gold. Later the term *al-kimiya* became restricted to indicate the art of transmutation (alchemy), whereas the term *iksir* or *al-iksir* continued to denote the medium by which the transmutation was effected (elixir) . . . It was believed that there was an occult connection between the planets and metals, as well as between the planets and various parts of the human body. The influence of this belief in Latin Europe is seen in such terms as lunar caustic and Martian preparations.[12]

The only other Arabian author who can be compared with Rhazes is also of Persian origin: Abdallâh Ibn' Ali-Hosain Ibn 'Ali As-Saib Ar-Raîs Ibn Sînâ, called Avicenna (980-1035). This man, physician, philosopher, and diplomat, to whom even his contemporaries attributed the title "prince of physicians," wrote among many other philosophic, natural historical, and medical books the "Qânûn fi't tibb." This was translated into Latin under the title "Canon Medicinae Avicennae."

To summarize his contribution:

> The entire theoretical and practical medicine with all its special branches is brought into a unified system. A perfectly uniform product is created without an equal of its kind in the entire history of medicine. The impression on the medical world in Orient and Occident was, therefore, enormous, surviving all other works. It

continued to be used as guide and authority nearly up to the 17th century. In the Orient the canon is still dominant.[13]

Of the five books into which the canon is divided, the second is devoted to simplicia, the simple drugs, and the fifth to the composita, the compounded remedies. The arrangement is alphabetic. The treatise of Avicenna is supplementary to that of Galen. Simultaneously the author used Dioscorides, many other Greek medical writers, and his Arabian predecessors, especially Rhazes. Perusal of the parts of the canon dealing with the medicinal uses of metals reveal a very extensive similarity to Dioscorides. Entire parts of the canon prove to be more or less literal translations of the Greek author.[14]

Schelenz[15] is of the opinion that the drug "uirz," mentioned by Avicenna, is to be considered as "kamala." Avicenna speaks of the silvering and gilding of pills. He is said to have introduced this practice into pharmacy. In addition should be mentioned the Persian 'Alî Ibn Al-Abbas (+994) who wrote a systematic textbook of medicine which became the first witness of Arabic science to be transmitted in Latin translation to the western world.

The famous Arabians of Persian origin who wrote on medical and pharmaceutical subjects were followed by those born in Spain. Abû'l Quâsim Al-Zahrâwi, called Albucasis (died 1013 in Cordova) owes his fame principally to his writings on surgery. He introduced the use of the actual cautery. Pharmacy is indebted to him for his "Liber Servitoris seu Liber XXVIII Bulchasin Benaberazerin"[16] dealing with the preparation of chemicals and a series of galenicals. He recommended the distillation of vinegar in order to get a purer product and improved the apparatus for distillation. It is interesting that he frequently quotes Dioscorides but never an Arabian author. Sir William Osler[17] regarded the "Liber Servatoris" as "primarily a manual for apothecaries, generations of whom battened on its rich polypharmacy . . . the most marvelous production of its kind."

The work of the Spanish born Ibn al-Baitar (born in Malaga 1197 and died in Damascus 1248) contains the most comprehensive list of drugs. Baitar mentions in his "Corpus Simplicium Medicamentorum" 145 drugs of mineral origin, 130 drugs from the animal kingdom, and about 1800 drugs from the vegetable realm. He describes and recommends among others the employment of colocynth, croton oil, nutmeg, and pyrethrum. He also gives detailed directions for the preparation of rose water by distillation.[18]

The origin of Jachia Ibn Serafiûn, called Serapion junior, is uncertain. He was born either in Persia or in Spain in the 11th or in the 13th century. His "Liber de Medicamentis Simplicibus or de Temperamentis

Simplicium" was an essential part of medieval pharmaceutical literature. Serapion describes liquid and solid storax and folliculi sennae.

Mention should also be made of the Spaniard, Abû Marvan Ibn Zuhr, called Avenzoar (1113-1162), whose treatise on practical medicine, named "Altersis" or "Theisir," describes the methods of preparing medicines in an interesting manner; also of the Spanish Jew Abû 'Imram Mûsa ben Maimon (1135-1208), called Maimonides, whose philosophy was perhaps of greater influence on the European world than his medical works of which his dietetic rules became especially famous. His rules concerning the duties of a physician are known as the "Oath of Maimonides," which, however, was compiled centuries later, about 1800.

However, great as has been the influence of these authors on Western pharmacy and chemistry, it was surpassed by the works of two unknown writers who for a long time were considered as Arabs living about the year 1000, but who are now known to have belonged to the 13th century: *Mesue junior and Gabir, latinized as Geber.*

In both cases the names adopted by the unknown authors were ennobled by previous fame, namely by the books of Mesuë Senior and the treatises of a mysterious Arab, Gabir Ibn Hajjan. According to Julius Ruska and Paul Kraus[19] the latter were in reality produced about A.D. 900 by an Islamitic sect, their objective being to combine the entire knowledge of that time with the theologic-philosophic ideology of the sect. The Latin treatises assumed to have been written in the 8th century had made the name of Geber famous, and on them rested the high regard for the early comprehensive Arabian knowledge of chemistry. These have been proved to be mystifications. Ruska's[20] opinion is: "Today a doubt no longer exists that these books are late Latin scripts (written in the 13th century), which were attributed for their better recommendation to the great Geber quite as other writings were attributed at about the same time to Aristotle and Plato, or to Rhazes and Avicenna."

According to Sudhoff,[21] Mesuë junior is "an assumed name under which, in the 13th century, writings of Occidental origin were issued." Sudhoff is of the opinion that the main treatises of Mesuë junior, namely his "Antidotarium" or "Grabadin," was written in upper Italy, probably in Bologna or Padua. "It remained obviously unfinished, hence Peter of Abano and Francis of Piedmont, both authors worthy of note, concluded the work."[22]

Although the names were fictitious, the works were of greatest reality and effect. The Latin writings of Geber were the holy books of the alchemists in the late Middle Ages and their unknown author was one of the earliest scientific chemists in Europe. The "Grabadin" of Mesuë junior was for centuries the authority on the composition of

medicaments. The book was not only in use in practically every European pharmacy but in addition became the basis of the later official pharmacopoeias. The "Grabadin" is, as Sudhoff calls it, "the pharmacological quintessence of Arabian therapeutics" and contains the entire armamentarium of compounded medicines which we owe to the Arabians. The arrangement is like that of the later pharmacopoeias. The compounded medicines are divided into groups according to their forms—confections, juleps, syrups, etc.—the monographs containing directions for the preparation of the respective products and also notes on their medicinal uses.

As to the paths by which Greco-Arabic medical literature entered the western world Campbell[23] writes as follows:

> The seventh to the twelfth centuries saw Islam and Christianity in intimate contact in Spain and Sicily, which were the two principal points from which the Latin West drew on Greco-Arabic medicine. After the fall of Syracuse (in Sicily) into the hands of the Arabians in A.D. 878, Sicily became a seat of Arabic culture until the year 1061, when the Normans under Guiscard and Roger, sons of Tancred, began the conquest of the island, completing it in 1091 . . . Of the Spanish centre of Arabic culture, Cordova was the principal seat, while Toledo, which was captured by the Christians in A.D. 1085, had a college of translators founded there by the Archbishop Raymond; this college became the most important centre for the transference of Arabic culture to the Latin West.

Of the three streams by which Greek science reached Western Europe, viz. the continuous tradition of Southern Italy, the Eastern (Byzantine) Empire, and the Arabians, the last was until the period of the Renaissance by far the strongest. It prevailed even in Salerno where the three streams met.

With Salerno we enter European soil and now will consider what happened to European medicine and pharmacy during the period between the rise of Islam and the time of the Renaissance, i.e., during the Middle Ages.

The Arabian Influence on Medieval European Pharmacy

There has been and still is much discussion as to whether the European Middle Ages were indeed the "Dark Ages," as they frequently are called by historians, or whether this contemptuous designation is due to a lack of understanding of the real circumstances of that period.

We should remember that the conquest of the ancient Roman Empire of the West, especially of Italy, by German tribes, the Vandals, the Longobards, the Visigoths, and the Ostrogoths, met a Rome represent-

ing only a shadow of her old glory and culture. Italy had been for centuries haunted by civil war, hostile invasions, and epidemic diseases which depopulated and demoralized the country. In such a situation the condemnation of earthly life and wisdom, the significant trend of early Christendom, not only found the broadest acknowledgment and success, but often led to the destruction of the works of pagan art and science. Long before the falsely alleged burning of the famous library of Alexandria by the Arabs, fanatic Christians had set fire to the Alexandrian Serapeion containing one of the largest ancient collections of medical manuscripts. The Christian Emperor Justinian I (527-567) closed the medical schools of Alexandria and Athens.

Thus the German invaders only continued the work of cultural destruction. They were all the more prone to do so because they could harmonize their increasing belief in the healing power of faith and the relics of saints more readily with their low cultural standards and previous religious ideas than with the scientific wisdom of antiquity. Thus the first tutelary saints for medicine and pharmacy, which in a measure replaced the old pagan deities of medicine, began to appear about the seventh century. The Arabian Christian martyr twins Cosmas and Damian, killed in the persecutions under Emperor Diocletian during the 4th century, became the most celebrated patrons of medicine and pharmacy in all the countries of Christendom. Later on other saints were added, to replace or to supplement Cosmas and Damian as guardians.

Individuals with some degree of knowledge of the old treasures, tried to rescue at least those parts of them which had practical value. The most important of these men was the learned Roman, Marcus Aurelius Cassiodorus (490-585), chancellor of the great Ostrogothic King Theodoric, in Ravenna (Northern Italy). Cassiodorus induced the king, who was himself familiar with ancient culture through his education at Byzantium, to create a magistrate especially empowered to safeguard relics of classical antiquity.[24] He himself founded a kind of classical academy in which the cultivation of medicine and pharmacy played an important part. In his "Institutiones," called by Sudhoff[25] the "fundamental book of medieval science" Cassiodorus established the rule[26] that the monks, who acted as physicians, had to consult Dioscorides, to read Latin translations of the works of Hippocrates and Galen and to study the work of Caelius Aurelianus, a Roman medical compiler of the first century. Thus the activity of Cassiodorus can be regarded as the basis of monastic medicine as well as of the survival of such independent scientific medical life as could exist during that period.

Sigerist[27] writes about the results of the activity of Cassiodorus as follows:

> Conditions developed in Ravenna and other centers that were very similar to those in Alexandria. And granted that there, too, the medical men may have been chiefly members of the church, their medicine was anything but monastic. The medical literature of the period is entirely Latin . . . By the end of the 6th century a fairly large number of classical books had been translated into Latin.

According to Sigerist the treatises of Oribasios and Alexander Tralliannus are to be added to the list mentioned in the "Institutiones" of Cassiodorus. This "fairly large number of classical books" represented, naturally, only a very small part of ancient medical wisdom. Moreover, it was used almost exclusively by a small group of persons. The empire of Theodoric the Great disappeared and new swarms of barbarian invaders put an end to that modest attempt toward a cultural renaissance. In those times of perpetual war, bloodshed and destruction, study was, according to Castiglioni[28] "almost exclusively restricted to the clergy, because only the church was a safe asylum provided for the studious . . . Thus was born monastic medicine." The prevalent spirit of that monastic medicine the same author[29] describes as follows:

> Medicine, after having played a most important part in Roman civilization, withdrew into the shadow of the church and became, under the influence of Christian dominance a dogmatic medicine in which the first and most important point was faith. Faith alone could cure the body and the soul of the sufferer and was the essential point in the help of the sick.

Therefore, during this period no opportunity was provided for the development of science nor for the enlightenment of men by science. In many monasteries the advice of Cassiodorus to collect and to use the old manuscripts was heeded. But only the few Latin treatises which the monks had rescued could be studied and used. According to Buck[30] these were principally "those of Celsus, Scribonius Largus, Pliny the Elder (to a slight degree only), and Caelius Aurelianus." Of the Greek manuscripts which they had collected and brought down to posterity they could make no use "being unable to read Greek." These manuscripts became important, when several centuries later, in the time of the Renaissance, scholars eagerly searched in all the cloisters of Italy and the West for original manuscript copies of the Greek medical writers. They found copies in a number of these institutions.

What really happened in the small sector in which there was a possibility of the cultivation and practice of scientific medicine in the Middle Ages we learn from the following statement by Sigerist:[31]

> What was mostly needed was short treatises, abstracts, epitomes, giving brief instructions for practice. A new literature arose, consisting of short treatises on urine, pulse, fever, dietetics, prognostic, bloodletting and, above all, endless prescriptions were written. These treatises sometimes were given the form of epistles or of dialogues, or of catechisms. They were anonymous, many of them falsely bearing the great names of Hippocrates, Galen, Democritos, Apuleius to give them more authority . . . This literature lasted, unchanged in character, until the 11th century. The turning point in the literary development was made by the translations of Constantin of Africa. They started a new movement, inaugurated a new literature, which from now on invariably had traces of Arabian influence.

The light of science in the Middle Ages, therefore, burned only gloomily and it was oxygen of Arabian origin which made it bright again.

Previous to the invaluable translations of Constantine of Africa the European scientific world had available the work of Dioscorides, parts of the treatises of Hippocrates, Galen, Celsus, Scribonius Largus, Pliny the Elder, Caelius Aurelianus, Oribasios, Alexander Trallianus, and some anonymous and pseudonymous abstracts. In his recent search in the Italian libraries, Sigerist[32] could encounter "over and over again" two such abstracts which he, therefore, considers to have been "undoubtedly the most popular treatises for many centuries . . . the passionarius Galeni and the herbal of Pseudo-Apuleius."

The "Passionarius Galeni" was probably compiled in Salerno in the 8th or 9th century from fragments or extracts of treatises of Galen and a series of compilations composed by authors of the 6th and 7th centuries which in their turn had again been based on Galen and other famous Greek physicians. The Pseudo-Apuleius called by Singer[33] "a futile work with its unrecognizable figures and incomprehensible vocabulary," represents an illustrated collection of vegetable drugs mainly taken from Dioscorides. Extracts from the work of Pliny are compiled for practical use in the so-called Plinius Valerianus and a "breviarium" known also as "Medicina Plinii" or "Plini Secundi Junioris de Medicina Libri." This breviarium, the "almost literally plagiarized Scribonius," also the Pseudo-Apuleius and other contemporary or earlier compilations are the sources of the book "De Medicamentis Physicis, Empiricis ac Rationalibus," written by a high Roman official of Celtic origin, Marcellus of Bordeaux, in 410 A.D. The peculiarity of the book lies in the fact that its author describes, in addition to the drugs of ancient classical literature known to him, many medicaments which were at that time in popular use by his people, the Celts.[34] About 200 years later the learned

Bishop Isidore of Seville (570-636) wrote his famous encyclopaedia, a part of which was devoted to medicine. In this treatise "especially Caelius has been plundered."[35]

Such in general was the materia medica of the Middle Ages until the infiltration of the Greco-Arabic medical literature into Europe: Some second-, third- and fourth-hand compilations brought together from the incidentally extant remnants of antiquity; very few fragments of original ancient medical literature written in or translated into Latin; and here and there Anglo-Saxon, Irish, French, and German books or lists, containing descriptions of indigenous vegetable drugs and directions for their medicinal use. The Anglo-Saxon leech books are the most famous representatives of the last mentioned type of treatises.

There is evidence that Irish and English scientists "contributed in a large measure to the preservation of civilization during the Dark Age."[36] The Anglo-Saxon Bede, called "the Venerable" (680-735), wrote a book "De Natura Rerum" which frequently refers to the encyclopedia of Isidore of Seville, and the scientific medical knowledge of that time such as it was. This manuscript was eagerly distributed by Irish and English scholars wandering through France, western Germany, and Switzerland as far as Northern Italy. The monasteries of Luxeuil (France), Fulda and Reichenau (Germany), St. Galls (Switzerland), and Bobbio (Northern Italy) were some of their stages.[37] It was at Reichenau in 825 that the German abbot Walahfried wrote his "Hortulus," a Latin poem on the plants growing in that district which became famous as poetry as well as an excellent description of the appearance and the medicinal virtues of the plants. The intense devotion to the medical and pharmaceutical treatment of the patients in St. Galls is attested by the plan of a new monastic building dating from the year 820. This plan, which has come down to us although the building itself has never been erected, provides not only an infirmary or hospital for the sick, but also a large "armarium pigmentorium," i.e., a special room for the preparation and storage of medicines, and last but not least a "herbularius," a garden for the cultivation of medicinal plants, the names of which are mentioned in the plan.[38] About 25 years earlier, in 794 or 795, the so-called "capitulare de villis" was promulgated by Louis the Pious, not by the Emperor Charlemagne as was assumed before the researches of Dopsch. This edict ordering and regulating the planting and raising of medicinally and otherwise useful herbs and vegetables in all the gardens appurtenant to the royal domain in Aquitania (Southern France) is important for pharmacy because it represents the first official acknowledgment of the importance of the cultivation of medicinal plants in Western Europe north of the Alps.

The medieval clerical or monastic medicopharmaceutical literature

reached its climax in the Latin poem about herbs entitled "De Herbarum Virtutibus" or "Macer Floridus," probably produced by Odo of Meune, Abbot of Beauprai, toward the end of the 11th century, and in the treatises "Physica" and "Causae et Curae" of the abbess Hildegard of Bingen (1098-1179). Of the "Macer Floridus" Singer[39] attests that it became one of the most popular books . . . and was the first independent herbal to be produced in the West in medieval times. Simultaneously, however, he states that the author used certain older Latin sources and that he drew on Constantine, i.e., on Arabian authors. Sudhoff[40] considers such an early "literary influence of South Italy, respectively Salerno, on the French medical schools . . . of little probability." However, in the case of the treatises of Hildegard, important especially for German pharmacy because of the many German botanical names mentioned by her, even Sudhoff states that the influence of Constantinus Africanus is unquestioned.

The famous School of Salerno was in existence long before Constantinus left the Orient and entered the Occident. In 539 Saint Benedict founded the hospital of his order at Monte Cassino located beyond the road from Rome to Naples. Gradually Salerno, the city at the foot of the Monte Cassino, became the seat of a guild of physicians to whom patients and students came from near and far. However, it is self-evident from the geographic and political situation of southern Italy that eastern influence should manifest itself before the time of Constantinus. Thus we know of an antidotarium written by the Jewish physician Sabbaitai ben Abraham, called Donnolo, who lived between 913-970 in Otranto.

This treatise was based on Arabic sources. Furthermore, according to Sigerist[41] the chief sources of the famous Salernitan "Antidotarium Nicolai" were Arabic. This, the first known version of which was written about 1100, was "the more or less official pharmacopoeia of the School of Salerno." These Eastern infiltrations, however, were essentially accidental and were neither fundamental nor were their consequences far-reaching. The activity of Constantine, however, was fundamental and influential. In him we have the first of the Western Latin translators of Arabian manuscripts.

According to Castiglioni[42] the period in which Constantinus Africanus (1020-1087) produced his translations of Arabic medical literature was that of Salerno's greatest splendor.

> Constantinus translated everything that came into his hands without picking the valuable from the meretricious, often forgetting to give the name of the author whose works he was translating.

The most important work of Constantine was the free Latin arrangement of the "Liber Regalis" of Alî Ibn Al-'Abbâs', which he very im-

pressively called "pantegni," the entire art in theory and practice, and which he published without naming the real author. The influence[43] on the European medical world of the translations of Constantine was enormous. Instead of mere fragments of ancient wisdom there were suddenly available systematic and complete works, which opened entirely new vistas. The effect became obvious within and outside of Salerno. Within a period of 50 years after the death of Constantine, Salerno produced a series of valuable medical publications. Especially remarkable from a pharmaceutical standpoint are two literary productions: 1. The alphabetically arranged comprehensive "Liber de Simplici Medicina" of Matthaeus Platearius, which under the title "Circa Instans," the two opening words of the book, was very widely distributed and translated into most European languages;[44] 2. an enlargement of the old Salernitan "Antidotarium," commented on later, by Matthaeus Platearius already mentioned. Outside of Salerno the effect of the activity of Constantine became obvious in two directions, in the employment of his translations in medical practice and instruction and in a series of further translations, for the most part produced on Spanish soil. The works of the so-called "Doctor universalis," the German count, bishop, teacher and writer on natural history Albertus Magnus (1206-1280) and of the so-called "Doctor mirabilis" Roger Bacon, the English monk and natural philosopher, were based on Latin translations of Arabian manuscripts originating in Toledo in Spain.[45]

In his doctor's thesis,[46] Joseph Hariz has made a series of statements, of which the following may be quoted:

1. Gerbert of Aurillac, who later became Pope Sylvester II, visited Spain about 967. He introduced the Arabic numerals into Europe and brought the knowledge which he acquired in Spain first to Germany, later on to Rheims, then to Chartres and finally to Rome. He can be considered the renewer of the scientific studies in the monasteries at the end of the 10th century and the first transmitter of Arabian wisdom to northern Europe.

2. Constantinus Africanus is the second transmitter of Arabian science and the first translator of Arabian medical treatises into Latin (11th century).

3. Gerard of Cremona, doubtless one of the most intelligent men of the Middle Ages, surpassed Constantine by far. He translated Avicenna, Rhazes' "Lumen Luminum," Albucasis, Serapion junior, and treatises of Hippocrates and Galen (12th century).

4. The Jewish physician Faraj Ibn Sâlim (Fararius or Faragut) completed his translation of the "Continens" of Rhazes in 1279.

In conclusion Hariz states:

> Arabian medicine was the means of connecting ancient Greek medicine with modern medicine, initiated in the period of the Renaissance.—It was first Chartres and Rheims, then, through the influence of Salerno, Paris and Montpellier, which made Arabic medicine a dominant part in the development of French medicine. During 9 centuries Arabic medicine led the way for French medicine.

What Hariz states for France can be said for the entire European world. According to Haefliger,[47] the Basel apothecaries of the 15th century were required to have the books of Mesuë junior, Avicenna, Serapion, Dioscorides, the "Macer Floridus," the "Circa Instans," the "Synonyma Medicinae" of Simon of Genoa (Symon Januensis, died 1303) and the "Antidotarium Magnum et Parvum Nicolai" in their libraries.

With the exception of Dioscorides and perhaps that of "Macer Floridus" all these books are of Arabian origin or more or less based on Arabic sources.

The "Antidotaria Nicolai" and the "Synonyma Medicinae" or "Clavis Sanationis" of Symon Januensis require a brief explanation. The book of Symon was of great importance because it represents a dictionary of all medicinal herbs mentioned by Greek, Arabic, and Latin authors. The "Antidotaria Nicolai" were subjects of discussion through the ages because of the somewhat complicated question of their authorship. Now historians agree that there are three important medieval formularies which bear the name "Nicolaus."[48]

1. The oldest formulary is the "Antidotarium Nicolai Salernitani" (falsely attributed to Nicolaus Praepositus) written about 1100 and probably not the work of an individual but representing rather a collection of formulas used and proved for a long time in the general practice of the Salernitan physicians and approved by them. It was enlarged and annotated by Matthaeus Platearius about half a century later.

2. The most comprehensive formulary is the collection of recipes written between 1270 and 1290 by Nicolaus Myrepsus also called Alexandrinus.

3. The "Dispensatorium ad Aromatarios" (previously regarded as a second treatise of Nicolaus Salernitanus), but now supposed, according to Wickersheimer,[49] to have been written by Nicolaus Praepositus at Lyon or Tours about 1500.

In the first version the "Antidotarium Salernitanum" contained about 50-60 formulas, later on 140-150. Incomplete French translations of a

later edition written in the 14th and 15th century have been edited with commentaries by Paul Dorveaux.[50]

Another famous book is closely associated with Salerno. Its authorship was for a long time a subject of controversy. This is the "Flos Medicinae" or "Regimen Sanitatis." According to the Latin statement on the title page "Anglorum Regi scripsit tota schola Salerno" it was written for an English king by the entire school of Salerno. Formerly the book, which contains dietetic and pharmaceutical rules in impressive verses, was supposed to have been written about 1100 at Salerno. Now most historians of medicine and pharmacy are of the opinion of Sudhoff[51] who writes:

> Arnald of Villanova composed a small selection of some 360 verses using old medical poetry from Salerno, from other Italian places, and France, and added a commentary in prose which in the earlier editions was always printed with the verses.

It has been translated into all European languages, frequently with comments and additions. In all there appeared about 300 editions.

Singer[52] sees in the mentioned "ascription" (dedication) of the "Regimen" to a king of England a "recommendation of the poem to the reader completely in the manner of the time . . . After all, these manuscripts had to be sold and what better way than to attach a King's name to them."

The same Arnald of Villanova (1235-1311) was one of the most progressive physicians of the late Middle Ages. He was a teacher of medicine at the University of Montpellier for more than a decade. Influenced naturally, like his colleagues, by Arabic medical science, he was one of the first European scientists who turned against the subtleties of the Arabian authors and against the strained interpretations which monastic authors placed upon them. He was one of the first physicians in Europe to recognize the importance of chemistry for medicine, leaning, however, in the direction of alchemistic speculation and mysticism.

The invention of the art of printing greatly extended Arabian influence on European medicine. Among the first dated printed medical books we find the "Grabadin" of the Pseudo-Mesuë, the "Antidotarium Nicolai," the "Liber Servitoris," all printed as early as 1471. There followed the Serapion (1473), Rhazes (1480), Avicenna's Commentaries, etc.[53]

With the transmission of Arabian medicine and polypharmacy to Europe the conditions, which in the countries of the East had caused the creation of public pharmacies, likewise caused the establishment of similar institutions in European states. In the 11th century, perhaps even earlier, public pharmacies began to appear in Southern Italy, Southern France, and probably in other places. We know of the "statuta sive leges municipales Arelates," regulations for physicians and apothecaries in

FIGURE 3. Arabic and Greco-Roman Scientists in a Pharmacy.

Arles, a town in southern France, which were promulgated between 1162 and1202. These statutes called for a separation of the medical and the pharmaceutical professions, provided a pharmaceutical oath and forbade the management of pharmacies by physicians.[54] The law, however, which created the European pharmacy, was the medical order promulgated by the German Emperor Frederick II for Sicily and southern Italy in 1240.

Thus, pharmacy, with its beginnings in the instinctive defense against disease by primitive peoples, developed under several diverse influences. As part of the work of the priests at first, it later fell among the duties of physicians. It found its own form and expression in the culture of Greece and Rome and developed a kind of professionalism in Byzantium. Only under the influence of Arabian wisdom and control, however, did it take firm root in European soil as an institution of public welfare to be respected, regulated, and further developed.

PART TWO

THE RISE OF PROFESSIONAL PHARMACY IN EUROPE

3

MEDICAL THEORIES AND MATERIA MEDICA

IN THE year 1240 the German Emperor Frederick II issued an edict which was to be the Magna Charta of the profession of pharmacy.[1] This edict, although promulgated by a Hohenstaufen who was emperor of the Holy Roman Empire of the German Nation, applied only to the restricted territory of the dual kingdom of the Two Sicilies, the kingship of which Frederick held as an inheritance from his Italian mother.

Three of the regulations of the edict created pharmacy as an independent branch of public welfare service and were of well-nigh universal application in the centuries that followed. Two additional regulations were highly influential in the development of public pharmacy in most of the states coming into the sphere of German culture. While these latter regulations became effective in part in Latin Europe they were not put into practice in the Anglo-Saxon world.

The three essential regulations are:

1. Separation of the pharmaceutical from the medical profession. This rule, which was transgressed now and again by both parties, nevertheless constituted the charter of pharmacy as an independent profession. This separation was an acknowledgement of the fact that the practice of pharmacy required special knowledge, skill, initiative, and responsibility in order to guarantee adequate care of the medicinal needs of the people. Forbidding any business relation between physician and pharmacist, the law tried to stabilize the ethical principle that only professional service and not exploitation of the sick should be the function of the healing professions.

2. Official supervision of pharmaceutical practice. Thus was acknowledged the importance of pharmacy as a public health service for the protection of the public.

3. Compulsory use of a prescribed formulary according to which medicaments must be prepared. At the time the law was passed and for the territories concerned the formulary prescribed was in all probability the "Salernitan antidotarium." This requirement acknowledging the necessity, not only of reliable remedies but also of their uniform preparation, can be considered the first European legal reference to a pharmaceutical standard similar to the later pharmacopoeias.

The two sections of the law which did not find general application were:

1. The limitation of the number of pharmacies; and
2. Governmentally fixed prices for remedies.

The question whether the public pharmacies have developed from the monastic dispensaries or from general stores, in which the trade with drugs became more and more specialized has been a subject of discussion. In the history of the period both trends can be discerned. However, the transference of the clerical dispensaries, open to the general public and therefore competitors of the private apothecary "shops," to private owners came at a relatively late period. Haefliger[2] states that in the case of the Swiss city of Basel, "monastic and private pharmacies existed for a long time side by side . . . Only the discontinuance of the monasteries after the reformation about 1528 caused the monastic dispensaries to disappear." In the countries which retained or restored the Catholic faith, e.g., in Bavaria and Austria, such public monastic apothecary "shops" existed until the early 19th century.[3] It is without doubt, however, that the first European non-monastic apothecary shops, like the non-monastic physicians in the Middle Ages, owe most of their scientific knowledge and practical skill to their clerical predecessors.

> Monasticism has eternally to its credit that it afforded to culture a sanctuary in the midst of barbarism and with far reaching result sowed the seeds of civilization simultaneously with those of the healing art where the Roman legions had never penetrated.[4]

We have seen that this "barbarism" in the late Middle Ages disappeared more and more under the influence of the Greco-Arabic literature. However, the foundations of science had to be relaid, since with few exceptions, Arabic and medieval Christian scholasticism were equally guilty in mistaking hair-splitting subtleties for research. Hence real scientific progress was impossible until the advent of that memorable period known as the Renaissance.

Sudhoff[5] has shown that the substantial replacement of the medieval Greco-Arabic medical literature by Greek originals, found in the monasteries and transmitted to Europe after the conquest of Constantinople by the Turks in 1453, was neither immediate nor considerable. "What benefit could be derived from the endeavour to acquire new authorities for the old ones?" asks Sudhoff. But the Renaissance meant not only the return to the original works of the Greeks, to "other authorities"; it meant the return to the Greek spirit, to the esteem of the Greeks for individualism and, with this, to their liberty of thought. The famous words of the philosopher René Descartes, [latinized Renatus Cartesius (1596-1650)] *cogito, ergo sum* (I think, therefore I am) characterize the essential meaning of the Renaissance period. It meant also that the restrictions imposed on Europe by the Arabian and clerical scholasticism

FIGURE 4. Gilded wood figures of disputing physicians. The originals are in the Historical Pharmaceutical Museum in Basle, Switzerland.

of the Orient were overcome. It meant the rebirth of independent thought, with the fair promise and challenge to the imagination that it offered. It opened new worlds of thought, discovered new horizons, created unexpected possibilities. The discovery of America, in 1492, gave opportunity for actual physical expansion and expression for this spirit. Those who followed Columbus, did so with the zest and creative vigor demanded of them by the richness and promise of the new world. Vasco de Gama found an all-water route to the East Indies six years later, in 1498, and the treasures of the Far East were brought closer to eager hands by the discoverers.

Now began that admirable intellectual competition of European individuals and peoples which made Europe, small though it was, the dominant continent, and its people dominant in the world. As in all fields of science, so in the development of medicine and therapy a chain of somewhat different ideas or systems followed one another. Many of these systems gained international acceptance and exercised influence on the materia medica and, through it, on pharmacy. Hence, the pharmacist should know at least the most important men associated with these ideas and the facts connected with them.

Thus far we have taken notice of but one theory of the human body and of the nature of the disease: the humoral pathology, hinted at in the Hippocratean Corpus and perfected by Galen (see page 14 and glossary). But another ancient concept, elaborated in the 2nd century by Soranos, offered the theory that not the "humours," but the "solids" were responsible for health or illness: the solidar pathology. Normal tension of the walls of the ducts which are to be found throughout the entire body signified health, too strong or too weak tension, producing the "status strictus" or "status laxus," caused sickness.[6] Hence if sickness is a physical condition it must be cured mostly with physical means.

With different variations we meet these two kinds of medical hypotheses again and again. The concept that sickness is nothing more or less than a disturbance of the body chemistry is another theory of highest pharmaceutical importance. Such a disturbance, according to this argument, could be cured by the use of the proper chemicals. The physican Paracelsus (1493-1541), one of the most revolutionary spirits of all times, was the first to propose this theory. His insistence that the preparation of efficient medicaments is the most important task of chemistry helped to explode the alchemist's old dream of turning baser metals into gold. Paracelsus endeavored not only to introduce chemicals for internal use into the materia medica,[7] but also tried to find new and efficient methods for the preparation of tinctures and of liquid extracts containing the essential virtues of the extracted drug, his so-called "quintessences." He assumed the presence of a mysterious force dominating all

functions of life which he called "archaeus"—the acceptance of this "vital principle" being in a measure inconsistent with his central theory. This archaeus and the concept that sickness is the expression of certain chemical changes in the body produced by a morbid mood of the archaeus, we find again in the medical system of the Fleming van Helmont (1577-1644), the famous discoverer of carbonic acid and the introducer of the concept and term "gas." However, the man who founded the so-called school of iatrochemistry was Franz de le Boe Sylvius of Leyden (1614-1672). His theory was a compromise between humoral pathology and the ideas of Paracelsus.

In striking contrast to the iatrochemical school stood the iatrophysical or mechanical theory founded by Santorio Santoro (1561-1636) in Padua, based on the concept of the body as an engine. A new kind of solidar pathology was announced by Friedrich Hoffmann in Halle, the famous inventor of Hoffmann's drops and many other remedies (1660-1742). According to him life depends, as the ancient Soranos assumed, on the normal tension of the solid parts of the body. However, unlike Soranos, Hoffmann taught that these solid parts are not the ducts, but the fibers, the ultimate elements of the body visible under the microscopes of that period. This materialistic theory had its antipode in the ideology of Ernst Stahl in Halle (1660-1734). His concept of illness and therapy was named "animismus," because Stahl considered the soul (Latin: *anima*) the highest principle of life balancing all bodily functions by a distinct rhythmic movement. This movement produced a certain tension called "tonus." The individual was ill if this tonus was not regular. The task of remedies was to aid the anima in its endeavor to restore the normal tonus. It may be mentioned that Stahl also formulated the phlogiston theory (see glossary).

Similar to the animism of Stahl was the vitalism of the Frenchman P. J. Barthet, a theory promulgated in 1778, in which the soul was replaced by the so-called vital principle. In England two theories in particular gained wide acknowledgment: 1. The concept of William Cullen (1710-1790) that all bodily functions are regulated by the so-called nervous principle which in cases of illness tries to restore normal conditions by convulsion or by atony. The remedies had, therefore, to be either irritating or emollient. 2. The Scotch physician, Brown (1735-1788), a pupil of Cullen, advanced the theory that not the nervous principle but the stimuli which set it in motion are the decisive factors for health or sickness. Normal life is considered a state of harmony between excitability and the incessant external and internal stimuli which act on the body, and all diseases have their final cause in a misproportion between the excitability of the organism and the stimuli, the latter being too strong or too feeble.

The first half of the nineteenth century saw the reign of the medical theory and school of pathologic anatomy which was started by Morgagni (1682-1771) of Bologna; continued by Corvisart (1755-1821) and Laennec (1781-1826) in Paris; and brought to its culmination by Rokitansky (1804-1878) and Skoda (1805-1881) of Vienna.[8] According to this school, maladies were localized in the ill parts of the body and made obvious by anatomic changes. There were generalized diseases too, their habitat being the blood. Even these general diseases, however, were supposed to have a tendency to localize themselves. Thus there were no sick individuals but only distinct, anatomically demonstrable illnesses. The natural consequence of this theory was to relegate therapeutic efforts more and more to the knife of the surgeon and to condemn or at least to deprecate internal medication which was of necessity more general.

> The physicians of the younger Vienna school threw everything overboard which seemed not quite sure in its action around the middle of the century. What remained was so little that one was forced to an actual therapeutic nihilism, which of course did not do the sick any particular good.[9]

The man whose work crowned the development of solidar pathology was Virchow (1821-1902), the founder of so-called cellular pathology which, briefly stated, is as follows: The cell is the bearer of life. Disease is the reaction of the cell to abnormal stimulation. "The organism is," according to Virchow's own statement, "not a unified but a social arrangement." Sigerist[10] characterizes the influence of the work of Virchow on therapy as follows:

> It was Virchow's work which enabled doctors to realize that the point of onslaught of remedies in the organism are not the organs in general but the cells. We now know that there are peculiar affinities between particular cells and particular chemical substances. Thanks to the recognition of this, both pharmacological and dietetic treatment had become far more purposive.

Internal therapy, almost annihilated by the Viennese school, once more received attention. The assumption of "peculiar affinities between particular cells and particular chemical substances" is the basis of the very useful theory of the Swiss Emil Buergi, according to which mixtures of drugs with different affinities multiply desired effects and eliminate those undesired.[11] This theory justified many of the mixtures of old and approved new combinations. Thus, on the basis of cellular pathology and the development of chemistry, pharmacology became an experimental science, testing the efficacy of drugs experimentally on animals. There exists an unquestioned relationship between the chemical constitution of

a substance and its pharmacologic action. "This is very important because it makes it possible to look for new drugs systematically by manufacturing in the laboratory synthetic chemical bodies with certain properties whose action may be anticipated. By this method Ehrlich sought for a specific remedy for syphilis and the 606th preparation which he manufactured, was salvarsan" (Arsphenamine).[12] This direct attack on the morbific agents in the body by the means of chemical substances having specific effects has become a wide field of therapeutic-chemical research under the name of chemotherapy.

The cellular pathology of Virchow is the last important European attempt to formulate a general theory to explain the nature of health and sickness and by implication to show the medical treatment indicated in various diseases. But there are several other specific medical, medico-chemical, and biologic discoveries which had and still have a great influence on pharmacy.

The idea of artificially induced immunity against contagious diseases was outlined by the English physician Edward Jenner (1749-1823), when he, leaning on earlier empiric observations and his own experiments, in 1798 first reported on his success in inducing in subjects the harmless cowpox and finding it a reliable prophylactic against small pox. This courageous deed received scientific support with the discovery of the laws of bacteriology and their practical application by the French chemist Louis Pasteur (1822-1897) and by the German physicians Robert Koch (1843-1910) and Emil v. Behring (1854-1917). To Pasteur we are indebted for the methods of employing cultures of weakened bacteria, the so-called vaccines; for his demonstration of the existence of sickness-producing germs in the air; and, especially, for the discovery of sterilization and pasteurization, the knowledge and technic by which micro-organisms and their spores can be destroyed by heat and other agents. These discoveries in turn made possible the introduction of antisepsis, i.e., the use of disinfectants in the treatment of wounds by the English surgeon Joseph Lister. Finally, this was followed by asepsis, i.e., the use of material made sterile by heat or other means. In addition to the discovery of a series of morbific agents, we owe to Koch the modern technic of bacteriology; to Behring we are indebted for the knowledge of how to produce antitoxins in the blood serum of animals by immunizing them with specific toxins.

Brief mention should also be made of the theory of so-called avitaminoses, diseases produced by the lack of some substances in food which we now know under the name of vitamins; and lastly of the diseases caused by lack or superabundance of hormones in the body.

The word vitamin is derived from the Latin *vita* (life), and amine, the chemical type to which the inventor of the term, Funk (1912), con-

sidered the vitamins to belong. Since 1913, the United States and England have contributed the greater part of the newer knowledge of the vitamins. At present the structure of only a few vitamins has been ascertained. They have been found in foodstuffs of both vegetable and animal origin.

The word hormone is taken from the Greek. It means to excite. The hormones are products of the glands of internal secretion and regulate to an appreciable extent our entire personality. We owe our knowledge of these internal secretions to the Franco-American physiologist Brown-Séquard, who published the results of his researches in the latter part of the 19th century. One of the most important hormones, insulin, was discovered by the Canadian physician, Banting, in collaboration with McLeod, Best, and Collip in 1922. Thyroxin was isolated from the thyroid gland in 1915 by E. C. Kendall of the Mayo Foundation at Rochester, Minnesota. A good survey of the vitamins and hormones, their history and use is given in the book entitled "The Little Things in Life."[13]

In addition to these theories and discoveries, a peculiar pharmacologic system was proposed in the beginning of the 19th century by the German physician, Samuel Hahnemann. Somewhat later this found wide acknowledgement and special cultivation particularly in America.

> Hahnemann established the general therapeutic principle that disease is cured by such remedies as call forth symptoms which resemble the disease in question. More than this, the remedies were to be used in very weak concentrations. The treatment was thus based on the principle "similia similibus" and Hahnemann called his theory homeopathy (from the Greek word *homoion*—similar) in contrast to the principles of the ancient therapy "contraria contrariis" (contrasting symptoms and remedies) and which Hahnemann consequently called "allopathy" (from the Greek word *alloion*—different).[14]

The pharmacist was forced to change with changing concepts. If we examine this problem thoroughly, however, we arrive at a very peculiar result. With one exception, and that a very important one, medical theories have exerted no great or decisive influence on the materia medica. Pharmacy and therapy are based mainly on empiric or on experimental observations. Changing medical theories could cause alterations in the combinations of remedies. Also, they could influence physicians in their choice of existing drugs. Finally, through the medical profession they could deny the usefulness of remedies altogether. These theories could only rarely find new drugs.

Therefore, it should be stated that no great influence was exerted

thereby on the materia medica kept, prepared, and dispensed in the pharmacies. As a matter of fact, only some of the physicians became followers of the new theories. Many of these, even the creators of the theories themselves, were by no means fanatical in their adherence to them. Thus we know that Sylvius, for example, in his own medical practice made liberal use of the old and tried remedies which had no justification according to his chemical theory.[15] This conflict between theory and practice we meet again and again and it always ends with the victory of practice. Even Galen of old was bothered with this problem. He was forced to create a special group for the specifically efficient drugs, although—or perhaps because—this group did not fit into his system in any way. The representatives of Galenical medical and pharmaceutical ideas had to face in later times the same difficulties. The medical teachers at the university of Paris in the 17th century, leaders in the fight against iatrochemistry, the so-called spagyric art of Paracelsus and his followers with its specifics against specific diseases, were confounded by the arrival of the new drugs coming from America.

> These herb preparations, which like chemical preparations, exerted violent, in fact specific, effects without the addition of other materials. Foremost of them was quinine (at that period not the alkaloid but the cinchona bark). "An impertinent innovation," it was called by Guy Patin, but its effect in malaria was too apparent to allow any of its opponents to hold out against its use for long. Even the Paris faculty had to admit it shamefacedly.[16]

Still another factor played its part in preventing the disappearance of useful drugs merely because they did not fit into a medical system. Between and even during the period dominated by certain medical theories there always were great and highly esteemed eclectic physicians who went "back to Hippocrates," i.e., who aided the healing power of nature with all reasonable and available means regardless of theory. Such physicians were the famous English medical practitioner Thomas Sydenham[17] (1624-1689), whom his grateful contemporaries called the English Hippocrates; the Dutch physician and teacher Hermann Boerhaave (1668-1738);[18] and the German C. W. Hufeland (1762-1836).[19] These men exerted great influence on the practice of medicine.

Above all, however, the common people did not forget tried remedies and continued to use them. It is a well-known fact that drugs which had lost official acknowledgement because they were not in harmony with the dominant medical theory, were preserved by popular use and later on, with the rise of a new and more satisfactory theory, were again officially approved. The best example is cod-liver oil. In the 15th century the English physician Howel in his formulary recommended the employ-

ment of "cod oil" in the preparation of a "cere cloth," a kind of cerate to be used on wounds. About 1730, Norwegian fishermen and farmers found that cod-liver oil cured rickets.[20] In 1770, the English physician Thomas Percival recommended the oil against rheumatism. There was, however, no theoretical explanation of the effect of the oil and the scientific world hesitated to acknowledge it. In 1837 the pharmacist Hopfer de l'Orme in Hanau found iodine in cod-liver oil,[21] and on this discovery an explanation of its beneficial effect was given. The oil entered the pharmacopoeias but as time went on it again fell into disrepute. There was an abundance of other iodine preparations and according to contemporary theories there was nothing in the iodine content of the oil to explain the peculiar effect attributed to it. Hence it was regarded as of no greater value than other fats and distinguished from them merely by the special disadvantage of bad taste.[22] The people, however, continued to use cod-liver oil and the pharmacist kept it in stock. Then, after the discovery of the vitamins, cod-liver oil was found to be one of the richest sources of vitamins A and D and now enjoys official acknowledgement once more.

These facts reveal an unquestionable duty of independent pharmacists, one, moreover, that is seldom recognized. Had they been nothing more nor less than compounders of prescriptions, many valuable remedies would have been discarded and much progress would have been blocked. The fact that the pharmacist is the trustee of the entire medicinal needs of the people, responsible for having the remedies desired by them in stock and in good condition, and also for the reliable preparation and preservation of all remedies, old as well as new, official and non-official, makes the profession an indispensable part of public-health service.

It has been pointed out that only one of the medical theories has caused a radical change in the materia medica. It was the theory of iatrochemistry, which, anticipated by Paracelsus in the 16th century and enthroned by Sylvius in the 17th century, triumphantly proceeded in the 18th century and the following centuries. Chemicals became the widely used remedies. The vegetable drugs, insofar as their usefulness was too obvious to be denied, were investigated as to their assumed efficient constituents in order to isolate by chemical means a chemical substance which was supposed to be responsible for their effect. Alkaloids, glucosides, and vitamins are the most important results of this development.

No knowledge is final. For some time a scientific movement in favor of botanical pharmacy has been in progress. It has been found that drugs of plant origin are efficient even though no definite constituents can be isolated from them. It became evident that at times the sum total of the constituents of a vegetable drug in their natural proportions had a

different and perhaps a better, effect than the one isolated substance which was considered the only or most efficient constituent. The introduction of Pantopon may serve as an illustration. Furthermore, the question arose whether the chemical processes used in the isolation of the efficient plant constituents do not produce essential changes in the plant contents and whether there could be found other more careful, perhaps galenico-pharmaceutical, processes to extract the unchanged contents in their full and original strength, thus attaining the Paracelsist quintessence of the vegetable drugs. All these problems have come into play and the pharmacist has become aware of them. Is it in any way surprising that many of the scientists working on the solution of these problems are pharmacists? Mention may be made of Tschirch in Bern,[23] of Winckel in Berlin[24] and of the late John Uri Lloyd in Cincinnati.[25]

Iatrochemistry has been given a place among the medical theories and mention has been made of it as the precursor of chemotherapy as a medical explanation of the healing effect of chemicals. These theories belong indeed in the field of medicine, because they have to explain, to justify and to recommend the employment of chemicals within medicine and by physicians. But Paracelsus and Sylvius were not only physicians, they were excellent chemists as well. Ehrlich, the founder of chemotherapy, while he passed the medical examinations, throughout his life practiced chemistry, not medicine. These men did not take their ideas from medicine, supporting them by chemical knowledge; they took them from chemistry and transferred them to medicine. From the effect in vitro (in the test tube) they assumed a like or similar effect in vivo (in the living body). That explains why iatrochemistry was the only one among the many medical theories which brought about radical changes in the materia medica. Its empirico-experimental root, growing up from the soil of chemistry and sending stem and branches into the air and the sky of medicine made these fruits possible. Furthermore, the origin of medical chemistry explains why, in this epoch of therapy, pharmacists played such an important role in the finding of new remedies. Suffice it here to recall the names of the discoverer of morphine, the German apothecary Sertuerner, and those of the discoverers of quinine, the French pharmacists Caventou and Pelletier.

It now remains to be seen how pharmacists responded to the change in the materia medica caused by the iatrochemists and their successors. In their official books, the pharmacopoeias, the pharmacists had for a long time merely added the new drugs to the old ones. Thus the first edition of the "Pharmacopoeia Augustana," published in 1564, contained about 1100 medicaments.[26] Husemann comments on this fact in his essays on the Augustana originally published in the "Pharmazeutische Zeitung" and in the English translation forming the introduction of the

facsimile edition of this very important formulary[27] as follows: "This number is relatively small when compared with that of the official and unofficial pharmacopoeias of the 17th century resulting from the union of Galenical and chymiatric remedies." One of the best reputed pharmacopoeias of the 18th century, the "Pharmacopoeia Wirtenbergica" of 1741 contains 1952 different drugs and formulas.

In addition there has always been an unofficial literature dealing with drugs which had not been admitted to the official books. That literature grew and sometimes became semi-official until in the 19th century an increasing trend to purification and simplification banished the largest part of the very old drugs from the pharmacopoeias. Many of the complicated preparations, sanctioned more by tradition and fading belief than by effect, disappeared altogether. But a greater number remained and formed, altered or unaltered, the contents of the unofficial books. Now the "extra" pharmacopoeias (England), the *officines* (France), the *Ergaenzungsbuecher* (Germany), the "dispensatories," "national formularies" and, finally, "recipe books" (America) came into being. In this connection it should be stated, that whereas the Pharmacopoeia of the United States is one of the most comprehensive official formularies, the United States is the only country in the world which has two official and obligatory formularies, the Pharmacopoeia and the National Formulary. In addition to these books it has the semi-official dispensatory and the association-official recipe book. No pharmacist in the world is so well supplied with authoritative literature as is the American.

The significant and common feature of Europe, as stated in the beginning of this chapter, is the regeneration of the ancient Greek independence of thought which has been so evident since the Renaissance. The scientific development in Europe was widespread and beneficial to all European peoples. Hence it became necessary to point out the general relations, resting on a common scientific basis, between European medicine and pharmacy before examining the specific ways in which pharmacy has gone in different countries.

FIGURE 5. Costume of an apothecary of Sienna, in Italy, during the fourteenth century. (*From Revue d'Histoire de la Pharmacie, IV, 154.*)

4

THE DEVELOPMENT IN ITALY

ITALY is the classical soil of European pharmacy as it is that of most of the European professions and arts. The law of the German ruler of the Two Sicilies, Frederick II (see page 35 and glossary), although promulgated in Italy and for Italian territory, was born more out of the German than out of the Italian spirit. The first real Italian legal regulations of the duties of both physicians and apothecaries of which we have knowledge are the Venetian "statuta" promulgated in 1258.[1] Although they resemble the edict of Frederick II, the "statuta," do not mention either a limitation of the number of pharmacies nor governmentally fixed prices for remedies. It is of interest to note that the "statuta" not only forbid the practice of medicine by the apothecary in general but stress that he is not allowed to examine the urine of patients, a method of examination which, up to the 17th century, was one of the most important means of medical diagnosis. Official supervision of the drug trade, including wholesalers as well as retailers, the "speziarii" and the "aromatarii," existed in Venice as early as the 12th century.[2]

It should be recalled that Italian professional pharmacy and apothecary "shops" were not created by governmental edicts but existed long before legislation dealt with them. They had, therefore, found their natural place in the framework of the guild system—an organization which, particularly in Italy, had a special dignity and task.

We know of guild-like associations in ancient Rome. According to Schelenz[3] the somewhat peculiar predecessors of the apothecaries, the "seplasiarii" (see page 15 and glossary), were united in such a guild. These associations bore the designations "ars," "collegium," "schola," or even "universitas." These names, to which the designations of the essential industrial economy of the special guild was to be added and which the later guilds in the Middle Ages partly adopted, by no means imply that these guilds had primarily an educational character. They were founded mainly for social and relief purposes.[4] In wartime they could be mobilized for military purposes. The statement of Staley[5] that they were "furnished with a staff of duly qualified and legally appointed teachers" is not affirmed by other historians and does not seem probable, since the education of apprentices was conducted in general by their masters and not by special teachers.

The organization of merchants and craftsmen into guilds according

to the kind of goods sold or the kind of wares manufactured is one of the most significant features of the Middle Ages. During the period of feudalism the guild system created a bourgeoisie regulating both production and distribution.[6] There were, however, great differences in the manner in which the guilds in the several countries fulfilled their task. In France, in England and in Germany they played at times a more or less important political role. They, again, like other groups, were restricted to the internal organization, regulation, or administration of their special branch of trade. In Italy they were, above all, political groups. This was particularly true in Florence. To be a citizen of Florence, and this implied eligibility to public office, was possible only by attaining membership in one of the guilds.[7] That is the reason why the renowned author of the "Divina Commedia," Dante, in 1296 became a member of the "arte dei medici et speziali" i.e., of the guild of the physicians and apothecaries. In the long list of celebrities mentioned by Staley[8] as members of this guild were the illustrious astrologer, Paolo Toscanelli, whose map Columbus used on his voyage of discovery to America; and also Amerigo Vespucci, who gave his name to the new continent.

We are especially well informed concerning the Florentine guild of physicians and apothecaries.[9] The combination of these two professions together with some others in the same guild took place toward the close of the 12th century. When Buonuomini, in 1236, by special ordinance, divided the principal trade corporations of Florence into two divisions, viz., into the seven major arts and the fourteen minor arts, the distinction was one of both technic and of class.[10] As group six, the guild of physicians and apothecaries belonged to the major arts representing the arts of higher esteem. In the membership lists of the guilds between 1297 and 1444 about 70 different callings were represented. However, the apothecaries and wholesalers of drugs outnumbered all the others. This is readily understood if we recall that at this time Italy, and more particularly Florence, Genoa, and Venice governed the entire European trade in Oriental drugs and spices.[11] The guild statutes of 1349 mention not less than 206 different articles as belonging to the monopoly of the apothecaries or spicers. Their trade extended to many products which at this time were rare and costly. The sale of books was in their hands. They had the monopoly of wax candles. Even funerals, especially those of the wealthier citizens, were conducted by the apothecaries.[12] Supervision was rigid. Once a year the apothecary "shops" were inspected by a special commission of the guild. Drugs not meeting the requirements were confiscated and the culprits excluded from professional practice for variable periods.

The part played by the guild of the physicians and apothecaries in

Florence is characterized by Staley[13] in the following brief sentence: "And a great guild it truly was . . . it yielded to none in the loftiness of its aim and in the splendor of its achievements."

Two beautiful works of art, from the workshop of the famous artists, the brothers della Robbia, have been preserved and give evidence of the importance, wealth, and cultural standard of the guild. These are a medallion on the south gable of the church of San Michele showing the patron of the guild, the Holy Virgin with the Child; and a bas relief above the door of the church of Santa Barbara. The fact that the last mentioned church was patronized by the guild, especially by the apothecaries, is affirmed by the inscription "sub gubernatione artis aromatariorum" (under the patronage of the guild of the dealers in aromatics, i.e., the apothecaries).

In Verona a special guild of the apothecaries, "la magnifica arte degli speziali," is mentioned in a document of the year 1221.[14] In Milan the "Paratico apothecariorum spetiariorum et aromatariorum" was founded about 1300. In Piacenza the "speciali" constituted a guild in the 13th century. In Venice[15] we again find physicians and apothecaries joined in the "capitolare medicorum et spetiatiorum," founded in 1258. In 1565, the apothecaries parted company with the physicians and formed the "collegio degli speziali." Conci[16] mentions additional pharmaceutical guilds in Monza, Como, Cremona, Siena, Mantua, Volterra, Lucca, Pistoia, Pisa, Perugia, Bologna, and Padua. The oldest Italian pharmaceutical guild still existing is the "nobile collegio chimico farmaceutico," founded as "universitas aromatariorum" in time immemorial and solemnly renewed in 1429 by a special edict ("bolla") of Pope Martin V under the title "nobile collegio degli aromatari."[17] The tasks of the collegio are described as follows: 1. The care of the poor and of sick members. 2. The "immatriculation and location" of all apothecaries having passed the examinations. 3. The regulation of the distance between the individual apothecary "shops." 4. The regulation of the prices for remedies. 5. The collection of taxes, to be delivered to the government. 6. The supervision of the producers and retailers of food, liquors, pastries, and medicinal herbs.

Naturally, pharmaceutical conditions were not uniform in the different states established on Italian soil between the 13th and the 19th century. Thus with regard to one of the most important provisions, the separation of the medical and the pharmaceutical professions, there were great differences. While all commercial association between the professions was forbidden, although not always rigidly enforced, in Rome, in Southern Italy, Pisa, and many other Italian states,[18] the Florentine statute of 1313 allowed the apothecary to employ a physician in his "shop" and the physician to employ an apothecary. A similar regulation is found in

the Mantuan statute of 1303. In Pistoia, physicians and apothecaries founded a commercial company. The apothecary "shop" was common possession and the profits were shared. Similar arrangements later became customary in Florence. The apothecary was forbidden to reimburse the physician for individual prescriptions. The physician was, however, allowed to have a share in the entire business of the apothecary.[18] In general, in most of the Italian towns it was customary for the physician to see his patient in a pharmacy or at least to be available through the pharmacy.

Until the close of the 16th century the cultural influence of the powerful city states was so great that their institutions served as a model for the other parts of Italy. During the period from the 12th to the 16th centuries Italy was once more the cultural center of the world. Pharmacists as well as physicians of Northern Europe who desired a better education than they could acquire at home came to the renowned Italian universities, especially to those of Padua, Bologna, Pisa, and Ferrara. This cultural development rested on the wealth acquired by the city-states. Their merchant princes, such as the Medici of Florence, not only controlled the Oriental spice trade but were international bankers as well. The Italian trade extended from Constantinople, Damascus, Alexandria, and Tunis to South Germany, France, London, Lisbon, Antwerp, Bruegge in the North.[19] As to the drugs involved in this trade information may be gained from "La Practica della Mercatora," written in the 14th century by the Florentine, Pegolotti, an employee of the Baldi, the great Florentine merchants.[20]

The Italian drug trade was supplemented very early by the development of a chemical industry, the first on European soil. In 1294 Venice is mentioned as the place of manufacture of corrosive sublimate and cinnabar. Somewhat later sugar of lead, borax, soap, sal ammoniac, Venetian talc and Venetian turpentine were added.[21] A very important pharmaceutical article of export was Venetian treacle. Another was the famous Venetian troches of vipers, legally required in some European states for the local preparation of treacle.[22]

In Italy we also observe for the first time industrial pharmaceutical activity by the monasteries. Thus the monastery of the church of Santa Maria Novella in Florence was famous for the distilled waters and cosmetics which the monks prepared and sold.

It is not surprising that the important role played by Italian pharmacy and apothecaries in the political and social life of their country found its expression in the public esteem as well as in the equipment of the apothecary "shops." The Italian apothecary was always considered a patrician. In Venice the profession was officially recognized as an "arte nobile" granting the apothecary the right to marry a "gentildonna

veneziana" (a Venetian lady of noble rank). During the middle of the 14th century, the Florentine apothecary, Matteo Palmieri, was appointed ambassador of his country to the court of the King of Naples.[23] Up to the present there have always been a great number of apothecaries active in Italian politics and represented in the literature of their country. Even in the military service the social and professional recognition of the calling finds expression. The pharmacists in the army are on the same footing with officers although they are not awarded military titles. The lowest army pharmacist has a rank equivalent to that of a second lieutenant; the rank of the highest equals that of a colonel.

The Italian apothecary "shops" of the Renaissance period were very often rooms of architectural beauty with equipment that even today is highly valued by connoisseurs of Italian art[24] and is the pride of many museums and private collections. A list of such museums and private collections is contained in Haefliger's "Pharmazeutische Altertumskunde."[25] The development of pottery from a simple handicraft to an art was especially stimulated by Italian pharmacy. Private apothecaries, hospitals, and the high nobility competed with each other in adorning their "shops" or pharmaceutical work- and storerooms with precious faïence jars, jugs, and vases. Of the princely house of Medici, well known for its interest in the arts and sciences as well as for its knowledge of poisons and the art of poisoning, a malicious author in mentioning the beautiful equipment of the princely court pharmacy wrote:

> The House of Medici was especially zealous in promoting the production of jars for containing the all too potent drugs of the period. When poisoning was considered to be so fine an art, it required all the artistry of ceramics to deck it.

In this connection it may be mentioned that the Medici, the most famous Italian princes of their period, are often said to have been the descendants of apothecaries because of the six pill-like balls in their coat of arms.

The decline of Italian trade and wealth began with the discovery of America and, more particularly, with the discovery of the all-water route to the East Indies. As early as 1501 King Manuel of Portugal wrote to the Venetian government that there was no longer a reason for Venetian merchants sending ships to Egypt (and the Levant) and suggested that they should rather buy the Oriental goods which they needed in Portugal.[26] The time of the Italian intermediate trade was a thing of the past. The drugs of the Orient were brought directly to Europe by the Portuguese and later by the Dutch; the drugs of the new world were made available first by the Spaniards and then by the English. Castiglioni[27] describes the Italian situation in the 17th century

as follows: "Venice and Genoa were on the road to decadence, Lombardy was pillaged by the Spanish, French, and Germans, the small Italian states were tormented by the fights of princes."

The political importance of the guilds had declined with the declining wealth and political power of the Italian municipalities. However, under the authority of their respective governments, they retained a certain internal authority. We know from the statute of the "collegio degli speziali veneti," issued in 1565, that an apothecary had to serve five years as an apprentice, also three additional years as a clerk, and had to pass an examination before he was allowed to operate an apothecary "shop" of his own.[28] These requirements were general at that time and remained so for a long period. In the course of the 18th century, politically characterized by interference on the part of Austria, the rise of Savoy in the North and the re-establishment of the southern Italian kingdom as the Kingdom of Naples, conditions changed. It was Austria, which, in 1778, with the "piano di regolamento per le farmacie della Lombardia austriaca," gave the impulse for progressive pharmaceutical legislation in Italy as a whole. The most important innovations were the limitation of the pharmacies, allowing only one pharmacy to 5000 inhabitants, and the requirement of academic study and examination for prospective pharmacists. In 1805 during the period of the shortlived kingdom of Italy, by the grace of the French Emperor Napoleon I this regulation became legal for the entire country. Pharmaceutical education was thereby taken away from the pharmaceutical guilds and transferred to the universities. Later political events brought no change in this particular. However, the organization of pharmacy in the various Italian states differed greatly. In some of them the number of pharmacies was not limited, in others one pharmacy was allowed to 3000 inhabitants (Rome) or 5000 (Lombardy) or a certain distance was required between the pharmacies (Naples).[29]

The new Italian Kingdom, established in 1870, gradually reduced these variations to a uniform system. In 1888 a law permitted registered pharmacists to practice the profession in all parts of Italy thus permitting the unrestricted opening of pharmacies. However, the new pharmacies which came into existence under this law were located for the most part in the large cities thus creating dangerous competition in the metropolitan districts, while in the country the need for well-distributed pharmacies was not met. Hence, the unrestricted and uncontrolled establishment of new pharmacies proved of no advantage either to pharmacy itself or to the public.[30] In 1913, a new set of restrictions replaced the freedom of the law of 1888. Since that time the government determines where a new pharmacy shall be opened. The privilege of establishing and operating such a pharmacy is awarded by competitive application to

the best applicant. These privileges or concessions cease with the death of the concessionaire and are neither salable nor hereditary. Upon the death of the owner the vacant concession is again subject to competition. With regard to the old hereditary and salable privileges the law of 1913 makes 1933 and 1943 respectively the last years for their sale or abandonment.

The fees to be paid for the establishment of a new pharmacy were placed rather high. The law provided, furthermore, governmentally fixed prices for remedies; prices which are, however, obligatory only for a rather small number of drugs enumerated in an official list.[31]

The present educational requirements for a license are:

1. Preliminary education: a certificate of graduation from a lyceum (the approximate equivalent of two years of college.)
2. Professional education: a three-year university course.
3. Professional experience: one year of probation after completion of the university studies.
4. Examinations: (a) after completion of the university studies, a written, laboratory, and oral examination in the studies pursued, (b) after the year of probation, a practical examination including laws and regulations.

Unfortunately, the Italian pharmacist as a class did not contribute his share to the advancement of the pharmaceutical sciences and this in spite of the high standards for the practice of pharmacy and the social rank of the pharmaceutical practitioner. Whereas in France and Germany a constellation of pharmacists attained high standing as scientists, and therefore recognition for their profession, the attainments of Italian apothecaries went scarcely beyond the compilation of treatises for the practice of their calling. An explanation for this situation may possibly be found in the fact that throughout the triumphant development of chemistry during the latter part of the 18th and during the 19th centuries, progress was due to researches conducted largely in France and Germany and to a lesser extent in England and Sweden. The great scientific achievements of the Italians lay rather in the sphere of physics and medicine.

Nevertheless, the contributions of Italy to scientific and professional pharmacy since the 14th century, made for the most part by representatives of scientific medicine, are by no means small. Mention has already been made of the dictionary of medical synonyms of Symon Januensis (see page 29). About 50 years later it was followed by the "Opus Pandectorum Medicinae" of the Salernitan Matthaeus Sylvaticus (died 1342). Of the greatest influence on the practice of pharmacy was the "Compendium Aromatariorum" of the physician Saladin de Asculo,[32] written in

the middle of the 15th century. Schelenz[33] calls it "the first real treatise on pharmacy in a modern sense . . . which became the model for all later textbooks of pharmacy which for centuries has been the indispensable vademecum (reference book) of the apothecary." The directions, given by Saladin for the different kinds of containers to be used for the preservation of drugs, correspond in large part with those of the older Dioscorides (see page 13). Of similar books mention should be made of the "Lumen Apothecariorum" by the physician Quiricus de Augustus de Dertona;[34] the "Luminare Majus," written toward the end of the 15th century by Joannes Jac. Manlius de Bosco of Alessandria near Pavia,[35] which "until the middle of the 16th century was the official guide in several countries and cities e.g., in Nuremberg";[36] and of the "Thesaurus Aromatariorum," written by Paulus Suardus of Bergamo in the first decade of the 16th century. Bosco and Suardus are the first known Italian pharmaceutical authors of pharmaceutical treatises.

A long time passed before another pharmaceutically noteworthy book, written by an Italian apothecary, was published. It is the "Nuovo et Universale Theatro Farmaceutico," written by Antonio de Sgobbis da Montagnana, owner of the famous Ostrich Pharmacy in Venice. This book, published in 1662, contains comprehensive and very noteworthy directions for the management of a pharmacy. It describes and illustrates all pharmaceutical processes and apparatus of the period, and contains much biographical material. The book is a real pharmaceutical encyclopedia and in some respects a first attempt at a "pharmacopoeia universalis."[37] One of Sgobbis' predecessors in possession of the ostrich pharmacy in Venice, the German-born Georg Melich, wrote a "practice" of pharmacy, the "Dispensatorium Medicum" of which the first edition in Italian was published in Venice in 1574, the last in Latin translation in Germany in 1657. After the close of the 17th century scientific pharmaceutical treatises by Italian pharmacists and physicians no longer acquired renown outside of the borders of Italy.

The earliest Italian pharmaceutical journal is the "Giornale di farmacia, chimica e scienze affini," founded in 1824 by Antonio Cattaneo in Milan. Of the later journals the following became well known in the scientific world: "Il giornale di farmacia e di chimica," Torino, founded in 1852, and the "Bolletino chimico-farmaceutico," Milan, founded in 1861 under the title "Bulletino farmaceutico." In 1906 the "Corriere dei farmacisti," Milan, made its appearance. In 1914 the organ of the "Federazione degli ordini dei farmacisti d'Italia" came into existence and in 1920 "La farmacia" was founded. This journal in 1927 became the official organ of the "general sindicato nazionale fascista dei farmacisti."

The first—these magic words have to be used again and again, in

writing the history of pharmacy on Italian soil—the first professional European apothecary "shop" here opened its door. The first post-antique antidotary made its way from Italy into the European world. Hence it is not surprising that we are likewise indebted to Italy for the first pharmacopoeia, for the first academic instruction in pharmacognosy, and for the first real botanical garden.

It was in 1498 that the first edition of the "Ricettario Fiorentino" was published. Since this book was made official, hence obligatory, for the Florentine apothecaries, it became the first official pharmacopoeia of the European world. The "Ricettario" is said to have been compiled by a commission of physicians at the request of and with the support of pharmacists and was used extensively by the authors of later pharmacopoeias. Naturally, the book is written entirely in the spirit of Arabic therapy and based mainly on the "Grabadin" of the Pseudo-Mesue (see page 21). A series of other local pharmacopoeias followed. Their chronologic order is more or less significant for the standard of pharmacy in the several political units which constituted the geographical region of Italy. More than half a century passed before a second city-state pharmacopoeia appeared in 1559, viz., the "Antidotarium Montuanum" in Mantua. There followed the "Antidotarium Bononiense" (1574) in Bologna, the "Pharmacopoea Bergamensis" (1580) in Bergamo, the "Antidotarium Romanum" (1583) in Rome, the "Pharmacopoea Veneta" (1618) in Venice, the "Antidotarium Messanense" (1629) in Messina, the "Antidotarium Neopolitanum" (1649) in Naples, the "Pharmacopoea Ferrariensis" (1725) in Ferrara, the "Pharmacopoea Taurinensis" (1736) in Turin, the "Pharmacopoea Sardoa" (1773) in Sardinia, the "Formulario farmaceutico" (1791) in Genoa, and lastly the "Pharmacopoea Parmiensis" (1823) in Parma. It will be noted that the title Pharmacopoea was not used in Italy until 1580 when Bergamo followed the examples set by Bretschneider-Placotomus in 1560 with his pharmacopoeia published in Antwerp and Foësius in 1561 in connection with his Metz treatise. It was not until 1892 that the government of the new kingdom of Italy, established in 1870, issued the first national official pharmaceutical standard for the entire country, the "Farmacopoea ufficiale del regno d'Italia." Whereas the German apothecaries had prepared a model even before the re-establishment of the German Empire in 1871, it took Italian pharmacists more than twenty years to attain the same goal.

So far as is known the first chair for "lettura dei semplici," i.e., for pharmacognosy was established in Padua (1533). There followed Bologna (1534), Mondovi (1561), Turin (1566). The well-known botanist Ghini taught in Padua. Of his students Pietro Andrea Mathioli of Siena (1501-1577) deserves special mention. Physician in

ordinary to the German Emperor Maximilian II, he published in 1544 a famous commentary on Dioscorides which was translated into many languages. It continued in use through numerous editions, either with or without annotations and additions. At times these appeared under the name of the editors. "The book of Mathioli can be regarded as the encyclopaedia of pharmacology of the Renaissance."[38]

The above mentioned Matthaeus Sylvaticus (see page 53) reports that he owned a Vividarium, a private garden with medicinal herbs near Salerno. Similar gardens existed at the same time (about 1300) in Castelnuovo and Naples.[39] The first real botanical garden in the modern sense of this term was established in Padua in 1545. Then follow Pisa in 1547, Florence in 1550, Rome in 1556, Bologna in 1567.[40] It was an Italian apothecary who almost two centuries before had made, in Prague, the first attempt at such a garden. This Italian was the Florentine, Angelo, owner of an apothecary "shop" in Prague and appointed as apothecary to the court by the German Emperor, Charles IV.

Finally, attention should be directed to an example of intensive and effective participation by an Italian apothecary in the cultural life of his country. A marble tablet on a house in Tornabuoni Street in Florence reminds the passerby that here, in 1584, in the private room to the rear of the "shop," upon the initiative of the apothecary Francesco Grazzini, called il Lasca, the renowned "Accademia della Crusca" was founded.[41]

5

THE DEVELOPMENT IN FRANCE

WITHOUT doubt Italy was the cradle of European professional pharmacy. Equally significant is the fact that almost simultaneously a similar development took place in France. As has been shown, the first known European legal regulation separating the professions of medicine and pharmacy was issued on French soil, viz., in and for Arles in southern France. (See p. 31.)

There has always been a very close connection between Italy and France. Ancient Gaul, the Gallia of the Romans, was during the last centuries of the Roman Empire more of a Roman province than a colony. Thus France felt itself to be and indeed was a legitimate heir to Roman civilization almost to the same extent as was Italy. There was only one difference, but this was a fundamental one which influenced the political and cultural development of both peoples: This difference was the elements composing the populations of the two countries. The original Italians did not amalgamate to any appreciable extent with all the northern peoples who overran and dominated them for longer or shorter periods. In all their dominant features they remained a Mediterranean race. In France, on the contrary, the pre-Roman inhabitants, the Aquitani, Celtae, and Belgae, the Romans, and the several Germanic tribes who overran the country, the Visigoths, the Burgundians, the Franks, and, finally, the Normans, blended into a new and almost homogeneous people. The French are one of the most striking examples of the amalgamation of different peoples into a unique nation united by the same customs and language, the same aims and thoughts. In 486 Clovis, a chief of the Franks, with his victory in the battle of Soissons definitely put an end to Roman rule in the north of France and settled a German tribe on French soil. For a time France and Germany constituted a united empire. This unity, however, was political. The division, in 987, of France and Germany was but the recognition of their different racial and cultural developments.

This intermediate cultural position of France between Germany in the north and Italy in the south, finds its obvious expression in the evolution of French pharmacy. In France, as in Italy during the Middle Ages, pharmacy found its place in the guilds. However, in contrast to the great Italian guilds these French associations were non-political

bodies. They were professional or commercial organizations based on and often founded by order of royal, parliamentary, or local authorities.

> It was within the form of communautés (guilds) that the great Associations arose with the purpose of fraternal assistance, joint defense of common interests, the organization of religious ceremonies, etc., characterizing French pharmaceutical life before the law of Germinal (1803).[1]

The fact that until the reign of the kings of the House of Bourbon (1589) there existed in France many feudal lords governing their territories like sovereigns and that later on until the great revolution (1792) the individual municipalities enjoyed wide administrative independence, did not prevent a rather uniform development of pharmacy throughout France. The guilds were given far-reaching self-determination in all matters concerning admission to the profession, education and examination of apprentices, the limitation of the apothecary "shops" and the care of poor colleagues, their widows and orphans.[2] In general it can be said that very wise use was made of the right of self-government.

According to Bouvet[3] there were in France three kinds of regulation of pharmaceutical life: by the central government, by local authorities, and by the apothecaries themselves, i.e., by their associations.

The last type of regulation was the most common.

In both Arles and Paris apothecary "shops" are traceable as far back as about 1180. In the 13th century we learn about others in several French towns. At that time they were numerous in Avignon. The fact that the Popes resided there during the 13th and 14th centuries brought an Italian infiltration to Avignon. At times the Italians outnumbered the natives of the town populace. Among these Italians were many pharmacists, most of them coming from Florence. It was but natural that these Italians should influence French pharmacy.

In the Paris "Livre des métiers" (book of trades), written by Etienne Boileau about 1270, we find the expression "apothicaires" for the members of the pharmaceutical profession, but according to Dorveaux[4] they were at that time usually called "épicier" (spicer). The designation "apothicaire" became general about 1400.

The first guild-like associations known were in Avignon, where in 1262 the sellers of drugs joined into the association of spicers; and in Dijon, where in 1281 the apothecaries owned a "domus apothecariorum" i.e., a kind of association headquarters building.[5] In Paris there was an association comprising apothecaries-spicers and some other more or less related callings, dating at least as early as the middle of the 13th century. It was to this association that King Philip IV called "le bel" entrusted, in 1312, the control of the weights and balances used by all retailers, thus

FIGURE 6. A Street in Paris in the 15TH century. At the lower right is an apothecary's shop showing the open front characteristic of the period. (*Revue d'Histoire de la Pharmacie, IV, 410.*)

making the apothecaries-spicers the appointed custodians of the standard weight. The ordinance refers to all merchants as "d'avoirs de poids" meaning dealers selling their merchandise by weight.[6] Here we have apparently the etymologic root of the term avoirdupois for a certain kind of trade weight. Outside of Paris similar regulations were issued, most of them making the apothecaries the appointed guardians and inspectors of the balances and weights used by all retail merchants.

There existed no special friendship between the Parisian apothecaries and spicers in the same guild. The reason is to be found in the fact that no sharp distinctions between the rights and privileges of the two groups had been laid down. Hence, they accused each other of trespassing. As a result an edict issued by Charles VII in 1484 forbade the practice of pharmacy by spicers.[7] Another ordinance of 1514 separated the small spicer from the apothecary-spicer. The small spicer was forbidden to practice pharmacy which, according to the ordinance, "requires much art, science, experience and knowledge of drugs as well as of the compounding of prescriptions which enter into the human body." The apothecary, however, was permitted to practice both professions simultaneously. In 1553 Henry II once more changed the situation. Now the apothecaries had to choose between the two callings. In 1560 Francis II again confirmed the union of the hostile colleagues within the same guild and in 1563 they moved into a common office. In 1581 it was ruled that apothecaries who desired to practice the trade of a spicer had to prepare a special masterpiece, i.e., had to pass a kind of spicer examination. In 1629, 1689, 1734, and 1742 parliamentary ordinances limited the rights of the competing groups.[8]

The definite separation of the Parisian apothecaries and spicers was brought about by the royal declaration of April 1777 replacing the old guild of apothecaries by the so-called "Collège de Pharmacie." This declaration allowed the spicers only the wholesale trade in drugs and the retailing of a few specially named drugs, also the trade in all herbs and roots in their natural form without any preparation or compounding.

Similar quarrels occurred in the provinces. They were accentuated by, rather than resulting from, the fact that the hostile colleagues were often members of the same guild, as was the case in Lille, Abbeville, etc. They were not peculiar to France but occurred in all countries and still occur today between pharmacists, druggists, herbalists, and merchants in general. The statement made by King Jean "le bon" in 1352 that all kinds of people compound and sell medicaments holds as good today as it did then. The quarrel with the herbalists culminated in the famous law of Germinal (1803) which created the class of herbalists. After having proved their knowledge by examination they were regarded as qualified to sell indigenous drugs.

In communities in which the number of physicians was not large enough for a special medical group they were united with the apothecaries. Sometimes surgeons, apothecaries, and barbers were in the same corporation. The special apothecary guilds, however, were prevalent. Of a total of 199 guilds in which apothecaries participated, 103 were exclusively apothecary associations.[9]

It was due to these guilds that the pharmaceutical profession in France gained and maintained a high standard. The requirements for entrance into the profession were high and strictly enforced. The applicant had to be of legitimate birth and of the Roman Catholic faith. He had to know sufficient Latin to read intelligently the formularies and the prescriptions of the physicians. In addition the guildmasters often asked whether the fortune of the applicant's family was large enough to enable him to buy a pharmacy later on. To the master taking in an apprentice a rather high stipend had to be paid. Bouvet says:

> Most of the apprentices were recruited from the rich bourgeoisie of the towns, very often from the apothecary families. The son succeeded the father, the nephew the uncle. That explains the numerous dynasties of apothecaries. In Rouen, for example, a widow Chandelier practised in 1214 and 11 members of the family practised pharmacy in that town from 1600-1786.[10]

The statutes of many guilds restricted the number of apprentices. Generally only one apprentice was allowed for each pharmacy.[11] Even the number of pharmacies was very often limited, sometimes by statute, as in Nancy and Nice,[12] sometimes by other means, e.g., the requirement that each apothecary coming from another district had to pass a local examination.

Thus the social status of the French apothecary from the 14th to the 18th century was doubtless that of a patrician. His social position was maintained in spite of the fact that the application of clysters belonged to the duties of the apothecary. From the 15th to the 18th century clysters were one of the most frequently used modes of administration—Louis XIII received no less than 312 clysters within a year—and one of the most remunerative. It was only when they became the target of ridicule on the part of the poets, especially of Molière (a fact which fortunately coincided with the passing of the fashion), that the apothecaries became aware of the unworthiness of this practice. It is sometimes overlooked that Molière in his famous play "Le malade imaginaire" scoffs at physicians and apothecaries in quite the same manner and that the special activity of the latter just indicated was for him only a welcome occasion for added ridicule. At any rate, so far as French public opinion was concerned, the designation "apothecary" gradually became associated

with the ridiculous picture drawn by the caricaturists. Hence we can well understand that members of the profession preferred the new name pharmacist which made its appearance in the 17th century and which became official with the establishment of the "Collège de Pharmacie" in 1777.

The attacks of Molière and his literary contemporaries were to a large extent directed against the high prices charged for remedies.* In France prices fixed by the government were never a general institution and we know of pharmaceutical invoices which, indeed, seem to be very high.[13]

Apothecaries and physicians, so closely associated in their professional life and the common target of sarcasm, have nevertheless very often had conflicts, possibly because of their close relationship. Nowhere, however, did they reach such a high degree of malice as in France.† As early as 1271 the medical faculty of Paris admonished the apothecaries not to trespass on the field of medicine. But on the other hand, we know that some French physicians in their turn sold medicines as late as about 1470.[14] Besides, the lack of learned physicians sometimes forced the apothecaries to practice medicine. As recently as 1724 a royal ordinance permitted the apothecary to visit the sick if no physician was available.[15]

The literary quarrel between both professions, initiated in 1532 by the physician, Symphorien Champier, became famous the world over. Champier's libel was called "Myrouel des apothicaires et pharmacopoles." It was followed by the "Déclaration des abus et tromperies que font les apothicaires," written in 1553 by the physician, Sébastian Collin under the pseudonym, Lisset Benancio; and the lampoon of the physician Jean Surrelh entitled "L'apologie des médecins contre les calomnies et grands abus de certain apothicaires" published in 1558. All of these were translated into many languages and quoted and used wherever someone wanted to find fault with the apothecaries. These treatises, however, were met by counter-treatises. Under the pseudonym, Pierre Brailler, apothecaire de Lyon, Bernard Palissy wrote, in 1557, his "Déclaration des abus et ignorance des médecins" and in 1558 his "Articulations sur l'apologie de Jean Surrelh." The quarrel found its echo in Germany and in England and both parties took their weapons from the respective French publications which have become the classic sources for all possible attacks and reproaches against the apothecaries on the one hand and against the physicians on the other.[16]

About 70 years later, in another quarrel with the apothecaries the medical authors not only used the old arguments but tried new means with the clearly expressed intention of ruining the pharmaceutical pro-

* Introductory scene to "Le malade imaginaire."

† Phillipe, "Histoire des apothicaires" proves that in its contents as well as in its entire tenor.

fession as a whole. It was in the course of his campaign against the use of chemicals in medicine that the famous head of the faculty of medicine at the university of Paris, Guy de Patin (see page 42) and his friends wanted the apothecaries to refuse to fill prescriptions containing chemicals. The answer of the apothecaries that they felt obliged to fill all prescriptions was considered a declaration of war. In 1625 the physician Ph. Guibert published his "Médecin charitable," a book which, selling at a very low price, instructed the public about the most important pharmaceutical processes and the best ways of procuring the raw materials in order to enable everyone to prepare the needed medicaments himself. A revised edition to which Guy de Patin contributed numerous additional details appeared in 1626. Concerning this revised "Charitable Physician," Bouvet states that it was

> a genuine treatise on popular pharmacy which lived through numerous editions in French, also was translated into other languages, together with the other works of Guibert.[17]

As a result, Guy de Patin could write in 1649 that the apothecaries of Paris had been ruined, the only clients remaining being strangers. Nevertheless, the quarrel ended with common sense triumphant over hatred, prejudice, and presumption. In 1666, the Parisian Faculty of Medicine admitted the use of antimony in the form of wine of antimony "as a purgative," and the French parliament confirmed this decision.

As previously stated the social, financial, and educational requirements to be satisfied by the applicant for apprenticeship were high. To become master he had to pass difficult examinations. It is known that in Marseilles such examinations were required as early as the 13th century. A Parisian ordinance in 1471 stated that the candidate had to prove his knowledge of drugs, and of the compounding of medicaments, by a protracted and difficult examination, and finally had to perform his masterpiece consisting of the preparation of galenicals requiring special technical skill and scientific knowledge. This masterpiece became a general requirement throughout France up to the 18th century. The number of the required preparations varied from one (Nancy before 1624) to six (Amiens in 1576). In special cases the number was increased. Not having fulfilled the time required for apprenticeship, Baumé had to give proof of his skill in 1752 by preparing not less than 17 preparations.[18] As an additional requirement for mastership, the prospective apothecary usually had to serve a certain time as "compagnon" (clerk) before he could become a candidate. The entire time thus spent varied from two to eight years as apprentice, to four to ten years as apprentice and clerk.[19]

Comparatively early academic studies were introduced and became more and more general. In 1536 an ordinance of Parliament stated that

the apprentices of pharmacy had to attend weekly two lectures relating to the art of the apothecaries. These lectures were given by a member of the faculty of medicine. In Poitiers an ordinance of 1581 stated that only those candidates who had attended for one year the lectures on the art and science of pharmacy could become masters of pharmacy. In the famous university of Montpellier the doors were always open to the students of pharmacy of the entire world. In 1558 the apothecaries at Montpellier requested and eventually established at their expense a course in the pharmaceutical sciences. The master apothecary, Bernhardin de Ranc who gave this course was therefore the first practising apothecary to become officially a member of the teaching staff of a European university. In 1601 Henry IV created at Montpellier a chair for surgery and pharmacy. In 1605 the famous master apothecary, Laurent Catelan, lectured on medicinal herbs and demonstrated the art of pharmacy. Finally in 1675 Louis XIV created a chair of pharmaceutical chemistry at Montpellier.[20]

In Paris it was the "jardin des apothicaires," founded by the apothecary Houel, 1576-1580[21] and preserved and enlarged during several centuries by the guild of the apothecaries in Paris which provided general scientific instruction for the apprentices of pharmacy. Other courses were given at the "jardin du roi" (the garden of the King), founded in 1635.[21] These courses were supplemented by special courses on pharmaceutical chemistry as private undertakings on the part of some of the famous apothecary chemists, e.g., by LeFebre and Lemery in the 17th and by Rouelle and Baumé in the 18th century.

These courses of instruction had to be private undertakings because the several attempts of the Parisian apothecary guild to organize official ones of academic character met with the same lack of fair professional sentiment on the part of the physicians which has been noted earlier. However, official courses existed between 1705 and 1723 and again from 1753-1765 but had to be abandoned because of the opposition by the Paris faculty of medicine. They were resumed after the replacement of the guild by the so-called "Collège de Pharmacie" in 1777 and were continued during the duration of this institution and that of its successor, the "Société libre des pharmaciens de Paris," i.e., until 1803.[22]

The transformation of the Parisian guild of apothecaries into the "collège de pharmacie" was of fundamental importance for French pharmacy. The law which created this "Collège"—note the change in name—excluded the spicers. It forbade the extensive sale of drugs by religious hospitals and societies[23] and it authorized the pharmacists to educate the rising generation without interference due to medical jealousy.

After trying a very short interlude of free pharmacy, the French revolution changed little more than the name of the tested institutions.

A decree of March 2, 1791, effective April first, had declared all persons entitled to practise any profession or trade. The immediate result was that in Paris and in the provinces numerous stores called pharmacies were established by uneducated owners. This put an end to revolutionary enthusiasm for liberty in the field of pharmacy. A month later a new decree, dated April 14th, 1791, announced the return to the old regulation of the practice of pharmacy. In 1796 the former members of the "Collège" constituted a new association called "Société libre de pharmacie de Paris," which in 1797 established an "École gratuite de pharmacie" (a free school of pharmacy). This developed into the "École supérieure de pharmacie de l'université" and more recently into the "Faculté de pharmacie de Paris."[24] Since then pharmaceutical education has been separated from the more general professional and commercial interests of the calling. It is of interest to note that the "Société libre" not only created a school, but also the first French pharmaceutical journal, the "Journal de la société des pharmaciens de Paris" in 1797. Two years later it was consolidated with the "Annales de chimie," which had been founded in 1780 and which had several famous French pharmacists on its editorial staff.

In 1803 the law of the 21 Germinal of the revolutionary year XI (April 11, 1803) and the decree of the 25 Thermidor (August 13) of the same year were issued. These constitute the basis of modern French pharmaceutical legislation.[25] They put an end to the closed pharmaceutical corporations without, however, suppressing the activity of the professional corporative life. Shortly thereafter, also in 1803, the "Société de pharmacie" was founded. Leaving the maintenance and defense of the commercial interests of pharmacy more and more to other and younger associations,[26] it gradually became the French pharmaceutical professional organization. In 1809 the "Bulletin de pharmacie" was founded. Since 1842 it has been known as the "Journal de pharmacie et de chimie." It is now the oldest continuously published pharmaceutical journal. Of younger associations, the "Association générale des syndicats pharmaceutiques de France," founded in 1878, is the most important. It issues its own journal. The legislation of 1803 provided six "Écoles de pharmacie" (*superieur*) for the education of the pharmacists of the first class (pharmaciens de premiere classe) who were permitted to practise pharmacy throughout the nation. It also provided committees for the examination of the pharmacists of the second class (pharmaciens de seconde classe) who were allowed to practise only in the district in which they had passed their examination.

These regulations have been changed several times. The actual educational requirements since the abolition of the second-class pharmacists in 1909 are as follows:[27]

1. Preliminary education: the baccalaureate in letters or science—the equivalent of about three years of college.

2. Professional experience: one year apprenticeship in a pharmacy, the proprietor of which has been officially authorized to receive apprentices.

3. Professional education: a four-year course at one of the "Écoles superieur" or at a university with a pharmaceutical faculty.

4. Examinations: an examination covering the technic or practice of pharmacy, after the apprenticeship. An examination at the end of each of the first three academic years, two examinations during the last year of study and a final examination at the close of the entire course. This final examination is divided into: (a) a practical part covering the examination of chemical and galenical medicaments, toxicology and foodstuff chemistry; (b) an oral part covering pharmaceutical chemistry, biologic chemistry, hygiene, toxicology, hydrology, geology, microbiology, materia medica, and pharmaceutical law.

The problem of the supervision of the pharmacies found a very satisfactory solution. During the first centuries of professional French pharmacy the supervision was either entirely the business of the physicians or was dominated by them. In 1336 the faculty of medicine in Paris was charged with the control of the apothecary "shops." An ordinance of 1353 created a commission consisting of the head of the apothecary guild, two further master apothecaries appointed by the municipal authorities and two members of the faculty of medicine. Everywhere mixed commissions of this type, in which medical dominance over pharmacy was maintained, were the rule. Supervision by apothecaries exclusively was rare.[28] The above mentioned decree of Thermidor (1803) made the supervision of the pharmacies the business of commissions elected from the staff of the schools of medicine and pharmacy in Paris and of the departmental councils of hygiene in the provinces. Finally in 1908 a new law established the supervision not only of the pharmacies but of the entire drug trade by pharmaceutical inspectors. "Pharmacy was thus freed from a servitude which has lasted too long and which could only injure its reputation by illusory control and repression."[29]

Until the 17th century the French apothecary "shops"[30] were opened towards the street and the apothecary worked in the public gaze. Gradually the equipment became more elegant. However, only the pharmacies of hospitals or religious societies equaled the luxury of Italian pharmacies of the Renaissance and later. In the 17th century, faïence jars and jugs from French potteries (Nevers, Rouen, Moustiers, etc.) began to replace the imported pots. From the close of the 18th century, the products of the French porcelain manufactures also entered the pharmacies. It may be mentioned that the discovery of the kaolin of Saint-Yriecx by the apothecary Villaris of Bordeaux made possible the French

porcelain industry. It was the so-called "chevrettes," the specially shaped jugs for syrups, medicinal honeys, and oils, "which constituted the pharmaceutical pot par excellence!" Their display was forbidden to all but apothecaries.[31] They became, therefore, the sign of the apothecary "shops," exhibited in the windows in order to distinguish the "apothecas" from other shops. An ordinance forbidding the spicers to use the so-called "pots a canon," cannon-like shaped containers for ointments, etc., caused this type also to become typically pharmaceutical.[32]

As has been pointed out, the French talent of self-organization stood the test through the ages. Although the number of pharmacies was not limited by law, the policy of the guilds and, later on, of the associations with their educational requirements kept this number down to a reasonable level. At the close of the 19th century there were 8442 pharmacies in France, i.e., one to about 4500 persons. In Paris there was one to about 2000 inhabitants.

About the middle of the 19th century French pharmacy gave another and very important proof of its appreciation of present-day economic needs. In 1852 Dorvault organized the "Pharmacie centrale de France," the first national co-operative covering pharmaceutical industry and commerce. This organization, the shareholders of which are exclusively French pharmacists, has developed into one of the largest pharmaceutical manufacturing and wholesale businesses of the world and affects the life of the French pharmacists in practically all of its aspects.[33] Since 1869 the "Pharmacie centrale" has published its own journal, "l'Union pharmaceutique." The subtitle of this journal, "organe des intérêts scientifiques, practiques et moraux de la profession," shows that it covers all phases of the profession. Of other French pharmaceutical journals still in existence mention should be made of the "Répertoire de pharmacie," established in 1844, the "Bulletin des sciences pharmacologiques," established in 1899 and the journal of the French students of pharmacy, "La pharmacie française," established in 1896. Furthermore, there are several bulletins of local pharmaceutical associations.

It is but natural that the professional spirit so evident in the entire development of French pharmacy likewise found expression in professional literature. Until the end of the 16th century the works of Arabian authors and their European followers constituted, naturally, the libraries of the French apothecaries. To these authors were occasionally added the "Grand herbier" or "L'arbolayre," a very free French translation of the "Circa Instans" (see page 28). Soon, however, the books of French origin increased. Jean de Ruelle, latinized as Ruellius, (1474-1537) wrote his "De natura stirpium." The Parisian, Jacques du Bois, latinized as Silvius, published in 1541 his "Methodus Medicamenta Componendi" and in 1548 his "Pharmacopoeae, libri tres" which was translated into

French by André Caille.[34] In 1556, G. Rondelet of Montpellier (1507-1566) published his famous "Materia Medica." In 1561, French pharmacy received its first real apothecary book written in French by the Parisian apothecary, Michel Dusseau, the "Enchiridion ou manipul des miropoles."[35] Another French apothecary, Thibaut Lespleigney, in 1537, wrote a description of simple drugs in verses. In 1603, Joseph du Quesne, latinized as Quercetanus, a zealous partisan of Paracelsus, and physician in ordinary to King Henry IV in his "Pharmacopoea Dogmaticorum Restituta" emphasized the ideas of his master (see page 37).[36] The books of Jean de Renou were of great influence on the practice of French pharmacy. Published first in Latin in 1608 and in a French translation by Louis de Serres in 1616, they represented a formulary, a textbook, and a collection of rules for the preservation of drugs, the equipment of the apothecary "shop" and laboratory, and professional ethics. These rules frequently reveal a similarity to the directions given by Saladin de Asculo in the 15th century (see page 53).

From the middle of the 16th century on, the number of famous French pharmacists and their books increases. The most important books, written by French apothecaries and used in pharmacy during the 17th and 18th centuries, were: The "Pharmacopée royale" of Moise Charas (1618-1698); the "Traité de la chymie," known also as "Cours de chymie," of Nicaise Le Febvre (1610-1674); the "Cours de chymie," the "Traité universel des drogues simples" and the "Pharmacopée universel" of Nicolas Leméry (1645-1715); the "Elémens de pharmacie" of Baumé (1728-1804); the "Manuel de pharmacie" of Demachy (1728-1803); the "Tractatus de materia medica" of E. F. Geoffroy (1672-1731). It was toward the end of the 18th century that Lavoisier, no apothecary himself but a pupil of the apothecary, Rouelle, published his famous experiments concerning the role played by oxygen in the process of combustion and thereby established the basis for the new chemistry and hence of scientific pharmacy.

In the 17th century the first official local pharmacopoeia appeared in France. It was the "Formulaire de Blois," issued in 1634. There followed the first Parisian "Codex medicamentorum seu pharmacopoeia Parisiensis," 1638, the "Pharmacopoeia Lillensis," 1640, the "Pharmacopoeia Burdigalensis" (Bordeaux), 1643, etc. The last French local official formulary was the "Pharmacopoeia Lugdunensis" (Lyon), issued in 1778. In 1818 the first edition of the "Codex medicamentarius seu Pharmacopoeia Gallica," obligatory for the whole of France, was published.

Thirty-two pages of the history of French pharmacy, written by André-Pontier[37] and 48 pages of Bouvet's history[38] are devoted to a brief enumeration of the famous French pharmacists from the 17th cen-

tury to the present. These men intensively and often decisively promoted scientific progress in the different branches of the natural sciences. Some of them simultaneously served their country in prominent positions with remarkable success. A few names have already been mentioned. There should be added those of Soubeiran (1797-1858), Bayen (1725-1798), Ballard (1802-1876), Sérullas (1774-1832), G. F. Rouelle (1703-1770) and his brother H. M. Rouelle (1718-1778), Parmentier (1737-1813), Proust (1754-1826), Vauquelin (1763-1829), Robiquet (1780-1840), Caventou (1795-1877), Pelletier (1788-1842). Bouvet tells us that 13 apothicaires were members of the French Academy of Science before 1803, that 6 pharmacists are now members of this academy and that 11 pharmacists are at present members of the French Academy of Medicine.[39]

The part played by pharmacists in the development of the French pharmaceutical industry is large and important. One of the first in France to manufacture chemicals and galenicals on a large scale was the apothecary Baumé. The "Prix courants des préparations de chymie et de pharmacie qui se trouvent à Paris chez Baumé, apothicaire," published in 1775, were very comprehensive.

In military service, the French apothecary is first mentioned in 1630.[40] From the beginning he was placed on the same footing with the surgeon. In 1766, the permanent office of an "apothecary-major of the battlefields and the armies of the king" was created. The usual designation, however, was abridged to "apothecary-major général."[41] In accordance with the title "médecin inspecteur général" of the leading military physician, this title was replaced, in 1824, by the designation "pharmacien inspecteur général." At present the French military pharmacists enjoy the following ranks and titles: "Pharmacien inspecteur"—brigade general, "pharmaciens principaux de première et de seconde classe"—colonels and lieutenant colonels, "pharmaciens majors de première et de seconde classe"—majors and captains, "pharmaciens aide majors de première et de seconde classe"—lieutenant and sub-lieutenant.[42]

For a longer or shorter period many of the best known French pharmacists have been in the service of the army, among them Bayen, Cadet de Gassicourt, Fée, Parmentier, Pelletier, and Sérullas. The apothecary general of the so-called "Grande armée" of Napoleon I, Ch. Laubert, enjoyed the special confidence of the Emperor. After the siege of Moscow in 1812, Napoleon planned the establishment of a mint to stamp coins out of the gold and silver which the French had found in the conquered city. Asked whether he knew someone to install and to operate a mint, the emperor answered: "Don't we have our pharmacien général? I commission him with everything!"

It was the famous apothecary-chemist-statesman, Dumas who wrote:

> To produce several eminent chemists, it is necessary to educate many. It is pharmacy which trains them. For this reason I have long persuaded myself to regard the learned profession of the pharmacist as a national asset which it is necessary to preserve without alteration and to restore little by little to the healthy conditions of its normal existence.[43]

6

THE DEVELOPMENT IN GERMANY

IT IS highly characteristic that in Germany, in contrast to Italy and France, the pharmaceutical profession was always regulated by governmental rules rather than being self-governing. During the Middle Ages the number of apothecaries in German communities was too small to make pharmaceutical guilds or guild-like associations possible. In this connection it should be pointed out that some cities in Germany and in the German-speaking part of Switzerland did not allow the establishments of tradesmen not belonging to a guild.[1] Thus the apothecaries were at times forced to join a guild of another calling. There were highly esteemed guilds, e.g., the "Guild of Safran" (saffron) in Basel, comprising the leading commercial groups and members of the intellectual professions;[2] and the "Hansegrebenguild" in Kassel.[3] Of both it is known that apothecaries not only were guild members but often elected to office. But even in these instances only the commercial side of the calling was subjected to the regulations of the guilds.[4] In general the apothecaries objected to becoming members of the guilds of retailers.

Such control as was guaranteed to merchants and craftsmen by their guilds—the closed shop and the monopoly of sale and manufacture—was accorded the apothecaries by the "privilegium," a typically pharmaceutical document peculiar to Germany and to those countries in which the practice of pharmacy was based on the German system. These deeds were bestowed on the apothecaries by the individual rulers of the principalities of the Holy Roman Empire of the German Nation, which, before its disappearance after the victories of Napoleon I over the German armies in 1806, had no less than 332 divisions including 65 hierarchic units (archbishoprics, bishoprics, and abbeys) and 56 imperial cities.

These privileges were of different types:

1. They were tied up with the building in which the calling was practiced. Hence the purchaser of such a privilege had to buy the building.
2. They were granted to individuals. In this case the privilege might terminate with the death of the individual, or it might be hereditary.
3. They were granted to individuals without restriction, hence were salable at any time.[5]

As to the first apothecary "shops" on German soil, viz., in Cologne (1225), Wetzlar (1233), Luebeck (1238), Trier (1241), etc., nothing very definite is known. From the 14th century on more documentary

FIGURE 7. The original pharmacy of the Merck Family, in Darmstadt, Germany.

There is scarcely another country in which industry emerged to such an extent and so directly from pharmacy as it did in Germany. Since the early 19th century numerous pharmaceutical establishments have originated from apothecary laboratories, among them the internationally known firms of E. Merck in Darmstadt, E. Schering (now Schering-Kahlbaum) in Berlin and I. D. Riedel in Berlin and Britz. The firm of Merck represents simultaneously another peculiarity of German pharmacy, a remarkably long and uninterrupted sequence of family members in control of the undertaking. The Merck family owns to-day not only the company but has owned also for more than 250 years the old pharmacy from which the plant developed.

evidence has come down to us. The archives in Zerbst preserve a "privilegium" signed by Margrave Otto IV of Brandenburg-Landsberg in 1303 which granted the apothecary, Walther junior, the vendible, hereditary, and exclusive right to practice pharmacy in Prenzlau. From the 14th until the beginning of the 19th century such privileges were the usual legal basis of the apothecary "shops" in Germany. Since that time, generally speaking, no new privileges have been granted. The old privileges were not abolished but the pharmacies established after 1804 in Bavaria, 1805 in Saxony, 1811 in Prussia, etc., have another legal basis. While differences exist in the individual German states the conditions during the 19th century and up to the present have been as follows: Permission to open a new pharmacy depends on a so-called concession. The place, or in towns where pharmacies already exist, the area in which the new pharmacy is to be established is made known in a public announcement and interested pharmacists are requested to make application. In general the concession is awarded to the applicant who has served the longest time as an employee in pharmacies.

In some of the German states these concessions were from the beginning of the new regulation neither salable nor hereditary. In Prussia, the largest of the German states, the owners of the concessions were given the so-called "right of presentation" of their successors. As each person so nominated as a "successor" was accepted, provided he was a licensed pharmacist, this right of presentation was identical with the right of sale and hereditary transmission. These concessions, representing a real value, became known as "real" concessions.

By royal order of 1894 the right of presentation was abolished. Hence all pharmacies established after June 30, 1894 are non-vendible and non-hereditary. After the death of the owner the contest for the concession of the pharmacy is announced by the district authorities in the same way as when the establishment of a new pharmacy is proposed. The pharmacist who receives the concession must pay the heirs of his deceased predecessor the actual value of the goods and equipment of the pharmacy. He may in addition be asked to pay a certain amount for investments made by the predecessor. The concessions granted after June 30, 1894 were designated "Personal" concessions because they were restricted to the lifetime of the concessionaire.[6]

Thus the German pharmacies of today are either (1) old privileges which can be disposed of quite as their owners desire; or (2) "Real" concessions, the sale or inheritance of which requires governmental confirmation with each change; or (3) "Personal" concessions allowing only the usufruct of the business during the lifetime of the concessionaire.

The fact that the number of pharmacies was limited made those that

were salable desirable subjects for investment and speculation. This was particularly true during the long period of prosperity which Germany enjoyed before the World War. As a result certain apothecaries bought and sold pharmacies, not for the purpose of practicing their profession, but as a matter of speculation. The battle against this "Apothekenschacher" constitutes an interesting chapter in the economics of German pharmacy.

In addition a few pharmacies in some of the German states are the property of the government or of former sovereigns, and are either leased to pharmacists (Dresden, Gotha, Stuttgart) or managed by a pharmacist for the owner (Berlin, Munich).[7] Most of these pharmacies have come down to the present from the 16th and 17th centuries in which they were established as the court pharmacies of German princes.

In the early times of German pharmacy, apothecary "shops" were often established by the larger municipalities, especially the imperial cities, i.e., cities with the same governmental sovereignty as was possessed during that period by the German princes and like them subject only to the supremacy of the Emperor. Such pharmacies, managed by pharmaceutical employees, existed, e.g., in Nuremberg in the 14th century, and in Augsburg, Hamburg, Hanover, and Frankfort on the Main in the 15th and 16th centuries.[8] It is significant that the municipalities did not derive that advantage from their apothecary "shops" which they had expected. Hence they first leased and then sold them. In modern times communities in some of the German states (Anhalt, Baden, Hessia, and Thuringia) were given governmental permission to establish pharmacies in places in which the government considered them to be necessary. These pharmacies were leased to pharmacists who were selected in the usual way by public contest. In Hessia there were, in 1934, 23 such communal pharmacies among a total of 128.

The first and only known German attempt at socialized pharmacy, i.e., pharmacy as an institution of the state executed by pharmaceutical officials, proved a failure at least from a financial point of view as was also the case with the early municipal apothecary "shops" mentioned above. It was the Duke of Brunswick who tried the experiment during the second half of the 18th century. Between 1747 and 1753 he bought the pharmacies in his country, created a central pharmaceutical administration, a central laboratory, and a central department for the purchase of all drugs and other articles pertaining to the trade. After 20 years during which neither the expected profit was achieved nor better service rendered to the public, the pharmacies were sold to private individuals.[9]

All of these different systems of regulation of the practice of German pharmacy agree in one decisive point: the limitation of the number of pharmacies. This principle was abandoned in Prussia for only one year

when, in 1810, with the introduction of the general liberty to practice any calling the restrictions for pharmacy likewise were automatically abolished. But this practice, a consequence of the ideology of the French revolution (see page 63) was abandoned in 1811. In the limitation of the number of pharmacies, introduced by the law of the German Emperor Frederick II in 1240 (see page 35), the characteristic German regulation of civil life finds a typical expression. No allowance is made, or at least but little opportunity is left, for self-determination. The government describes in detail practically all the duties of both individuals and the calling they represent. In exchange it grants rights and protects them. The government expects the pharmaceutical profession to serve public welfare. Thus it limits competition to enable the profession to accomplish this task. It does this not only by the limitation of the number of pharmacies and their distribution over the country according to the number of inhabitants—one pharmacy to approximately 10,000 peoples—but also by the protection of the monopoly of the pharmacists.

Most of the old privileges, issued between the 14th and the 18th centuries, contained detailed instructions about the management of the pharmacy and at the same time enumerations of the goods which were monopolies of the apothecary. Among these goods forbidden to the general retail trade, we often find such articles as sugar, spices, liquors, wine, tobacco, coffee, and chocolate. Some of these articles were used in medicine and were costly substances. The main reason, however, for reserving them for sale by the apothecaries was the necessity of securing a livelihood for the apothecary. In the privilege granted to the apothecary, Kestner, in Landsberg a.W., in 1585, it is explicitly stated that he must be given a monopoly in the trade with spices and in the retailing of wine and liquors because it would be impossible for him to earn his livelihood from the sale of medicaments only.[10] We find the same idea expressed in many of the numerous laws, ordinances, and edicts. In an ordinance of the Count of Schleiz in the 17th century the authorities of the town of Schleiz are admonished to protect the apothecary "shop" from illegal competition by the general retailers lest "this precious jewel so very useful for town and country becomes damaged or even perishes."[11] Later on, naturally, the monopoly rights of the apothecaries became restricted more and more to medicaments. However, the fundamental concept of the governmental obligation to protect the pharmacies in behalf of the public welfare has not been changed.

It is the natural consequence of the German principle of achieving and maintaining a just balance between the rights and the duties of the people by legal regulation, that the governmental limitation of competition had to be supplemented by governmental protection of the people from an abuse of this restriction. It was this concept that caused

the early introduction, in the law of Frederick II, of a regulation of prices for remedies sold by the privileged apothecaries, and gave rise to the development of the very carefully elaborated lists of governmentally fixed prices which up to the present regulate the commercial relations between the pharmacists and the public to the benefit and satisfaction of both parties in Germany and in those countries under German cultural influence. We know of about 530 such governmental German price lists (Taxen) from the 15th century until 1935.[12] In 1905, the lists of all the smaller German states, the lists of the individual towns, etc.,[13] which had previously disappeared in the 19th century, were replaced by the first "Arzneitaxe für das Deutsche Reich" (meaning a list of governmentally-fixed prices obligatory for the entire German Empire). A new edition was issued annually with prices following the changes in the wholesale prices. The "Arzneitaxe" not only fixes prices for drugs but also rates for the pharmaceutical work done in filling prescriptions in accordance with the amount of time required and technical skill involved.[14]

As stated above, the monopoly rights of the apothecaries gradually came to be restricted to remedies. There was naturally a continuous quarrel between the apothecaries on the one side and their competitors on the other, and a large part of the many edicts and laws concerning pharmacy which were issued through the centuries is devoted to this subject.[15] Again and again the various governments stated the kinds of goods reserved for sale in the apothecary "shops" and the articles which might be sold in other stores.

The original tendency to reserve the entire trade in remedies to apothecaries naturally underwent a gradual change. Concessions had been made to the "Materialisten," a combination of retail grocer and hardware dealer. Further concessions were made by turning over the trade in spices, cosmetics, etc., to others. Decided modifications of these regulations followed in 1872. In that year the first of a series of so-called "Kaiserlichen Verordnungen" (Imperial edicts) was issued. This took out of the pharmaceutical monopoly all unprepared and unmixed drugs—with the exception of a number of very potent ones—and all preparations intended to be used as cosmetics, foodstuff, dietetics, and prophylactics, even those with healing or mitigating properties. One result was that there developed a new art of advertising, the purpose of which was to remove from the pharmaceutical monopoly as many remedies as possible by labeling them cosmetics or dietetics or—above all—as prophylactics. Nevertheless, they continued to be recommended for their primary use as healing agents. In as much as the edicts did not enumerate what was allowed for free trade but only stated the kinds of preparations reserved to the pharmacies, many possibilities for inter-

pretation were left open. Gradually a distinct class of shops, the so-called "Drogerien" developed, which specialized in the sale of technical chemicals, cosmetics, dietetics, spices, candy, dyes, varnishes, and all those drugs, and remedies, which were "free" or could be interpreted as being free. The number of these "Drogerien," the owners of which since 1872 have been united in a very active organization, amounts now to about 10,000. Having achieved their success on the basis of the assertion that no special pharmaceutical knowledge is needed for the sale of "harmless" drugs, the "Drogisten" have since clamored for official recognition as a kind of second-class pharmacists (with certain privileges over the general storekeepers) and have organized special schools for their apprentices.

During the early period, the professional education of the German apothecaries[16] was not so well regulated as it was in France. Lack of co-operative self-determination left the regulation of pharmaceutical education to circles outside of pharmacy. Thus until the end of the 17th century the numerous decrees contain but vague remarks concerning pharmaceutical education. Customary during that period was an apprenticeship of 6 years. A satisfactory knowledge of Latin was a general requirement. From an edict of the Duke of Bavaria issued in 1595 we learn that the examinations had to be in writing, oral, and practical.[17] The examiners were physicians. Aside from the required preliminary Latin instruction no fixed course was outlined. Berendes, therefore, states that in general German pharmacy in the 17th century could not rise above technical skill.[18]

This situation, however, was changed in the course of the 18th century. The attendance of apothecaries at universities increased. In the statute of the University of Goettingen, founded in 1737, the "res pharmaceutica" (pharmaceutical matters) and the "pharmacopolae" (apothecaries) are explicitly mentioned. Above all, obligatory examinations based on definite requirements, first introduced in 1725 in Prussia, gave the German apothecaries a place among the representatives of the scientific professions. There were, henceforth, in Prussia, two classes of apothecaries. Those of the second class, permitted to operate in small towns only, were not required to study. They had to serve their apprenticeship, mostly of 5 years duration, and clerkship, mostly 6 years, and then pass an examination before their provincial "Collegium medicum" (medical board). The apothecaries of the first class were required to serve at least 7 years as clerks after their apprenticeship and had to attend a course at the superior "Collegium medicum" in Berlin, an institution for the scientific education of military physicians and surgeons. This course consisted of lectures in chemistry and botany; discourses on the chemicals used as remedies, their preparation and "the chemical-physical reasons" for the several kinds of preparations, and finally a

"processus pharmaceutico-chymicus," i.e., practical pharmaceutico-chemical instruction. The first professor of pharmaceutical chemistry at the superior "Collegium medicum" was the apothecary, Caspar Neumann (1683-1737), the last one the apothecary, M. H. Klaproth (1743-1817) who later on became the first professor of chemistry at the University of Berlin after its foundation in 1809. The division of the Prussian apothecaries into two classes disappeared in 1854.

During the last third of the 18th century the German apothecaries themselves began to raise their educational standards. A series of private institutes devoted to the education of pharmacists was established, some of which became famous far beyond the German frontiers. The institute of the apothecary Johannes Bartolomaeus Trommsdorff in Erfurt, e.g., had many students from foreign countries. The Prussian government acknowledged the education acquired in this institute as equivalent to the study "at Berlin or at universities."[19] In 1808, Bavaria made study at a university obligatory for apothecaries. The other German countries soon followed. The present educational requirements for German pharmacists are stated in the law of April 1, 1935. They are as follows:

1. Preliminary education: a certificate of graduation from a gymnasium, realgymnasium, or superior "Realschule," corresponding to about 3 years of college.

2. Professional experience: two years of apprenticeship, previous to admission to a university, in a pharmacy the proprietor of which has been officially authorized to receive apprentices, and one year of probation after the completion of the university studies.

3. Professional education: a three-year university course.

4. Examinations: (a) After the two years of apprenticeship, examinations, written, oral, and laboratory, testing the practical skill of the applicant and his knowledge of the scientific professional fundamentals; (b) After completion of the university studies a written, laboratory, and oral examination. This includes general chemistry, pharmaceutical chemistry, botany, pharmacognosy, physics, galenical pharmacy, history of pharmacy, and bacteriology. During the 3 years of study the student must complete successfully courses in hygiene, sterilization, law and economics, and homeopathy. The fundamentals of these subjects may also be included in the examination.

It should be mentioned that one half of the year of probation must be served in a place having only one pharmacy with a pharmacist who is unable to pay a professional assistant. Remuneration in this case is restricted to free room and board. The pharmacy owners in question are enumerated in a list revised annually.

For a long period the inspection of German apothecary "shops" was quite generally the duty of physicians. It was not until 1642 that, in an

edict issued for the town Brandenburg, the co-operation of an apothecary was officially admitted. It took more than 80 additional years before —in 1724—this local regulation became general for the entire Prussian Kingdom. This situation has not been changed up to the present. Since 1935 the Prussian regulation, i.e., the co-operative inspection of the pharmacies by a medical official and a pharmaceutical practitioner has become obligatory for the entire German "Reich," replacing the inspection by pharmacists only in the several states in which it had been introduced in the course of the 19th or 20th centuries—Hessia (1867), Saxony (1836), Thuringia (1920)—thus confirming the medical supremacy over pharmacy. It should be stated that according to the legal regulation the pharmacist participating in the inspection is co-ordinate with, not subordinated to, the physician. It is of interest to note that the inspection of the retail trade in drugs outside the pharmacies, hence, the inspection of the "Drogerien," is the business of pharmaceutical practitioners. It is but natural that the owners of these stores resent this interference and demand that their places of business be inspected by officials appointed from their own ranks.

Socially the position of the German apothecary has been very similar to that of his French colleague (see pp. 60-61). He was and is the typical representative of the middle class. Throughout the ages representatives of the calling have been awarded all the honors which ordinary civil life has to offer.[20] Again and again we find apothecaries as municipal deputies, as senators, as mayors and, later on, as members of parliament.[21] There were three reasons for this special social esteem: Firstly, the fact that the apothecary for the most part belonged to the well-to-do class; secondly, that very often there were dynasties of apothecaries active for generations in the same place;[22] thirdly, that they were the most available and sometimes the only representatives of science, especially of natural science, within their communities and used their knowledge for the benefit of their fellow citizens.[23] As a classical illustration of the scientific and social standard of German pharmacy at the beginning of the 19th century one of the greatest Germans, the poet and statesman Goethe, may be quoted. In 1822 he stated that "in Germany the apothecary enjoys a highly esteemed position within society . . . The German apothecaries cultivate science. They are aware of its importance and endeavor to utilize it in practical pharmacy."[23]

It is noteworthy that this scientific endeavor of the German apothecary at times made him a questionable figure and caused him to become the target of literary derision.[24] He stood and stands between trade and science. Particularly in Germany with her very exact class distinctions, sharply differentiating socially between tradesmen and scientists, this hybrid condition was bound to create tragicomical situations. In addition

it is significant that German pharmacy was the culture medium of a large number of well-known poets.[25]

It was in the 17th century that the apothecary buildings and "shops" in Germany began to mirror the social position of their owners. Of 16th century "Apotheken" we know only one instance of an architecturally beautiful building still serving pharmaceutical purposes. It is the "Ratsapotheke" in Lemgo (Westphalia), one of the most characteristic edifices of the Renaissance period which has come down to us. During the 17th and 18th centuries the German apothecaries tried in general to make their houses and "shops" places of dignity and artistic culture.[26] Thus indigenous faïence production which, after the end of the 17th century spread over the whole of Germany, gave to most of the pharmacies the possibility of equipment which previously had been restricted to the few who could afford to import Italian, French or Delft jars.

As in all European countries the first scientific pharmaceutical knowledge came from Arabian sources via Italy. The first German original literature, dealing with subjects of pharmaceutical interest and influencing pharmacy, was of a special kind: books on general natural history including pharmacy, so-called "Arzneibuecher" (books dealing with remedies and their application), "Destillierbuecher" (books on the art of distillation), and herbals. Most of these books were written in German and in a popular style. The best known of these books are: the cleric Conrad v. Megenberg's (1309-1374) "Buch der Natur," the first natural history in German;[27] the "Arzneibuch" of a supposed physician named Ortloff von Bayrlandt, a compilation of the Latin medical books of his time written at the beginning of the 15th century;[28] the "Gart der Gesuntheit" (garden of health), called also the little "Hortus Sanitatis" (Latin translation of "The garden of health") written in all probability by the physician Joh. Wonnecke of Caub and published in 1485.[29] This book was followed in 1491 by the so-called large "Hortus Sanitatis," an anonymous comprehensive work written in Latin;[30] the books on the art of distillation written by the surgeon Hieronymus Brunschwygk (1430-1512);[31] the herbals of the so-called fathers of botany, i.e., Otto Brunfels (1500-1534), Hieronymus Bock (1498-1554), Leonhard Fuchs (1501-1566); the herbals of Adam Lonicerus (1528-1586) and Johann Theodor called Tabernaemontanus (1510-1590).

The "Destillierbuecher" as well as the "Kraeuterbuecher" (herbals) often contained more than their names implied. In the herbals not only herbs but also animals and gems and their assumed medicinal effects are described. Thus the large "Hortus Sanitatis" describes 392 animals and 144 gems besides 530 herbs. In the large book on the art of distillation we find not only very detailed instructions on distillation enhanced by numerous illustrations: the products obtained and their medicinal

effects are described, also the herbs used. Written almost exclusively by physicians—Bock, a clergyman, is the only one who was not a physician—these books were intended to serve not only the colleagues of the authors, but the apothecaries as well and, last but not least, the laymen. Thus Brunschwygk, in the introduction of his small "Destillierbuch" states that the illustrations are for the purpose of giving an idea to those unable to write or to read.[32] The famous commentary on Dioscorides of Mathioli (see page 56) was published in German under the title "New deutsch Kreuterbuch" in 1563. With annotations it was republished by Joachim Camerarius in 1588, by B. Verzascha in 1678, and by Ph. Zwinger in 1696. These men also were physicians. The first German apothecary known as author of a botanical book of importance was the Nuremberg apothecary Basilius Besler (1561-1629) who wrote the "Hortus Eystettensis," a description of the botanical garden in Eichstaett, containing more than 1000 illustrations.

It may be mentioned that Brunschwygk, in addition to his Destillierbuecher, wrote a "Thesaurus Pauperum," the first known formulary for economical prescribing (1566) and that Brunfels was not only the author of one of the most used herbals but also of "Die Reformation der Apotheken," a guide for the equipment and management of the pharmacies similar to the book of the Frenchman, Renou (see page 67), based on Saladin de Asculo.

In the 16th century, books by German authors begin to appear covering the entire scope of pharmacy. In 1560, Johan Bretschneider, called Placotomus, published his "Pharmacopoea in Compendium Redacta," following the example of Jacques du Bois (Sylvius) in using the term "pharmacopoea" for a formulary instead of the terms "antidotarium," "enchiridion," or "dispensatorium." In 1561, the physician J. J. Wecker of Basel published his "Antidotarium Generale" which by 1647 had appeared in 9 Latin and 2 French editions. The book contains a comprehensive formulary, very instructive explanations of the art of filling prescriptions and directions for the preparation of the galenicals as well as of the chemicals of that time. The book is significant for the fact that the use of excrements which had never quite disappeared became fashionable once more. The "Antidotarium" contains a special chapter on "excrementa." It may be mentioned that this fashion reached its climax in the so-called "Dreckapotheke," published by the physician Paullini in 1714 and devoted exclusively to excrements, intending, as the author says in the preface,

> to cure favorably almost all even the most serious diseases and charmed harms from the head to the feet internally and externally by excrements and urine.

The universal textbook of the German apothecaries for at least 100 years, however, was the "Pharmacopoea Medico-physica" (or "medico-chymica") of the physician Joh. Christian Schroeder (1600-1664), published in Latin in 1641 and translated not only into German, but also into English under the title "The Complete Chymical Dispensatory." The 17th century produced many books concerning materia medica and pharmacy written by German physicians. The most important of these, conveying the pharmaceuticochemical knowledge of that period to the apothecaries, were the books of Oswald Croll (1560-1609) one of the most ardent followers of Paracelsus, and the "Pharmacia Moderno Saeculo Applicanda" (pharmacy applied to modern times) of D. Ludovici (1625-1680) published in 1671. In 1654 Joh. Rudolf Glauber (1603-1670), one of the first German chemists and one of the founders of German chemical industry,[33] published his "Pharmacopoea Spagyrica" (spagyrica-chemica). Though not educated pharmaceutically he was, in 1644, manager of the court pharmacy in Giessen.

The first book on pharmaceutical subjects written by a German apothecary was the excellent "Lexicon Pharmaceutico-chymicum" of the apothecary, Joh. Christoph Sommerhof, published in 1701. However, from that time on, i.e., since the middle of the 17th century the number of such books increased extraordinarily. Moreover, they were, almost without exception, of a very high standard. The following list enumerates only the most important educational books written by apothecaries. In this connection it should be stated that all of these men have also written many other books and participated prominently in the chemical discoveries of that period.

In 1740, after the death of the author, the apothecary Caspar Neumann (see page 76), his "Praelectiones Chymicae" were published. This book, based on his own experiments, represented a much more critical spirit than the book of Schroeder and became very popular. In 1777, Wiegleb (1732-1800) published his "Deutsches Apothekerbuch" (German Practice of Pharmacy). One year later, in 1778, Goettling (1755-1809) published his "Einleitung in die Pharmazeutische Chemie" (Introduction into Pharmaceutical Chemistry). Between 1778 and 1782, Hagen in Koenigsberg (1749-1829) published his "Lehrbuch der Apothekerkunst" (Textbook on the Practice of Pharmacy) which, until the middle of the 19th century, was the most used book in the scientific education of the apprentices. In 1790, Joh. Bartholomaeus Trommsdorff (1770-1837) began his long series of textbooks on pharmacy, among them the first textbook on pharmacognosy written in German and his "Allgemeines pharmazeutisch-chemisches Wörterbuch oder die Apothekerkunst in ihrem gesamten Umfange" (Pharmaceutico-chemical

Dictionary or the Art of Pharmacy in its Entire Extent). In 1792, Hermbstaedt (1760-1833) published his "Katechismus der Apothekerkunst" (Catechism of the Art of the Apothecary) and, in 1795, Westrumb (1751-1819) published his "Handbuch der Apothekerkunst fuer Anfaenger" (Textbook on Pharmacy for Beginners). The pharmaceutical textbooks written by apothecaries in the 19th and 20th centuries are too numerous to permit the naming of even a selection.

Like most of the unofficial pharmaceutical literature in Germany until the 18th century, the official books of the calling, the pharmacopoeias, were written by physicians. The first official pharmacopoeia in Germany was the "Dispensatorium" of Valerius Cordus,[34] issued in 1546 and made official within the imperial city, Nuremberg. In the 16th century it was followed by the "Enchiridion" or "Dispensatorium Augsburgense"[35] compiled by Adolf Occo in 1564 and by the "Dispensatorium Coloniense" (Cologne) in 1565. These three earliest German pharmacopoeias represent the three types of official formularies which followed. The book of Cordus is a good compilation of old formulas without special additions by its author. The book of Occo contains in part experiences of the author, is more comprehensive, and involves legislative regulation. Only those drugs to which an asterisk is added, must be kept in stock by the apothecaries. Finally, "Dispensatorium Coloniense" is not only an official formulary but a textbook as well. It devotes 144 pages to a description of the simple drugs and their alterations.

It is noteworthy that between 1618 and 1648 i.e., during the time of the bloody religious quarrels fought out on German soil, which afterwards became known as the Thirty Years War and in which the German population was well-nigh decimated, no official pharmacopoeia was published in Germany proper with the single exception of that of Frankfort on the Main (1624 and 1626). On the other hand the legal regulations controlling the practice of pharmacy were increased in the 17th century to three times the number of those issued during the 16th century.[36] At the end of the 17th century the first state pharmacopoeia, the "Dispensatorium Brandenburgicum," was published (1698). The seven editions which followed appeared under the title "Dispensatorium Borusso-Brandenburgicum" (Prussian and Brandenburgian) in accordance with the fact that in 1701, Prussia, the duchy, had been made a kingdom and the electorate of Brandenburg had been assigned the second place in the union of the two states. Until 1806, i.e., the disappearance of the Holy Roman Empire of the German Nation, further state pharmacopoeias were published in Württemberg (1741, 1750, 1754, 1760, 1771), Pfalz (1764, 1802), Hanover (1706), Saxony (1779, 1782, 1791), Hessia (1806), in the hierarchic principalities Fulda

(1787, 1791), Münster (1739) and Würzburg-Bamberg (1778, 1782, 1796). Within the same period dispensatories of municipalities were issued in Bremen (1792), Hamburg (1716, 1768, 1772) and Regensburg (1727, 1737).

In Austria, until 1806 one of the most important parts of the German Empire, the conditions were very peculiar. In 1570 the medical faculty of the University of Vienna announced a Dispensatorium pro Pharmacopoeis Viennensibus in Austria, which, compiled by members of the faculty, was to be obligatory for the apothecaries in Vienna. At that time no book could be printed without permission of the sovereign. For some unknown reason this permission was not obtained. Thus this Pharmacopoeia, although official, was never printed and the Viennese apothecaries were forced to copy such parts as they thought necessary. In 1618 the "Pharmacopoea Augustana," edition of 1613, became the official standard for Vienna and the Austrian provinces. It was supplemented by a collection of official formulas published in a "Catalogus Medicamentorum Compositorum." Up to 1722 all subsequent editions of the Augustana remained in force. In 1729, the first Austrian pharmacopoeia printed in Austria appeared under the title "Dispensatorium Pharmaceuticum Austriaco-Viennense." This book lived through 6 further editions until 1770. In 1774, there appeared the "Pharmacopoeia Austriaco-provincialis." The name signified that Austria was but one of the many provinces of the Empire. The last editions of this standard were issued in 1794 (Latin) and 1795 (German). It was followed in 1812 by the first "Pharmacopoea Austriaca."[37] Again this name is significant. Now Austria was no longer one of the provinces of the Holy Roman Empire of the German Nation. It had become a separate state, one of a new empire embracing all the countries belonging to the Austrian line of the princely house of Habsburg to the exclusion of most of the German states. The eighth edition of this "Pharmacopoea Austriaca" was still in force when Austria was annexed by Germany in 1938.

Besides the Prussian-Brandenburgian dispensatory the "Pharmacopoea Wirtembergica" was the most esteemed and used official book of that period being used even beyond the German frontiers. It contained a special part with good descriptions of the simple drugs, thus representing the type of combination of textbook and formulary which had been known since the "Dispensatorium Coloniense" of 1565. It was one of the most comprehensive formularies, supplying the apothecary with information about all drugs, new and old. The edition of 1771 still contained 107 drugs of animal origin. Both of these official books, the Prussian-Brandenburgian and the Wuertembergian pharmacopoeias, reflect the victory of the chemical school, of the school of Paracelsus.

Instead of the names of the Arabian physicians, of Avicenna, Rhasis, Mesuë and their European followers Nicolaus, Fernel, and Occo, attached to the titles of the compounded formulas, of which they were the real or supposed authors, we find in the Brandenburgian-Prussian Pharmacopoeia of 1698, in addition to the name of Paracelsus, the names of the paracelsists Becher, Craanen, Croll, Ludovici, Mynsicht, Quercetanus, Rolfink, Sylvius, Wirtz and Zwelffer. In the "Pharmacopoea Wirtembergica" of 1771 this list of names is augmented by those of other chemically minded men such as Camerarius, Dippel, Minderer, Schroeder, Stahl, Wedel etc.[38]

It was in consequence of the new theory of Lavoisier concerning the role played by oxygen in the process of combustion that the authorship of the German pharmacopoeias underwent a decided change. The first "Pharmacopoea Borussica," indicating by its title that now the electorate of Brandenburg had been merged completely in the kingdom of Prussia, represents an important milestone in the history of German pharmacopoeias. This book, published in 1799, was not only one of the first official pharmaceutical formularies based on the new chemical theories, it was also the first one in Germany primarily prepared and decisively influenced by pharmacists and not by physicians.[39] The explanation is to be sought in the fact that in Germany the development of chemistry and more particularly of pharmaceutical chemistry has been fostered by apothecaries since the middle of the 18th century. Their opportunity had come and it had found them ready. Thus they could not be overlooked and ignored. It was the triumvirate M. H. Klaproth, S. F. Hermbstaedt and Valentin Rose junior, who, assisted by other pharmacists, and, naturally, in collaboration with physicians, elaborated the pharmacopoeia.[40]

This preparedness on the part of the German apothecaries proved eventful at the next decisive step in the history of the German pharmacopoeias. During the middle of the sixties of the 19th century the general as well as the pharmaceutical situation in Germany demanded some kind of unification. Before the German political unification—with the exclusion of Austria—became a reality in 1871, the German apothecaries anticipated it by presenting, in 1865, to the German professional world a "Pharmacopoea Germaniae" elaborated exclusively by apothecaries under the sponsorship of their association.[41] This book became official only for Saxony, but it paved the way for and showed the necessity of a pharmaceutical standard obligatory for all apothecaries throughout the reunited Germany. It was, indeed, one of the first governmental acts of the new German Empire to create such a standard. In 1872, only one year after the establishment of the new Empire, the first "Pharmacopoea Germanica" appeared. This book as well as all later editions (published

since 1890 in German instead of Latin), was elaborated by representatives of all interested professions and groups, but the influence of the pharmacist prevailed.

It is surprising that since the middle of the 17th century such a host of prominent men should emerge suddenly from a profession with a relatively small membership, and that so large a number of textbooks should have been published which survived through several editions. The explanation is to be sought in the establishment of special laboratories in connection with the "officin." This was especially true after the appearance of the "Destillierbuecher" (see page 78). Aromatic waters, the precursors of the volatile oils, and aromatic spirits, both regarded as the quintessences of the drugs from which they were prepared, became the most important preparations of the pharmacies. When shortly afterwards the increasing use of chemicals in medicine demanded laboratory facilities and skillful technicians both requirements could be fulfilled by the apothecaries. Several illustrations of German apothecary laboratories of the 17th century have come down to us showing well-equipped workshops with apparatus for distillation and the implements used during that period for preparing chemicals.

Hence the German "Apotheken" were the only places during the first stage of modern chemistry in which the art could be learned practically. Not only were most of the professors teaching chemistry at the German universities between the middle of the 18th and the first third of the 19th century apothecaries; they frequently instructed their students in their pharmacies.[42] In the appointment of K. G. Hagen as professor of chemistry a decisive factor was that he owned "a well-equipped laboratorium chymicum."[43] The apothecary laboratories in Germany were doubtless the precursors of the later university chemical laboratories.

To the names of famous German apothecaries already mentioned, the following, representing only the most important scientists, may be added:

A. S. Marggraf (1709-1782), G. L. C. Rousseau (1724-1794), E. W. Martius (1756-1849), Gren (1760-1798), Gehlen (1775-1815), K. L. Willdenow (1765-1812), Du Mênil (1777-1853), Doebereiner (1780-1849), Sertuerner (1783-1841), J. A. Buchner (1783-1852), Ph. L. Geiger (1785-1836), Nees v. Esenbeck (1787-1837), F. F. Runge (1794-1867), Wackenroder (1798-1854), H. H. J. Hager (1816-1897), C. F. Mohr (1806-1879), H. v. Fehling (1812-1885), M. v. Pettenkofer (1818-1901), Flueckiger (1828-1894), E. Schmidt (1845-1921), E. Beckmann (1853-1923), H. Thoms (1859-1931).

These laudable activities on the part of the pharmacists for the welfare and the development of science in general had to find expression

within the profession itself. In France, the only country with a similar scientific pharmaceutical activity, the frame for that expression was given by recognized official pharmaceutical bodies with extensive powers of self-government (see page 64). In Germany, where such bodies did not exist, other possibilities for united activity and the dissemination of information had to be created. In Germany appeared the first journal devoted exclusively to pharmacy: the "Almanach oder Taschenbuch fuer Scheidekuenstler und Apotheker," founded in 1780 by Goettling.[44] Since then a large number of scientific pharmaceutical journals have made their appearance, among them "Trommsdorff's Journal der Pharmacie" (1794), the "Berlinisches Jahrbuch für die Pharmacie" (1795), "Gehlen-Buchner's Repertorium für die Pharmacie" (1815). Subject to frequent changes were the "Annalen der Pharmacie" which first appeared in 1832, combining Haenle-Geiger's "Magazin für Pharmacie," founded in 1823, with the "Archiv des Apothekervereins im noerdlichen Teutschland," founded in 1822 (first issued two years previously as "Pharmaceutische Monatshefte"). In 1834 "Trommsdorff's Journal" was merged with the "Annalen." However, in 1835 the "Archiv" regained its independence under the title "Archiv der Pharmacie." It was Woehler in his capacity as one of the editors who suggested that the original title "Annalen der Pharmacie" be changed to "Annalen für Chemie und Pharmacie." After the death of Liebig the word pharmacy was dropped. Since 1874 this lost child of pharmacy bears the title "Justus Liebig's Annalen der Chemie." Of the numerous other journals devoted primarily to scientific pharmacy and being independent, i.e., not affiliated with or supported by an association, the "Pharmaceutische Centralhalle" became best known. It was founded by Hermann Hager in 1859 and is still published. Of the independent journals devoted to professional pharmacy as a whole, to the scientific as well as the ethical and commercial aspects, mention should be made of the "Pharmazeutische Zeitung," founded in 1856 by Hermann Mueller, and the "Süddeutsche Apotheker-Zeitung," founded in 1861 as "Pharmaceutisches Wochenblatt." The former was discontinued toward the close of 1937; the latter is being continued.

Aside from these independent journals others appeared, supported by associations as their official organs. The first larger German pharmaceutical organization of importance was founded in 1632 in Nuremberg.[45] In 1794 the "Berliner Apotheker Konferenz," in 1798 the "Magdeburger Apotheker Konferenz," in 1808 the "Erfurter Kraenzchen" followed. These associations, however, possessed local character only. A more comprehensive organization, the "Apothekerverein im noerdlichen Teutschland," was founded in 1820 by Brandes, Beissenhirtz, Du Mênil and Witting. In 1872 this association and the "Sueddeutscher Apotheker-

verein," which had been founded in 1848, were combined as the "Deutscher Apothekerverein." After the governmental change in 1933 the "Deutscher Apothekerverein" became first the "Standesgemeinschaft Deutscher Apotheker" and in 1935 the "Deutsche Apothekerschaft." This totalitarian association is at present the only one permitted representing the professional and commercial interests of the German apothecaries.[46]

In 1890 upon the initiative of Hermann Thoms the "Deutsche Pharmazeutische Gesellschaft" was organized. Its special object was to promote pharmaceutical science and research. This society still exists but under the jurisdiction of the leader of the "Apothekerschaft."

The "Deutscher Apothekerverein" as well as the "Pharmazeutische Gesellschaft" issued their own publications. In addition to the "Archiv der Pharmacie" the "Apothekerverein" since 1886 has published the "Apotheker-Zeitung." After 1933 this became known as the "Standeszeitung Deutscher Apotheker" and after 1934 as "Deutsche Apotheker-Zeitung." Since 1906 the "Jahresbericht der Pharmazie," published annually since 1841, has been edited under the patronage of the "Apothekerverein." Since its foundation (1890) the "Pharmazeutische Gesellschaft" has issued the "Berichte der Deutschen Pharmazeutischen Gesellschaft" which was consolidated with the "Archiv der Pharmazie" of the "Apothekerverein" in 1924, the publication now bearing the dual title "Archiv der Pharmazie und Berichte der Deutschen Pharmazeutischen Gesellschaft."

It should be mentioned that, since 1818, attempts were made repeatedly to organize associations of pharmaceutical employees. They were more or less successful. A lasting and very active association of this kind was founded in 1904 by Ehrlich and Wiskirchen under the name "Verband Konditionierender Apotheker für das Deutsche Reich," known, since 1910, as "Verband Deutscher Apotheker." Gradually this came to include the majority of all pharmaceutical employees. Since 1905 the "Verband" has issued the "Zentralblatt für Pharmacie." In 1934 this association like all others disappeared. With its funds it was absorbed by the new and totalitarian pharmaceutical association mentioned above.

Apart from these associations, for the most part voluntary, there were and are official bodies. The first of this type were the so-called "Apotheker-Gremien" organized in Bavaria, in 1842.[47] Such a "gremium" in which membership was compulsory for all owners of pharmacies existed in each governmental district. The gremiums were auxiliary administrative bodies and had to report to the government about conditions, desirable changes and abuses in the field of pharmacy either upon request or upon their own initiative. In addition they had

to take care of the social welfare of their members and to establish and support welfare institutions. In Saxony similar compulsory bodies entrusted with the same tasks were founded in 1865 under the name "Pharmaceutische Kreisvereine." Later on so-called "Apothekerkammern" were constituted. The purposes which they had to serve were essentially the same but they were also given disciplinary power over unethical acts of their members. Such "Kammern" have existed in Brunswick since 1865, in Prussia since 1901, in Baden since 1906, in Hessia since 1923, in Wuertemberg since 1925, in Thuringia since 1926, in Bavaria since 1927.

In 1937, the "Reichsapothekerkammer" came into existence based upon the "Reichsapothekerordnung." With that institution an official and compulsory pharmaceutical body for the "ethical" affairs of all German pharmacists was created. Unlike the Pharmaceutical Society of Great Britain (see p. 94ff.) this official body has no real administrative power. It is an institution for the promotion of general progress within pharmacy and exercises a kind of police power. All pharmacists, even those not in active service, have to belong to the "Kammer" and are submitted to a rigid jurisdiction which is even authorized to punish disobedient members by forbidding them the further practice of pharmacy. The leader of the "Deutsche Apothekerschaft" is also president of the "Reichsapothekerkammer." He controls the professional and in part even the private activities of German pharmacists.

Until the re-establishment of the Empire in 1871, the position and the rank of the German apothecary in military service was different in the various states. Both title and rank changed from time to time. Thus the head of the military pharmaceutical service in Prussia was a Generalstabsapotheker in 1798, Oberfeldapotheker in 1808, and Oberstabsapotheker since 1818. This title was retained in imperial Germany and after the first world war (1918) in the German Republic. In 1935 the old designation Oberfeldapotheker was readopted.[48] The rank is equal to that of lieutenant-colonel. In this connection it may be pointed out that the resistance of the German troops in East Africa during the first world war (1914-1918) would have been impossible had not the Stabsapotheker Schulze succeeded in the ex tempore manufacture of sufficient amounts of quinine from cinchona trees cultivated in the Usambaradistrict.[49]

There has been scarcely one branch of natural science which has not been promoted very definitely by German pharmacists. The rapid development of scientific and industrial chemistry starting at the end of the 18th century is doubtless to a great extent due to the noble emulation of French and German pharmacists in just this field of science.

7

THE DEVELOPMENT IN ENGLAND

THE MOST striking feature in the history of English pharmacy is the fact that a real pharmaceutical profession based entirely on the art of pharmacy and with the purpose of developing the professional and social standards of its members did not exist in England before the 19th century and in Scotland before the 18th century. In this respect England differs significantly from the other large European cultural zones—the Italian, the French, and the German.

Naturally, in England as well as on the continent there were early dealers in drugs. Moreover the terms by which they were designated were the same as those used on the continent. But while the creation of the calling of the continental apothecaries was based principally on the very early separation of the medical and the pharmaceutical professions either by law (see the law of the Emperor Frederick II of 1240 in the glossary) or by statutes, privileges, etc., this separation in England was not the beginning but the end of the development.

In all European countries transgressions of the legal limitations of both professions were very frequent and the complaints on both sides belong to the history of continental pharmacy as well as of medicine. The principle of separation, however, was in general beyond all dispute. At times even the transition from one profession to the other was not difficult. In the 17th and 18th centuries there were many persons on the European continent who had passed the examinations in pharmacy and medicine and were therefore entitled to practice both professions. Moise Charas,[1] the author of the famous "Pharmacopée royale" (1676), Nicolas Lémery,[2] the author of the first "Pharmacopoeia universalis" (1697) and many other Frenchmen were simultaneously pharmacists and physicians. In Germany this dual education was even more common and caused many conflicts.[3] England, however, was the only European country in which not only a larger or smaller number of persons changed their professions, based on personal qualifications and fulfillment of the usual requirements, but in which an entire calling gained the legal recognition of its ambition and became a part of another profession without—and this is the irony of the situation—resigning completely the rights of the first profession.

The reason for this peculiarity is to be found in the insular and topographical character of England, which, while enabling Scotland

FIGURE 8. The Laboratory of John Bell & Company, 1842. The original was engraved by J. G. Murray after a painting by W. Hunt. (*From the Chemist and Druggist, Special Issue, 1933.*)

and Wales to remain separate culturally for centuries, also isolated England from continental Europe. Of its aboriginal inhabitants the Celts, closely related to the French Celts, only those who lived in Wales and Scotland or were able to flee into these areas, survived the conquest of the country by Germanic tribes, i.e., the Jutes, Saxons and Angles (about 450). Throughout the centuries there was not much harmony between the people in Wales and Scotland and those of England proper. The amalgamation between the Anglo-Saxons and the later conquerors of the islands, the Normans, who came over from France (Normandy) and dominated the country after their victory in the battle of Hastings (1066), took place very gradually. Therefore, until the Elizabethian period (16th century), conditions in England were not sufficiently stable to cast professional life into uniform and rigid moulds. Even later the proportion of educated people was small. As a result the way was, and had to be, free for each one to make the most of his opportunity. This freedom for every Englishman to seek adventure and success inside and outside the British Isles has, indeed, created the wealth and power of England. On the other hand, this system of "laisser faire" (let it go), finding its theoretical basis in the Manchester liberalism, formulated in the thirties of the 19th century by the Manchester School of economics, has often retarded that steady, uniform development and balance within and for the totality of the people which may be achieved only by stating and protecting definite principles and regulations.

During the Middle Ages the English trade in drugs was largely in the hands of the guild of pepperers in London. This guild, mentioned in records of 1180 as one of 18 guilds fined because they had not sought a royal license, was designated "the Keeper of the King's Great Beam at the Staple Yard or Steelyard"[4] making it the warden of weights and measures in England (see the similar regulation in France, page 59). With this guild the apothecaries were associated, and shared, therefore, its fate. C. J. S. Thompson reports as follows:

> In 1328 the pepperers adopted the name *grossarii* (grocers, i.e., dealers *engros*) and received official recognition as the body that had the regulating of weighing in the City. Some years later they amalgamated with another body called the spicers, who traded in similar wares, but they ultimately came into difficulties and in 1345 a new fraternity was founded. . . . Their patron saint was St. Anthony, and until the year 1373 they bore the title of the fraternity of St. Anthony.

Then the guild adopted the title, Company of Grocers and under this name received its first charter from King Henry VI in 1428. Thompson says:

> It is obvious from these historical records, that the pepperers, spicers and apothecaries were originally branches of the same guild, the latter dealing more in drugs for medicinal use, while the former traded in the spices and condiments employed for domestic purposes. This is corroborated by the particulars of their stocks which are still on record. In addition to drugs, the apothecaries kept the rarer kinds of aromatic gums exported from the East through Italy and also sold pepper, sugar and wax candles.

Thompson also quotes Chaucer who in the "physician's tale" says: "Ful redy hadde he hise apothecaries to send his drogges."[5]

Besides these so-called apothecaries who, naturally, formed the anonymous rank and file of the calling, there were others whose names have come down to us. They were mostly Frenchmen, some of them being appointed apothecaries to the royal court, as Henri Montpellier (1290), Roger de Frowicke (1329), Pierre de Montpellers (1330), Coursus de Gangeland (1345), J. Falcand de Luca (1357).[6] "Apothecaries, who were minor medical practitioners, specializing in the preparation and compounding of drugs" are referred to by J. P. Gilmour.[7]

The first regulations for the English practice of medicine and pharmacy were promulgated by Henry VIII. In 1511, he ordered that

> . . . no person could lawfully practise medicine or surgery within the city of London unless he had been examined and licensed by the Bishop of London or the Dean of St. Paul's, who were to be assisted in the examination by four doctors of physic and of surgery or other expert persons in that faculty.[8]

The bishop as chairman of a medical board of examination is not so peculiar as it seems to be. The chairman had to be impartial, i.e., no physician, and he had to be a master of the Latin language, a condition not so easily fulfilled in the England of those days. What is more peculiar, and a very significant proof of English conservatism, is the fact that persons were licensed by English bishops to practice medicine within their dioceses as late as the middle of the 18th century. In the act of 1511 the designation "apothecary" is used for the assistants to physicians.[9]

In 1518 the Royal College of Physicians was founded and in 1540 powers were given it to "search, view and see the apothecary wares, drugs and stuffs." Thereby the continental system of subjecting apothecaries to medical supervision was introduced into England. In an act of 1553 the new powers of the college are stated more specifically. Four members were authorized "to survey and examine the stocks of apothecaries, druggists, distillers and sellers of waters and oils, and preparers

of chemical medicines." This enumeration gives a complete illustration of the different groups of people who were at that period in any way active and officially recognized in the field of pharmacy. The reference to "chemical medicines" is indicative of the fact that the ideas of Paracelsus had come relatively early to England.

The acts of 1511, 1518, and 1540 previously mentioned tended to make the practice of medicine the monopoly of physicians licensed as such. But the physicians were more zealous in defending their rights than their small number and the urgent need of medical help, especially in the open country, warranted. In 1543 a new act was passed confirming the right of "every person being the King's subject, having knowledge and experience of the nature of herbs, roots and waters to use and minister, according to their cunning, experience and knowledge."[10] This act is a typical instance of "laisser faire." It paved the way for everyone who had "cunning, experience and knowledge," leaving the decision as to the possession of these qualities entirely to the individual claiming them. Barrett says:

> By this act the numerous irregular practitioners were protected and they were legally tolerated. It could hardly have been otherwise as these formed the ordinary doctors or professors of the healing art at the disposal of the general public throughout the kingdom . . . These unincorporated practitioners were the forerunners of the incorporated apothecary of the first Stuart King of England.[11]

And now this "incorporated apothecary" enters the scene. In 1609, a charter of the first Stuart King of England, James I, created the Society of Apothecaries of London, again uniting, however, the apothecaries with the grocers. After many disputes and dissensions the King, influenced by his court physicians Theodore Mayerne and Henry Atkins, granted them on December 16th, 1617, a new charter, which formed them into a separate company under the name of the Master, Wardens, and Society of the Art and Mystery of the Apothecaries of the City of London.

> This charter conferred upon them the monopoly of keeping an apothecary's shop and rendered it unlawful for the grocers or any persons, "to make or sell, to compound, prepare, give, apply or administer any medicines or medicinable compositions, viz., distilled waters, compounds or *olea chimica, apozemata,* sirrups, conserves, *eclegmata, electuaria, condita, medicinalia, pillulae, pulveres, troches, olea, unguenta, emplastra,* or by any other way to use or exercise the art, faculty, or mystery of an apothecary or any part

> thereof, within the City of London and the suburbs or within seven miles of the City."[12]

As was but natural, the grocers protested. The King, however, held to his original decision, stating that the grocers were but traders, having no professional skill. In 1619 the new "dispensatorie troy weights," having remained the English apothecaries' weights, were introduced by law and their use made obligatory for the members of the society.

The new society had to fight on two fronts: against the physicians in order to defend their assumed rights as "minor medical practitioners," and against the druggists and chemists who, in spite of the monopoly of the apothecaries, continued to multiply and flourish.

> The merchants and druggists, being a section of the grocers' company, merely sold articles in the raw or unprepared state, and the chemists (who were not incorporated) took upon themselves the duty of preparing those medicines which required the aid of fire and which were chiefly, if not entirely, minerals, earths, or preparations of the metals.[13]

The campaign against the medical front was difficult and lengthy but, as mentioned at the beginning of this chapter, finally victorious. It was a fight with actions and with words and lasted more than a century.

Without any doubt the apothecaries practicing pharmacy trespassed on territory not belonging to them. They had, however, gradually gained a large number of clients depending upon them and they had proved themselves useful in the medical part of their activity in a time of need, viz., during the Great Plague (1665-66). At that time when the majority of the physicians in London either had died or had fled, "the friends of the sick were obliged to call in the aid of the apothecaries who readily forsook their shops to visit the sufferers at their bedsides."[14]

The battle of words, each side using the arguments already reviewed in the similar French quarrel (see page 61) found its most famous expression in "The Dispensary," a poem by the well-known physician Dr. (afterwards Sir) Samuel Garth, in mock heroic verse, which was published in 1699.[15] On the part of the apothecaries it is significant that in a tract under the title *pharmacopolae justificati* (the justified apothecaries) published in 1724, they based their defense on the assumption, "that an academical education is nowise necessary to qualify a man for the practice of physic."[16]

So far as action was concerned, the quarrel centered in the opening of dispensaries by members of the College of Physicians and by the prosecution of apothecaries practicing medicine. While the first mentioned undertaking of the physicians proved successful and inflicted much harm

on the apothecaries—Pitt stated in 1703 that "the dispensatories of the college now make up twenty thousand prescriptions,"[17]—the other, the prosecution of the apothecaries, led to the defeat of the physicians. A judgment of the court decided in favor of the college of physicians against an apothecary Rose who had been accused of prescribing medicines. The House of Lords, however, on the 15th of March, 1703 ordered "that the judgment given in the Court of Queen's Bench be reversed." From this time on the apothecaries were recognized medico-pharmaceutical practitioners.[18]

The battle on the other front, i.e., against the chemists and druggists, was not so favorable for the apothecaries. Here they were on the defensive and they were forced—willingly or unwillingly—to use in this quarrel the same arguments which the physicians had used against them shortly before.

> The apothecaries failed to get powers to search chemist shops and they were likewise unable to persuade parliament to pass a measure to prohibit druggists from practising pharmacy and to make it unlawful for physicians and surgeons to prepare and sell medicine. Renewed attempts in 1794, 1795 and 1812 for the same or similar purposes were equally unsuccessful.[19]

In 1815, however, they succeeded, although only temporarily. The apothecaries' act of 1815 forbade "unqualified persons"—and there were no qualified ones besides the physicians, the surgeons, and the apothecaries—to judge of disease by external indications, to sell poisons, and to dispense medicines. But the chemists and druggists by an emergency organization achieved an amendment which reserved for them their customary rights. They defined these rights as consisting of the buying and preparing of drugs and medicinal compounds and selling them wholesale and retail.[20] With this definition, excluding all medical ambition, the chemists and druggists drew the boundary between the medical and pharmaceutical professions.

The more the apothecaries became medical practitioners the more, naturally, their original tasks passed into other hands.

> By the end of the eighteenth century the chemists and druggists had absorbed a considerable proportion of the sale of drugs and medicines and after the first few years of the nineteenth century, had practically monopolized it.[21]

There existed, therefore, at this period a class of privileged dealers in drugs and preparers of prescribed medicines the members of which had lost the basis of this privilege, although wanting to retain the usufruct, and another group which had advanced to be the real and efficient

fulfiller of this neglected task without being legally recognized. The apothecaries' act of 1815, the consequences of which were prevented only by the public appearance and activity of the chemists and druggists, had shown the danger resulting from this lack of recognition. It was due to the efforts of Jacob Bell and William Allen that public interest was aroused and a satisfactory solution of the problem attained when they started the Pharmaceutical Society of Great Britain.

In 1841 the members of the board of examiners of the Society of Apothecaries, in the course of negotiations with the College of Physicians declared, "that one of the chief evils in the present position of the apothecary is his name which has little reference to his actual duties, that he is in fact the medical attendant on the larger mass of the community and should be designated the general practitioner of medicine."[22]

In the same year the Pharmaceutical Society was founded "to benefit the public and elevate the profession of pharmacy, by furnishing the means of proper instruction."[23] According to Bell, it was the odium resting on pharmacy as a trade which induced the apothecaries to aspire to medical practice as a profession. They did not become aware that it was their own fault if pharmacy in England had not attained the continental standard. Pharmacy in the present day, said Bell, has become so complicated and embraces so many sciences "that a complete knowledge of the subject can only be acquired by those who devote their exclusive attention to the pursuit."[24]

"Le roi est mort, vive le roi!" The Pharmaceutical Society continued on its road of slow but continuous success. In 1843, February 18th, the Society received its charter as a corporative body and by virtue of this charter the power of regulating the education and admission of members. In 1852 the first Pharmacy Act empowered the Society to conduct examinations by means of two boards, one for England and Wales and another for Scotland, also to grant certificates of qualification for pharmaceutical chemists. The use of titles denoting such qualification was legally restricted to the registered holders of them.[25] The Pharmacy Act of 1868 brought forward as its most important step the compulsory qualification and registration of all members of the profession. In addition the sale of poisons was henceforth to be permitted only in open shops.[26] An amendment Act, passed by Parliament in 1898, extended full membership, reserved hitherto to the Pharmaceutical Chemists (title of all those having passed the major examination), to the Chemists and Druggists (title of all those having passed the minor examination). The Pharmacy Act of 1908 brought the pharmaceutical company business under the control of the Society and gave to it the power to make by-laws and, with this, to institute a compulsory curriculum. The membership, however, was voluntary, and the Society with all its examination

and registration activities was but an auxiliary institution to the proper authority. It became such an authority, i.e., the executive pharmaceutical authority in Great Britain, in 1933.

The Pharmacy Act of 1933 made membership in the Pharmaceutical Society compulsory. Every person registered as an English pharmacist, by virtue of his registration, is a member of the Society. The titles Pharmacist, or Chemist and Druggist, or Druggist are protected. The statutory committee has the power, subject to appeal to the High Court, to remove names from the register. Each registered pharmacist carrying on a business which comprises the retail sale of drugs is to be an authorized seller of poisons. Inspectors, who must be registered pharmacists, are to be appointed by the Society.

Thus, indeed, the Act of 1933 became the magna charta of British pharmacy. In an editorial explaining the new Act, the official journal of the Society wrote: "Pharmacy is recognized as a self-governing community, free to conduct its own affairs and subjected to governmental control only in those matters where its activities affect the public."[27]

"Self-governing community!" The principle employed by England in her relation to her colonies in advancing them to dominions, i.e., to "self-governing communities" if they have proved to be sufficiently mature for self-government, is here transferred into civil life. Behind the English "laisser faire" stands the belief in natural development and the readiness to acknowledge it.

There is still another event in the history of English pharmacy illustrative of this system. The change of the apothecaries into medical practitioners previously mentioned was followed much later, in 1878, by the change of a large number of druggists into dentists. In an amendment to the Dental Practitioners Bill of 1878 initiated by the Pharmaceutical Society, the English government provided that druggists should be registrable who had practiced dentistry in conjunction with pharmacy. Thus a large group of druggists in this way became dentists.[28]

The main objective of the Pharmaceutical Society of Great Britain in the first decades of its existence was and had to be the gradual formation of a group of uniformly and sufficiently educated pharmaceutical practitioners upon whom could be conferred the legal right to supply the people with drugs and medicines. The Society tried to make pharmaceutical science available to the average chemists and druggists, but it could not promote scientific research to the desired extent since many pharmaceutical scientists did not belong to its organization.

For this reason the British Pharmaceutical Conference, "an organization for the encouragement of pharmaceutical research," was founded in 1863. Until 1922 membership of the conference, apart from honorary membership, was purely contributory. It is, however, significant that

prominent leaders of the Pharmaceutical Society were among the first elected officers of the Conference and that this close connection between both associations continued. Since 1922, membership of the Conference is dependent on membership in the Society. As a result, since 1922, the conference is a part of the organization of the Society, though its work is carried on by its own officers. According to Gamble:[29]

> the good work done . . . by the American Pharmaceutical Association . . . in the field of pharmaceutical science particularly" was of influence on the founders and the foundation of the Conference.
>
> Reynolds described the American method of allotting subjects for investigation to individuals for report at the annual meeting, and referred to the inclusion in the published "Proceedings" of the American Association of a section which formed a "Year-Book of Pharmacy" both home and foreign.

The publication of the Conference, the first of which was issued in 1864, followed its American model. It appeared under the title "Proceedings of the British Pharmaceutical Conference," being collated in pamphlet form from the Pharmaceutical Journal, the organ of the Pharmaceutical Society. In 1870 the first Year-Book of Pharmacy was published together with the proceedings or, as they were called since 1871, the "Transactions of the British Pharmaceutical Conference." Since 1926 the Year-Book has been published by the Society and since 1928 the collated material has appeared in quarterly issues under the name "Quarterly Journal of Pharmacy and Pharmacognosy" (in the first year [1928] it was entitled Pharmacy and Allied Sciences), "the four issues, when bound into a volume for the year, representing the Year-Book of Pharmacy." The Pharmaceutical Society had developed into the administrative and educational body of English Pharmacy, with the British Pharmaceutical Conference representing its scientific work. There was now a need for an institution devoted especially to the commercial interests of the profession. Thus in 1921 the Retail Pharmacists' Union was created with the support and expressed approval of the Society. One of the main duties of the new Union, which since July 1, 1932 has borne the name National Pharmaceutical Union, is the representation of the pharmacists in all affairs concerning Health Insurance.

The "Pharmaceutical Journal" mentioned above was founded in 1841 by Jacob Bell who in 1859 presented the copyright of it to the Pharmaceutical Society of Great Britain, the organ of which it has been from its very beginning. The changes in the title are significant. Until 1895 it was called "The Pharmaceutical Journal and Transactions," from 1895-1909 simply "The Pharmaceutical Journal." In 1909, coincidentally with an official attempt to popularize the designation "pharmacist,"

the title was changed to "The Pharmaceutical Journal and Pharmacist." In 1934 the designation "pharmacist," not having been adopted by the majority of the English practitioners, was dropped and the title again reads "The Pharmaceutical Journal."

"The Chemist and Druggist," founded in 1859, is another important English pharmaceutical journal. Since its foundation it has not changed either its name or its objectives. The main idea was to produce something "simply useful—a trade journal," to quote from an editorial about the founders of the journal.[30] Likewise a commercial journal is "The British and Colonial Pharmacist," founded in 1884 under the name "The British and Colonial Druggist" and bearing its new title since 1915.

The first English journal connected with pharmacy was "The Chemist," which existed for two years only, 1824 and 1825. Another journal with the same title was published from 1839 to 1858.

The main difference in the development of pharmacy in England and Scotland was that in Scotland a guild-like connection between spicers or grocers and early apothecaries is not traceable, and the later amalgamation took place not with the physicians but with the surgeons.[31] The reason for this is that, in all probability, in this classical land of feuds surgery and surgeons were much more needed than physicians and internal medicine. In 1575 the town council of Edinburgh prohibited apothecaries who did not belong to the surgeons' guild from performing any surgical operations. In 1599 James VI, influenced by the surgeon Peter Low and the apothecary William Spang, granted a charter to the Glasgow Faculty of Physicians and Surgeons, under which a register of medical practitioners, surgeon-apothecaries and "farmatians" was instituted. In 1643 representatives of both professions, the surgeons and the apothecaries, agreed that all external applications should be performed by the surgeon while the apothecary was to be allowed only the administration of medicine internally. But as early as 1657 the surgeons and the apothecaries united once more. Pharmacy was now taught with surgery in Edinburgh and it was forbidden to practice the art without examination by members of the corporation. In other parts of Scotland the surgeon-apothecary became the general practitioner of the 17th century. In 1682 a decree of separation was issued. In 1695, however, the callings were again brought together. However, some of the apothecaries who did not take the examination as surgeon-apothecary, remained apothecaries proper. In 1721 all apothecaries became, without examination, members of the corporation of surgeons on payment of £50 (=$250). The Edinburgh apothecaries became surgeons almost at the same time the English apothecaries became medical practitioners. In Scotland as in England, a new group of practitioners devoted exclusively to pharmacy arose. They found, however, in contrast to England, the

immediate and full recognition of the medical practitioners. According to Wilbert the college of physicians in Edinburgh adopted in 1754 an act, "that prohibited their Fellows and Licentiates from taking upon themselves to use the employment of an apothecary, or to have or to keep an apothecary shop."[32] In 1786 the Edinburgh Society of Druggist-Apothecaries was founded, followed in 1839 by the Aberdeen Society of Chemists and Druggists. The year 1851 saw the establishment of the North Britain branch of the Pharmaceutical Society of Great Britain.

The inspection of the apothecary "shops" reflects the general development of English pharmacy. In 1447 a royal order of Henry VI gave the grocers power to examine "anis, wormseed, rhubarb, scammony, spikenard, senna and all sort of drugs belonging to medicine, so as not, in the buying of these to be hurt in their bodily health."[33] In 1540 and 1553 royal decrees gave the supervision of the apothecary "shops" to the physicians (see page 90). The charter of the Society of Apothecaries of 1617 empowered the society, i.e., its master and wardens, to inspect any apothecary "shop" and to burn all drugs and preparations they deemed corrupt or unwholesome before the offender's door.[34] In 1723 the power "to visit and examine the shops of apothecaries attended by the master and wardens of the company of grocers" was given again to the College of Physicians by an act of Parliament.[35] In 1730 a clause was agreed upon by which the court which judged questions of confiscated and seized medicines was composed partly of physicians and partly of apothecaries.[36] In 1748 the right to search the apothecary "shops" in London or within seven miles was returned to the Society of Apothecaries.[37] In Scotland the charter of the Glasgow Faculty of Physicians and Surgeons of 1599 provided the supervision and inspection of the apothecaries' wares by the faculty. In 1621, under James VI (who was also James I of England), inspectors were to be appointed yearly to search "within all whatsumever apothecaries shoppes within our said burgh of Edinburgh."[38] In 1684 the College of Physicians in Edinburgh was authorized "to visit at least twice a year all apothecaries shops and chambers within Edinburgh, Suburbs and Liberties thereof, calling to their assistance one or two of the oldest or ablest of the brotherhood of the apothecaries."[39] The above mentioned new regulation, granted by the Pharmacy Act of 1933 and placing the English pharmacists definitely under the supervision of their own society is in force, naturally, for both England and Scotland.

In trying to gain an impression of the social position held by the members of the pharmaceutical calling in England through the ages we have to select as representatives, until the end of the 18th century, the apothecaries. From the middle of the 17th century we also must consider the chemists and from the beginning of the 19th century the new pro-

fessional group resulting from the gradual amalgamation of chemists and druggists and constituting the rank and file of modern English pharmacy.

As in all other countries the social position of the English apothecary was based on the one hand on respect for his professional work, and on the other hand, on the fact that most of the apothecaries were, or at least were considered to be, well-to-do people. Thompson gives a description of two apothecary "shops" of the sixteenth century "extracted from contemporary records," stating that physicians sometimes kept an open shop like the apothecaries.[40] The description shows the shops to have been well equipped with furniture, containers of various kinds and sizes, and weights and balances. The prescriptions of the physicians were copied in a great book which stood on a raised desk or table. As in other countries the apothecary "shops" in England had at this period "a window-frame over which canvas was stretched, but when this was rolled up they were open to the street."[41]

In the 17th century, after the foundation of the Society of Apothecaries, the wealth and esteem of the calling increased. The building, the so-called hall, which they acquired in 1629 and rebuilt in 1666, after the great fire which destroyed the largest part of London, was enlarged in 1786 and stands even today as a witness of the old glory.[42] The good financial condition of the Society was not so much based on membership fees as on its manufacturing and commercial undertakings. In 1623 the Society started with the preparation of galenicals and chemicals, the sale of which was confined to members on a co-operative base. In 1628, however, this undertaking acquired the status of a regular commercial company.

> The company as a company, was henceforward to hold no more than a quarter share in the undertaking. The shares in the laboratory were to be equalized as far as possible to a limit of £25 (=$125) a man, neither more nor less, and no subscribers to shares were to be admitted, even from among the livery unless voted in by a majority of the subscribers.[43]

The laboratory became a real chemical plant in 1671, and in 1703 the Society was given the monopoly of supplying the English navy with drugs. At this time it established a special naval stock. "Practically a company and distinct from the laboratory work the funds were raised in a similar way, that is by money borrowed on bond and by shares taken to a fixed amount by the livery."[44] In 1801 the East India Company decided to buy all drugs and medicines from the Society of Apothecaries. In 1811 and for 5 years previously drugs supplied to the navy averaged

annually £24,917 (=$124,485). The supply of drugs to the East India Company averaged £21,582 (=$107,910) annually.[45]

The "Pharmacie Centrale" in France, founded in 1852 and comprising the pharmacists of the entire nation has been referred to as the first national co-operative pharmaceutical undertaking (see page 66). The "companies" of the London Society of Apothecaries, although organized on a local basis are the first known example of co-operative pharmaceutical work operated on a larger scale.

It is noteworthy that the equipment of the English apothecaries of the 17th and 18th centuries, unlike those of their continental colleagues in general, did not reflect the wealth and social position of their owners. The fact that the apothecary considered himself primarily a medical practitioner made it unnecessary to aspire to a dignified and representative pharmaceutical atmosphere. "On the wall hang saws, knives, forceps and other surgical instruments; for the apothecary was ready to perform any operation, from the cutting off a wen to the amputation of a leg."[46] Furthermore, the description refers to the English imitations of Delft earthenware which became general in England after the 17th century and were therefore used in English pharmacy. "The walls are lined with shelves bearing an array of Delft jars of blue and white for which the Lambeth potters were famous."

Another type of pharmaceutical work and retail shop was represented by the chemist's shops, which are first mentioned in 1576 but did not become numerous before the second half of the 17th century. The most famous of these chemists was the German-born, Ambroise Hanckwitz, who afterwards took the name of Godfrey. He was brought to England by no less a person than Robert Boyle who, according to Kopp, "conveyed to chemistry that direction of work which it kept up since that time with so much success."[47] Together with Hanckwitz, Boyle found a new method for preparing phosphorus and "for many years the 'English phosphorus' supplied from Hanckwitz from his laboratory . . . monopolized the European market."[48] Godfrey-Hanckwitz's laboratory and shop, built in 1706, "became a fashionable resort in the afternoon when he performed popular experiments for the amusement of his friends."[49]

Around 1800 the manufacturing chemists parted company with the dispensing chemists, although some of them retained both businesses and carried on or rather created the idea of professional pharmacy and later became the founders of the Pharmaceutical Society of Great Britain. In general, however, very little of the old glory of the art of the apothecaries or of the recent fame of chemistry came down to the newly arisen combination of chemists and druggists. They practiced pharmacy, it is true, but primarily as merchants like their predecessors, the druggists. With few exceptions, this background differentiated the character

of their shops and their general social position from those of their continental colleagues. In continental Europe the pharmaceutical profession, as a profession, gave and gives to all of its members a certain traditional reputation. In England this reputation was lost with the apothecaries of old and at present has been re-established only in part.

One of the most important means of building up a professional reputation is, naturally, the education of the rising generation.

It was in Glasgow, i.e., in Scotland, that an examination was legally required for the first time in the British Isles. On the basis of the charter granted to the Glasgow faculty by James VI in 1599 the "faculty issued a license to practice pharmacy to candidates who passed its examination in pharmacy, and still retains the right to do so, but has not exercised it since the advent of the Pharmacy Act of 1868."[50] In 1657, in Edinburgh an examination became compulsory for all those who wished to practice pharmacy within the city.[51]

In England proper the first official requirement of a definite time of apprenticeship and an examination of the presumptive apothecaries is contained in the charter of December 6, 1617 constituting the Society of Apothecaries of London. It is ordered, that

> No Person or Persons whatsoever may have, hold, or keep, an Apothecary's Shop or Warehouse, or may exercise or use the Art or Mystery of Apothecaries, or may sell, set on sale, utter, set forth, or lend any compound or composition to any person or persons whatsoever, within the City of London and the Liberties thereof or within Seven Miles of the said City, unless such person or persons have been brought up, instructed, and taught by the space of Seven Years at the least, as apprentice or apprentices, with some Apothecary or Apothecaries exercising the same Art, and being a Freeman of the said Mystery. And after such Seven Years Service or Apprenticeship as is afore said, shall be expired and finished, that then every such apprentice may appear and be presented to the Master and Wardens, calling unto them the President of the College or Commonalty of the Faculty of Physicians of London for the time being, or any Physician or Physicians by the said President to be nominated, and thereunto to be assigned from time to time, if upon warning thereof given, such Physician will be present, and taking advice with the same Physician or Physicians, shall be examined, proved and tried concerning his knowledge and election of Simples, and concerning the preparing, dispensing, handling, commixing and compounding of Medicines, and shall be by them the said Physicians, Master and Wardens, approved and allowed, before he shall presume to have, keep or furnish an

> Apothecary's Shop, or to prepare, make, mingle, work, compound, give, apply, minister, utter, put forth, sell, or set on sale, any medicines, or otherwise by any other ways or means exercise the Art of an Apothecary or any part thereof, within the City of London and Liberties and Suburbs of the same, or within Seven Miles of the same City.[52]

The London Society of Apothecaries, in 1619, held its first examination, resulting in the refusal of the candidate.[52a] Botanical courses were organized in 1627. These courses led to the lease of land and to the establishment of "a physic garden" at Chelsea in 1673. In 1722 it was presented to the Society of Apothecaries by Dr. Hans Sloane, one of the most active and best known medical practitioners of his period. The apprentices were examined before entering the calling. In 1683 an apprentice was rejected "for insufficiency in the Latin tongue."[53] Lectures in materia medica were offered after 1753. Periodic examinations by a committee of examiners started in 1758. In 1827 the first regular curriculum of the Society of the Apothecaries was issued. This was mainly medical. It required five years of apprenticeship, the attendance at courses in anatomy, physiology, in theory and practice of medicine, etc.

Real pharmaceutical education began in England only after the foundation of the Pharmaceutical Society. One of the fundamental demands in the program of the Society was "the development of scientific requirements . . . to remove our (the English pharmacists) apparent deficiency as pharmacologists when compared with other nations."[54] After the establishment of a laboratory in 1844-45 the society's school of pharmacy was the first institution in England offering the possibility of laboratory instruction under proper guidance.[55] The present educational requirements in Great Britain are as follows:[56]

1. Preliminary education: Matriculation or other examination admitting to a course for a degree at any university in Great Britain or other university approved by the council of the Pharmaceutical Society.

2. Professional education: An approved "preliminary" scientific course in chemistry, physics, and biology of at least 25 hours weekly during each term of a session of three terms. This course may be taken before apprenticeship. On completion of the apprenticeship and preliminary scientific course, an approved course of instruction of not less than 25 hours weekly during each term of a session of three terms (one academic year) in pharmaceutical chemistry, pharmacognosy, pharmaceutics, physiology and forensic pharmacy. Candidates for the major, the "Pharmaceutical Chemist"—examination, have to take a two-sessions course.

3. Professional experience: Apprenticeship (indentured) of 4000 hours

for the minor, the "Chemist and Druggist" and 2000 hours for the major, the "Pharmaceutical Chemist" curriculum.

4. Examinations: (a) preliminary scientific: examination in chemistry, biology, and physics; (b) qualifying: examination in pharmacognosy, physiology, pharmaceutics, pharmaceutical chemistry, forensic pharmacy, history of pharmacy from 1600 (minor-chemist and druggist examination); a more profound examination in the same subjects and in the history of chemistry from 1750 (major-pharmaceutical chemist examination).

The examinations are to be taken before the board elected by the Pharmaceutical Society. The examinations pertaining to the degree of pharmaceutical chemist can be taken also at any university recognized by the society. In this case examinations have to be supplemented by an examination in forensic pharmacy before the board of the society. Botany and zoology are included in biology.

From the very beginning the Pharmaceutical Society of Great Britain had established two kinds of examinations, the "minor," enabling the candidate to fulfill the duties of a pharmaceutical practitioner, and the "major," the purpose of which was the education of scientific representatives of the profession.

Redwood describes the procedure in the first examinations held by the society as follows: "The textbook of examination was to be the Pharmacopoeia of the London College of Physicians and questions were to be submitted with reference to chemistry, materia medica, botany and pharmacy as embodied in that work."[57]

There were three pharmacopoeias official within the United Kingdom until 1864: The above mentioned London, the Edinburgh, and the Dublin pharmacopoeias. The first edition of the "Pharmacopoeia Londinensis" was published in 1618, just one century after the establishment of the London College of Physicians. The first printing, issued on May 7, 1618 was, as a contemporary official account stated, executed so "surreptitiously and prematurely" that on December 7th in the same year the College brought out a corrected edition. The pharmacopoeia was very comprehensive. It was, quite naturally, compiled primarily in the spirit of the Galenic-Arabic school and comprised 1192 simples and 963 preparations and compounds. Among the simples were 31 animals and 163 parts of animals including various excrements and urines.[58] There were, however, some signs indicating the dawn of a new era. The book contained 19 chemicals, among them calomel, mineral acids, preparations of steel and antimony, sugar of lead, and caustic potash. "The inclusion of some of these may no doubt be attributed to the influence of Sir Theodore Mayerne."[59] The second edition appeared in 1650 and brought tinctures as a new class of preparations. The subsequent

editions, each of them representing more or less the actual state of pharmaceutical, chemical, and medical knowledge and thought,[60] were published in 1677, 1721, 1746, 1788, 1809, 1824, 1836 and 1851.

The first "Edinburgh Pharmacopoeia" appeared in 1699, the second in 1722, the third in 1736, etc., in all, 15 editions until 1841, in which year the last edition was published. The first "Dublin Pharmacopoeia" was published in 1807, the second edition in 1826, and the third and last in 1850. While the "Dublin Pharmacopoeia" did not gain much attention beyond Ireland, the "Edinburgh Pharmacopoeia," during the 18th century, ranked high among the internationally acknowledged pharmaceutical standards.

The first "British Pharmacopoeia," issued in 1864, and replacing the London, Edinburgh, and Dublin standards, disappointed the mass of the medical and pharmaceutical practitioners by omitting or changing many of the preparations which they were in the habit of prescribing or dispensing.[61] It was, therefore, superseded by a second edition in 1867. The next editions were published in 1884 and 1898. In 1900 and thereafter there appeared an "Indian and Colonial Addendum" which was incorporated into the "Pharmacopoeia" of 1914. The "Pharmacopoeia" issued in 1932 showed for the first time the influence of a closer co-operation with the Committee for the Revision of the United States Pharmacopoeia. In 1936 an "Addendum" was issued.

Until the end of the 18th century the preparation of the official pharmacopoeias in England was apparently the exclusive business of the medical profession. In 1785 we find the first mention of pharmaceutical co-operation. An entry in the proceedings of the Society of Apothecaries reports on an invitation from the College of Physicians to assist the college in revising the "London Pharmacopoeia" in order that it "should be as correct and free from errors as possible, and that all the formulae should be such as can be easily prepared by the gentlemen of your society."[62] A similar invitation followed in 1806.[63] That is, however, the last entry in the proceedings of the Society of Apothecaries concerning co-operation in the revision of the "London Pharmacopoeia."

The "gentlemen of the society of apothecaries" had become primarily medical practitioners and could not any longer be considered the representatives of pharmaceutical practice. In this situation a new proof was given of the English tendency to take the good wherever it may be found and to confer tasks and responsibilities on those who have shown the necessary ability. The College of Physicians, editing the "London Pharmacopoeia," had encountered much criticism on the part of the pharmaceutical chemists. The impossibility of editing such a standard treatise exclusively from the medical point of view and knowledge had

become evident and the necessity of pharmaceutical co-operation had become apparent. But neither the old apothecaries nor their successors, the chemist and druggists, unorganized as the latter were at that time, had produced the experts needed. There was, however, a learned pharmacist, Richard Philips, who had criticized the edition of 1809, the corrected reprint of 1815, and the edition of 1824 with utmost acrimony. It was he who was commissioned to translate the Pharmacopoeia of 1824 and to prepare a commentary thereon. "Subsequently he assumed a more responsible position with reference to the work as editor as well as translator and commentator, in which capacities his name is associated with the editions of 1836 and 1851."[64]

These two editions of the "London Pharmacopoeia" are, therefore, to be considered essentially the work of a pharmacist. The "British Pharmacopoeia," however, was not edited by the College, but by the General Council of Medical Education and Registration. With it the Pharmaceutical Society, now the representative of English pharmacy, has continuously co-operated, though dominance is retained by the medical profession. It is of interest to note that a representative pharmacist, Peter Squire, after the appearance of the first edition (1864) "brought out a book called 'A Companion to the British Pharmacopoeia,' which proved a useful guide to medical practitioners, and acquired a great circulation."[65]

The general conditions in English medicine and pharmacy, as described above, were not conducive to a large and systematic literature on pharmaceutical subjects previous to the 19th century. There were in use in England until the 16th century the same books of the Galenic-Arabic school which formed the professional library of the apothecaries in all European countries, viz., the "Antidotarii Nicolai," the "Grabadin" of Mesuë, the book of Symon Januensis, etc. Later on the most important works of French and German pharmaceutical literature were introduced. Of English books written in the 16th century, the following should be mentioned: "The New Herbal," written in 1551 by William Turner, physician to the court of Edward VI; Robert Recorde's "The Urinal of Physick," first published in 1548; and William Bulleyn's "Bulwarke of Defence," issued in 1562.[66] Bulleyn's "Bulwarke" was quoted frequently because of the twenty-one rules for apothecaries which it contained. Rule 19 admonishing the apothecary "that he does remember his office, is only to be the physicians coke" has often been quoted by the physicians in their quarrels with the apothecaries. In the 17th century the English translation of the French physician Guibert's "The Charitable Physician" with "The Charitable Apothecary" (see page 62) was popular.[67]

In 1688 the apothecary James Shipton published a collection of

formulae which according to him were prescribed by the physician, George Bate, and to which he gave, therefore, the title "Bate's Dispensatory." The book, usually known as the "Pharmacopoeia Bateana," lived to see several editions and was in use as book of reference until the end of the 18th century.[68] In 1718 the first edition of "Quincey's New English Dispensatory" appeared. The popularity of this book is proved best by the fact that it was issued in ten editions by 1736.[69] There were a few other compilations from continental works and some commentaries on the London and Edinburgh pharmacopoeias, among them "Lewis' Dispensatory," "Duncan's Edinburgh Dispensatory," and "Thomson's London Dispensatory," but not the slightest sign of the live, fruitful, and sometimes creative activity, so characteristic of the continental, especially the French and German pharmacists.

Since there was no want of great chemists in England, as is witnessed by the names of Boyle, Mayow, Black, Priestley, Dalton and Davy; and since the general interest in chemistry was great, this deficiency as to pharmaceutical literature can be explained only by the fact that during this period the interests of the English apothecaries were directed exclusively to the practice of medicine. Remembering the abundance of pharmaceutical textbooks on the continent around 1800, more particularly in France and in Germany (see pp. 67, 80), it is almost incredible that in 1843, when the young Pharmaceutical Society of Great Britain tried to organize a systematic pharmaceutical education, "books and periodical publications, conveying educational knowledge in the department of pharmacy were wanting."[70]

This enables us to understand that the number of scientists growing up out of English pharmacy has not been large. Mention has been made of Richard Philips (1776-1851). There should be added the names of George Fownes (1815-1847), Jonathan Pereira (1804-1853), David Hanbury (1825-1875), and the pharmaceutical botanist Thomas Johnson (died 1644).

It is very significant that the organizers and first presidents of the Pharmaceutical Society, William Allen (1770-1843)[71] and Jacob Bell (1810-1859), were not only owners of retail pharmacies, but also of pharmaceutical factories which, founded about 1800, are still in existence. This union between professional interest and commercial intelligence and activity was not rare in English pharmacy. According to the descriptions by the "Chemist and Druggist" of English pharmaceutical industry in the Manchester area, in Scotland, London, and Leeds,[72] a large number of the English pharmaceutical plants and wholesale businesses, also several non-pharmaceutical establishments[73] have had their origin in the shops of retail chemists and can often be traced back a century and more. Most of the founders of the Pharmaceutical Society

had extended their pharmacies to industrial or wholesale plants. To the names of Allen and Bell there should be added those of John May, Thomas Morson, and John Savory, all of London, and those of later presidents of the society, Peter Squire of London, F. B. Benger of Manchester and Richard Raimes of Edinburgh (North British Branch). These firms are still in existence. Attention should also be directed to the chemist John Fletcher Macfarlan of Edinburgh who was one of the first English manufacturers of alkaloids, at first in the laboratory of his pharmacy and later on in the factory which had grown out of the "shop" laboratory.

It cannot be said that the English chemist's shop has been the nucleus of English pharmaceutical industry to the same extent as was the German "Apotheke." The part of the English chemists in scientific research was not sufficiently general nor intensive. That it was, however, the same people who in England in the beginning of the 19th century created anew the profession of pharmacy and took simultaneously an important part in the development of the English pharmaceutical industry is a further proof of the natural connection between retail and manufacturing pharmacy.

One of the largest pharmaceutical concerns in England with headquarters in London and with associated houses all over the world was developed on the basis of American pharmaceutical education. S. M. Burroughs as well as Henry Wellcome, the two late founders of the firm of Burroughs, Wellcome & Co. were graduates of the Philadelphia College of Pharmacy. Although Henry Wellcome became a naturalized Englishman and later on an English baronet he never lost his connections with his native country and, through his life membership in the American Pharmaceutical Association, with American pharmacy. Perhaps this may be of symbolic significance.

8

INTERNATIONAL TRENDS

SINCE the Middle Ages the interrelationship between the European peoples has been so close that most of the developments within the individual countries can be considered as a national reaction to the general European trend. Naturally, allowance should be made for special conditions and for the character of the people concerned. These reactions may be divided into two classes, viz., those in which the national trends are predominant—see the chapters devoted to the development of pharmacy in Italy, France, Germany, and England—and those in which the common ideas and facts prevail. To the latter belong science and the practical use of it—see the chapter on "Medical Theories and Materia Medica"—all movements originating from or resulting in the facilitation of trade and eventually the concept of international intellectual and spiritual intercourse.

Of the trade movements mentioned above, two in particular have been of great and steadily growing influence on the practice of pharmacy: The rise of pharmaceutical industry and health insurance. It should be borne in mind that industry and health insurance merely represent the two sides of the same coin. Health insurance in one form or another is an almost inevitable result of the development of big industry which concentrates, uses, and consumes large masses of people. Gradually these become conscious of the power inherent in their mass. Moreover, they become impressed with their human rights or what they and their political or union leaders regard as such.

Long before the general triumph of industry, i.e., the mass production of mass goods by, as far as possible, mechanized processes, manufacturing of pharmaceutical products on a large scale was carried on in Italy, especially in Venice (see page 50) and in some monasteries in Italy, France, and Germany.[1] The products of pharmaceutical industry can be divided into (1) chemical compounds prepared to be used as ingredients in filling prescriptions or preparing medicines, cosmetics, etc.; (2) galenicals, which like the items of the first group are sold in bulk to the pharmacists; and, finally, (3) products designed to be sold in the form delivered to the retailer by the manufacturer as ready-made goods, the so-called proprietaries and nostrums. It was especially the third class of industrial production to which the representatives of medicine and professional pharmacy objected.

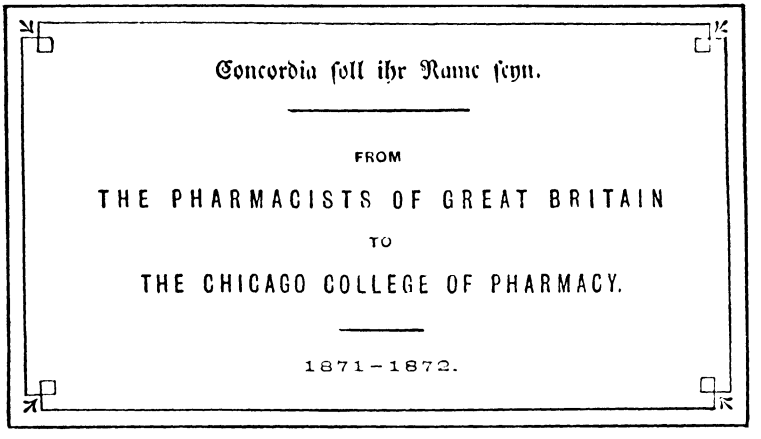
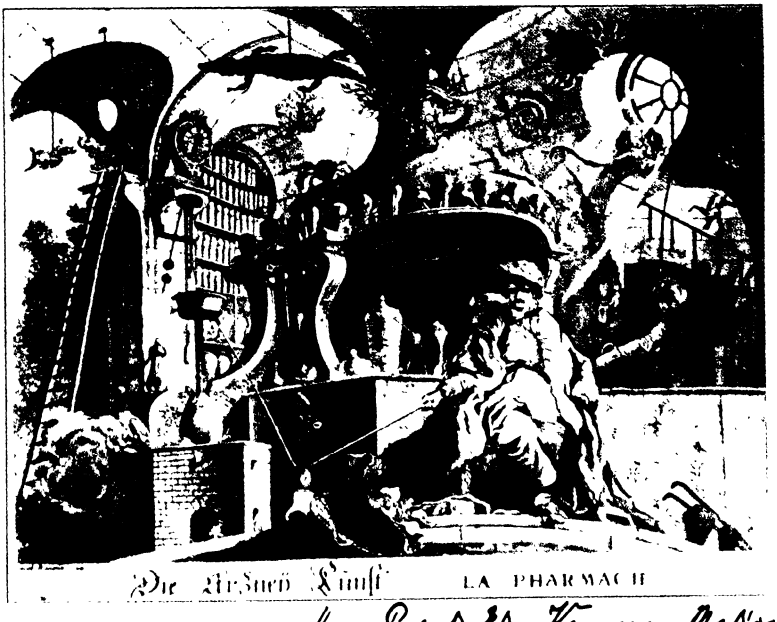


FIGURE 9. Presentation inscription in one of the volumes given to the Chicago College of Pharmacy after the loss of the College Library in the Chicago Fire.

GESELLSCHAFT FÜR GESCHICHTE DER PHARMAZIE



MITGLIEDSKARTE FÜR Herrn Prof. Dr. Edw. Kremers, Madison

SCHRIFTFÜHRER

FIGURE 10. Membership Card of the Society for the History of Pharmacy. Note the allegorical design, showing pharmacy as master of the art of distilling.

The pharmaceutical proprietaries and nostrums, the "ready to use" remedies, the ingredients of which are known only to their manufacturers may be traced back to the *arcana* of Paracelsus.[2] They have this in common with the modern nostrums that Paracelsus attributed to them an extraordinary efficiency and kept secret their ingredients as well as the process of manufacturing. They are distinct from the modern nostrums in that Paracelsus did not commercialize them, but used his arcana exclusively for the supposed benefit of his patients.

Some of the nostrums prepared in the 17th and 18th centuries were so highly regarded that rulers bought the formulas from their inventors and published them for the benefit of their people. The most famous example of such a transaction is the sale of the formula for a decoction of cinchona bark by the Englishman Talbor, to Louis XIV of France in 1680 for an extraordinarily high price.[3] In 1740 the English parliament bought the formula for a nostrum against gallstones, consisting of alicante-soap and burnt eggshells, for £5000 ($25,000).[4] Frederick the Great of Prussia in 1775 for the formula of a nostrum against tapeworm, consisting of Filix, Jalappa, and Scammonium, gave to its inventor Mathieu not only an annuity but also a title.[5] Similar "bargains" are reported by Wootton.[6]

The trade in such remedies has developed into a great enterprise. Moreover, these nostrums have to a great extent participated in bringing about the legal protection of goods, the production or administration of which was supposed to be based on special individual peculiarities or inventions. Thus nostrums are responsible, at least in part, for the concept of the protection of the rights of the inventor, the essential basis of modern patent legislation.

In the past, reigning princes, as part of their prerogatives, considered themselves entitled to grant monopoly privileges to anyone who had gained their favor. Hence, the beginning of patent legislation was the same in all countries. Such privileges for the production and the sale of nostrums were granted by the German emperors and princes as well as by the French kings until the end of the 18th century, and by the English kings until the first third of the 17th century.

It is significant that England was the first country to establish governmental regulation in this matter in lieu of princely arbitrariness. Business interests were concerned and thus the usual "laisser faire" had to cease. A statute of King James I of England, promulgated in 1624, declared all monopolies that were grievous and inconvenient to the subjects of the realm to be void with the exception of those privileges for the "sole working or making of any manner of new manufacture within the realm to the true and first inventor of such manufacture, which others at the time of making such letters patent or grants should

not use, so they be not contrary to law nor mischievous to the state by raising of the prices of commodities at home or hurt of trade or generally inconvenient."[7] Upon these words rests the entire law of letters patent for invention. It is the manner of manufacture, being novel and having the quality of utility, which is patentable; not the product itself.

The first real medicinal patent was granted in England in 1698 to the physician Nehemiah Grew for Epsom salts under Patent No. 354. Others for *Sal oleosum volatile* (1711), Stoughton's elixir (1712), Turlington's balsam (1744), etc., followed. Of special interest is the patent granted to the London "chymist" Thomas Wilson for his "Patent Ague Drops" in 1781. These drops were used with great success by Dr. Thomas Fowler, physician to the general infirmary of the county of Stafford, in his practice. They were analysed by Mr. Hughes, the apothecary to the infirmary, who found them to be a solution of arsenic. The famous Fowler's solution was the final result of the cooperation of the physician Fowler and the apothecary Hughes. It may be mentioned that Fowler, as well as Dr. Withering of digitalis fame, appreciated the merit of Mr. Hughes. Withering calls him in a letter to Fowler "my good friend and your excellent apothecary" and Fowler writes in his "medical reports of the effects of arsenic " (London, 1786) that Hughes' "industry, attention, and abilities in his professional line, justly merit applause."[8]

The English patent law of 1852 required preliminary disclosure concerning the provisional specification. With this an era of real invention began as is shown by the following patents granted in the years 1854-1856: Use of glycerin in cosmetics (1854, No. 85, John Henry Johnson), capsules (1855, No. 824, Jules Denoual), first aniline dye (1856, No. 1984, William Henry Perkin), use of "paraffine" in hair oils and ointments (1856, No. 2945, Charles Humphrey).[9]

A so-called medicine stamp act, issued in 1783 imposed the requirement of a license on any person selling medicines except one who had "served a regular apprenticeship to any surgeon, apothecary, druggist or chemist," and introduced simultaneously a tax on all medicines sold by a person so licensed or sold under patent letters. In 1785 the form in which the tax was levied was altered referring now to the names of the medicines coming into question and also upon all like articles in respect of which any secret art or exclusive right was claimed or which were sold under any letters patent or were advertised for the prevention, cure, or relief of disease. Finally in 1802 a law defined the requirements more exactly, excepting from duty especially "known, admitted and approved remedies when sold by qualified persons, that is, by surgeons, apothecaries, chemists and druggists." According to the official interpretation, confirmed again and again up to the present time, a medicine

s entitled to the benefit of this exemption, if either: 1. The label on the enclosure contains an adequate indication of the ingredients, or 2. The medicine has been prepared in accordance with a formula in the "British Pharmacopoeia" or other well-known and recognized book of reference and this fact is disclosed by a statement on the label or some other distinct manner.[10]

In France a royal decree of 1728 subjected all proprietaries, whether based on letters patent or not, to an examination by a commission of physicians and apothecaries. In 1778 Louis XVI conferred the examination of remedies for internal use on the Royal Society of Medicine, founded by him, while a special commission consisting of surgeons, physicians, and apothecaries had to examine the remedies for external use.[11] In 1803 the revolutionary government forbade the sale of all remedies of unknown composition. In 1810 Napoleon I again granted permission for their sale but only after an examination by a special commission. Being approved, the formula was to be published and the inventor to receive a remuneration of about $500. There were, however, exceptions concerning the inventions of some physicians and pharmacists. In 1850 a new decree conferred the duty of examination of proprietaries on the Academy of Medicine. The academy was given the right to publish the formulas of the new remedies in its bulletin.[12] The manufacturer had to be a qualified pharmacist and even in the factory there had to be a pharmacist bearing the responsibility. The sale was permitted only in pharmacies. All proprietaries without exception have been subjected to a duty since 1927.

In Germany legislation has restricted itself to the prohibition of the advertising of the so-called secret remedies (Geheimmittel). The most comprehensive decree concerning the advertising of proprietaries was issued in Prussia in 1933.[13] There are two official lists of "secret" remedies, first published in 1903 and since then altered frequently. All preparations named in these lists are to be sold only in pharmacies. Remedies of List B are to be dispensed only on the prescription of a physician. The medicaments enumerated in List A may be sold without such a prescription if the pharmacist thinks that he knows the ingredients sufficiently to take the responsibility.[14]

As mentioned above, modern patent legislation was born in England. In 1844 France issued a modern patent law. In 1864 the law introduced in Sardinia in 1859 was extended to the whole of Italy, and in 1877 the first German patent law was issued, having been preceded by laws of the separate German states. It is noteworthy that the German patent law has taken over the English concept that only a new method of manufacture and not the product itself is patentable for medicines, foodstuffs, and substances prepared by means of chemical processes. The

idea is to avoid a monopoly for these vital necessities of daily life. An international patent convention was signed in Paris in 1883.

These laws, protecting inventors and inventions, were of the greatest influence on the progress of applied science in all fields including pharmacy. The development of the large pharmaceutical concerns, based on scientific research, could not have grown up into such dimensions without the patent laws. However, the preparations protected by these laws, cannot, except in rare cases, be prepared with the means at the disposal of an average pharmacist. These preparations have partly replaced the *simplicia* (simples) of the old dispensatories and it makes little difference to the pharmacist whether he now dispenses these new substances in place of those.

The real invasion of the field of the pharmaceutical practitioner, the preparation of proprietaries, gained its rapid extension not so much by the modern patent laws, the requirements of most of which could not be met by this class of products, but by the legal protection granted by trade-marks. These consist of a picture, a label, a word or words which identify the thus "marked" goods as the production of a distinct manufacturer and distinguish them from similar goods prepared by other manufacturers. With this protection the "brands" started on their triumphant march. With the introduction of trade-mark legislation the disclosure of the ingredients, at least to the extent necessary to liberate them from the restrictions of advertising in force in some countries for "secrets," had lost its significant effect. The protected name, hammered into the minds of the people with shrewd and incessant propaganda, itself guaranteed the desired monopoly.

In England the first step toward the legal recognition of trade-marks was taken by the act of 1862. Provision for the registration of trade-marks was first made by the trade-mark registration act of 1875, followed by the trade-marks act of 1905.[15] In France the fundamental legal regulations concerning trade-marks were issued in 1857 and 1890, in Germany in 1874, followed in 1894 by the law in force at present. In 1883 an international regulation was agreed upon in Paris, signed by 25 countries among them Italy, France, Germany, England and the United States of America. The name "patent-medicine," generally used for this category of remedies, has long since lost its real meaning. On the one hand it owes its continuance to the fact that in some countries the office for the registration of trade-marks is a department of the national patent office and, on the other hand, is a reminiscence of the time in which, as mentioned above, the "patent-letters" of princes supplied the legal foundation for the existence of the early proprietaries and nostrums.

Since 1918, after the first world war, a general movement to regulate and restrict the flood of proprietaries became evident. Spain, in 1918,

became the first country to introduce an elaborate system of control, the principal postulates being that the actual manufacturer must be a qualified pharmacist—according to the French pattern previously mentioned—and that the preparation should receive official approval prior to its registration. In addition, declaration of the composition on the label is required. Up to 1924 the following countries had issued similar regulations: Argentine, Belgium, Esthonia, Greece and Latvia.[16] Later on analogous decrees were promulgated in Italy in 1925 and 1927,[17] in Austria in 1925 and 1937,[18] in Poland in 1926,[19] in Czechoslovakia in 1926,[20] in Jugoslavia in 1932,[21] in Denmark in 1933,[22] in Sweden in 1934.[23] It is noteworthy that all these countries have no large pharmaceutical industries of their own.

The development of an industry of chemical and biological substances is the result of the progress of science and research stimulated by patent laws. The rise of the proprietary industry is the product of the extension and perfection of the art of advertising furthered by the trade-mark acts. The industry of galenicals is essentially the product of the indolence and short-sightedness of the pharmacists. It has not been promoted by legislation at any time. On the contrary it has grown up in spite of certain legal attempts to prevent its development.

The preparation of galenicals by the apothecaries themselves during the Middle Ages and generally until the end of the 18th century is readily understood since transportation for the most part was poorly organized and expensive. Moreover, European authorities considered it the duty of the apothecary to manufacture all of his preparations himself. It was not until 1827 that the "Pharmacopoeia Borussica" permitted the purchase of chemicals, "which can be purchased genuine from industrial plants and the preparation of which by the apothecaries is not without some danger and inconvenience." It is, however, distinctly affirmed that the preparation of all galenicals remains the duty of the apothecary. In 1862 the Prussian authorities capitulated. The "Pharmacopoeia Borussica, editio septima (1862)" allowed the purchase of all products, "the preparation of which by the apothecary would be inexpedient," leaving, however, to the apothecary the full responsibility for all the products delivered by him to the public.

As mentioned above, modern social legislation of which the health insurance laws are a part, is only the natural consequence of the change in the structure and living conditions of human society produced by the industrialization and mechanization of life. It is very interesting that the legal act by which, in 1844, the English administrative policy of "laisser faire" received its death sentence, the so-called factory act, was born out of the necessity of protecting the working people, in this case

especially, women and children, from ruthless exploitation by and within industrial factories.

There were in ancient Rome as well as in the Middle Ages organizations built up on compulsory membership and devoted to the care of the sick. This care became the acquired or self-imposed duty of almost all guilds. Thus, particularly in mining, the first European large scale industrial undertaking, there were early institutions of a rather modern character, requiring regular fees and affording medical and medicinal care. The change, however, from private co-operative assistance, in cases of sickness, to authoritative institutions introduced by law and protected and guaranteed by the government, was first introduced during the middle of the 19th century in Germany. These laws were perfected by the so-called social legislation, introduced in 1881 by a special public message of the German Emperor Wilhelm I (*Kaiserliche Botschaft*) and were intended to counteract the agitation of the German socialists through a well-planned government-fostered social welfare program.[24] In a publication of the International Labour Office of 1925 it is stated that "the motive of the reform was a desire to improve the living conditions of the workers in order to reconcile them with the state as an institution defending the capitalistic organization of protection, and at the same time to deprive the workers' occupational organizations of the potential weapon they possessed in numerous mutual aid and provident bodies attached to the trade unions." It may seem strange that, in consequence of a detail to which not much attention was paid at that time, the German Health Insurance Act not only did not prevent the growth of the socialistic party in Germany but decidedly promoted it. Instead of centralizing health insurance and making it a governmental institution—as was done with the other phases of the "social legislation," the old age, invalid, and employee insurances—the law created independent local health insurance bodies with authoritative prerogatives and far-reaching self-administration, in which the controlling influence was with the insured, i.e., with the working people of lower income classes.

Thus, it came about that the intellectual leaders of those workers who were members of the Social Democratic party were placed in numerous positions of health insurance administration. Hence, these politicians were not only granted an official livelihood, but were given an opportunity for wide contact and propaganda. The disadvantages of this system, not only for physician and pharmacist but for the insured as well, were that the contracts concerning medical and medicinal care were negotiated not by a centralized and unbiased governmental authority, but by individual representatives of local bodies. Frequently these representatives tried to deprive the physicians of their liberty of action by prescribing detailed rules for the medical treatment of the insured. As to

nedicinal care they tried to exclude the pharmacists as much as possible by delivering all bandages, etc., and many remedies directly to the insured and finally by the production of proprietaries in their own plants. The final objective was the definite socialization of the healing arts and practitioners.[25] The restrictions placed upon both physician and pharmacist in the provision of medicaments for the insured were numerous.[26] From the beginning the remuneration of the pharmacist was based on the governmental price lists, issued annually, less discounts of from 10 to 20 per cent. In Austria a law establishing a similar system was passed in 1888. In this country after 1914 special price lists for the health insurance bodies have been issued.

England was the next great European country to introduce health insurance, almost 30 years after Germany, viz., in 1911. English health insurance is "confessedly based largely on the German system."[27] However, it avoids the disadvantages mentioned above by centralizing the administration and putting it under direct governmental control. The contracts for service with the medical and pharmaceutical professions, at first made through statutory committees, are now made through the Ministry of Health (in Scotland through the Scottish Board of Health). The pharmacist is paid for the ingredients used in filling the prescriptions in accordance with a price list agreed upon. He also receives remuneration for his work, at present (1939) 3 pence for a simple medicine and 5 pence for a compounded one. The prescriptions are taxed not by the individual pharmacist but by official bureaus.

In France health insurance became obligatory in 1930. Here the payment is likewise based on a special tariff for the drugs plus a dispensing fee varying according to the nature of the operations required. The manner of payment differs from the hitherto mentioned systems since in France the insured person pays the pharmacist in cash for his medicine. The latter gives him a detailed receipt for which the patient is reimbursed by the proper authority.

In all countries with legally established health insurance such insurance is compulsory only for employed persons with a limited income (annually about $600 to $800). One of the pharmaceutical complaints, expressed especially in Germany and Austria, has been that in consequence of the required economy as well as of the rush of people within the consultation hours, the prescribing of the physicians became simplified after the introduction of health insurance. On the other hand, it was only by health insurance that medical and medicinal care were obtained by many people who previously had not been able to afford it. Because of this the turnover of the pharmacies was greatly increased.

The German "Hauptverband Deutscher Krankenkassen (Ortskrankenkassen)" reports in its yearbook for 1931 that its expenses for

medicines and medical sundries in 1931 amounted to Rm. 86,500,000[28] ($17,125,000—the dollar at that time being equal to about Rm. 4). As the "Hauptverband," with approximately 10 million members in 1931, comprised about two-thirds of the total of the insured people, the sum of approximately 25 millions of dollars may be recorded as the total amount paid in 1931 by the German Health Insurance for medicines and medicinal sundries. In the same year there were dispensed in England and Wales 57,468,411 insurance prescriptions, payment for which amounted to £1,888,123 = $9,440,615. After allowance is made for the greater population of Germany the per capita payments are not much different.

This increase in income, however, is not the only advantage, which pharmacy has achieved, especially in England, by means of health insurance. Until the introduction of health insurance, England was the only larger European country in which the physicians enjoyed full liberty to dispense and deliver medicines. Under the English Health Insurance Plan the physician is forbidden to do so. Dispensing of medicines is restricted to pharmacists. Due to the activity of the pharmacist, Sir William Glyn-Jones, who in 1911 was a member of parliament, the act contains a clause which prohibits "arrangements for the dispensing of medicines being made with persons other than persons, firms, or bodies corporate entitled to carry on the business of a chemist and druggist under the provision of the Pharmacy Act."[29]

In France and Germany where the separation between physician and pharmacist has been compulsory for centuries, such a clause was not necessary. Here, however, another danger existed: the dispensing and delivery of medicaments and medicinal supplies by the health insurance bodies, also the establishment of special pharmacies for the insured. In both countries clauses within the act itself (France) or in other laws (Germany) exclude such possibilities at least to a great extent. In Poland, where a similar precaution was not taken, the local health insurance bodies, created according to the German model, i.e., with self-administrative powers, established their own pharmacies, depriving the private pharmacies of a great part of their legitimate field. In 1925 there existed in Poland about 200 such health insurance pharmacies. As a consequence "many private pharmacies, especially in highly industrialized centers, became completely ruined and had to be closed."[30]

In England, as in almost all countries where the introduction of health insurance was under discussion, "the medical profession were at first extremely hostile to it . . . while chemists showed little enthusiasm." An editorial "Twenty-one Years of Insurance Dispensing," published in the official journal of the Pharmaceutical Society of Great Britain[31] states that prior to the passing of the insurance act "there were hundreds,

ıay thousands, of chemists who scarcely ever saw or dispensed the ɔrescription of a medical practitioner" and it concludes as follows:

> While the rate of remuneration has never been on the generous side, insurance dispensing has provided, for thousands of chemists, an assured portion of their income, and has been an invaluable standby in times of depression. The material side is not the only factor to be considered. The act marked a great step in the separation of the functions of the medical practitioner and the pharmacist, establishing the latter in his proper sphere as the one person qualified by training and examination to undertake the dispensing of medicines. It may be also claimed that its working has helped considerably to educate the public to an appreciation of the value of the services rendered by the trained pharmacist.

Whereas in the development of industrial pharmacy and of health insurance under governmental control, the pharmacist had to adapt himself as best he could to changed circumstances, in the adaptation of pharmaceutical affairs to international intercourse and consequent cooperation he was left to his own initiative.

It was the old pharmaceutical dream of an international pharmacopoeia which may be regarded as the main incentive for the creation of an organized international intercourse. The *Allgemeiner Deutscher Apothekerverein* (General association of German apothecaries) decided in 1864 at a meeting held in Wiesbaden to convene an international congress in order to discuss matters of international pharmaceutical interest, primarily the plan of an internatiɔnal pharmacopoeia. The first congress was held in Brunswick in 1865, the second in Paris in 1867, the third in Vienna in 1869, the fourth in Petersburg in 1874, the fifth in London in 1881, the sixth in Brussels in 1885, the seventh in Chicago in 1893, the eighth in Brussels in 1897, the ninth in Paris in 1900, the tenth in Brussels in 1910, the eleventh in Leyden (Holland) in 1913, the twelfth in Brussels in 1935. Representatives of American pharmacy have participated in these congresses since 1867.[32]

These international congresses were based on mutual understanding concerning common aims. However, they lacked an organization which might guarantee the collection of membership fees, and also a permanent bureau. Hence all they could accomplish was to publish the results of their deliberations. With the adjournment of each congress the organization was disrupted. Moreover, participation in the congress had been open to everyone interested in the sciences and problems of pharmacy regardless of the individual's affiliation with pharmacy or with any pharmaceutical association.

Hence, in 1910, the 10th International Congress in Brussels decided

to found an international association of pharmacy, composed chiefly of representatives of the national pharmaceutical associations the world over. In September 1912 the constituent assembly of the new *Fédération Pharmaceutique Internationale* (International pharmaceutical federation) was held in The Hague.[33] "The object of the federation is to develop pharmacy through international channels, as a profession and as an applied science" (article 2 of the statutes[34] which have remained essentially unchanged since their first publication in 1912). The second assembly of the federation was held in Ghent (Belgium) in 1913, the third in Brussels in 1922, the fourth in London in 1923, the fifth in Lausanne (Switzerland) in 1925, the sixth in The Hague in 1927, the seventh in Paris in 1928, the eighth in Stockholm in 1930, the ninth in Brussels in 1935, the tenth in Copenhagen in 1937. The eleventh was to have been held toward the end of August 1939 in Berlin. The war having broken out about that time, prevented this meeting and interfered with the work as had the first world war (1914-1918). The American Pharmaceutical Association became a member of the Federation in 1925.

The international pharmaceutical congresses as well as the international federation have done remarkable work. Not only have they discussed almost all questions of general pharmaceutical interest but what is more, they have proved the necessity of such an international intercourse. By representing and expressing a pharmaceutical world ideology they have brought the concept of pharmacy as a profession and the importance for public welfare of its professional status to the knowledge and appreciation of all governments of the civilized world. The federation has organized many inquiries and investigations, and the publication of the results in the bulletin of the federation, issued since 1912, has given to pharmacy an invaluable fund of information.

Although the chief goal of both organizations, an international pharmacopoeia, has not been achieved so far, the problem of the unification of potent medicines has become the subject of international agreement. At the Chicago congress in 1893 the idea of an international code of potent medicaments was launched by the American Pharmaceutical Association which contributed $1000.00 to launch the undertaking. In 1902 the delegates of 18 countries met in Brussels and agreed on the principles of such a code.[35] On November 29, 1906, the first convention concerning the unification of potent medicaments met and the so-called "Protocol Internationale" (P.I.) was signed. A revision and enlargement of this "protocol" was presented in a report of the Federation's committee for pharmaceutical nomenclature. The recommendations of this committee were accepted by the second international conference on the unification of potent medicaments and the second protocol was signed September 29, 1925 in Brussels by the representatives of 26 countries.

Another international movement of pharmaceutical interest, also initiated and carried on by pharmacists, is concerned with the cultivation of medicinal plants and all questions connected therewith. The international association for promoting the cultivation and utilization of plants used for medicinal purposes and as spices was founded in Vienna in 1927. The second meeting took place in Budapest in 1928, the third in Padua in 1929, the fourth in Paris in 1931, the fifth in Brussels in 1935, the sixth in Munich in 1937.

The associations of pharmaceutical employees in Austria, Germany, and Czechoslovakia united in 1924 in organizing an international union of pharmaceutical employees. In the course of time the union included the associations of employees of Austria, Bulgaria, Denmark, Finland, Germany, Jugloslavia, Norway, Poland, Rumania, Sweden, and Czechoslovakia. It met in Vienna (1925), in Budapest (1927), in Prague (1929), in Warsaw (1931), in Vienna (1934). At the Vienna, 1934, meeting the union held a joint session with representatives of the European associations of pharmacy owners. Since then the "union" has not met again. It has been practically dissolved due to the political developments in the countries concerned.

The pharmacists in the active service of army and navy have found an international connection in the International Congress of Military Medicine and Pharmacy (*Congrès internationale de médecine et de pharmacie militaire*). This congress met in Brussels in 1921, in Rome (1923), in Paris (1925), in Warsaw (1927), in London (1929), in The Hague (1931), in Madrid (1933), in Brussels (1935), in Bucharest (1937).

As has been mentioned the two Brussels "Protocols Internationales" (1906 and 1925) concerning the unification of potent medicaments have been generally approved. Their statements have found recognition in practically all national pharmacopoeias. This recognition was voluntary. There have been, however, other international regulations imposed on pharmacy. They deal with the trade in opium, morphine, diacetylmorphine, cocaine, ecgonine, and Indian hemp and are based on agreements by the convention at The Hague in 1912 and later agreements by the convention in Geneva in 1925 under the protection of the League of Nations. These agreements are signed by almost all governments of the world including the United States and have given rise to corresponding legal restrictions in the individual countries.

All international pharmaceutical movements mentioned so far have had more or less immediate practical objectives. There is, however, one other trend apparently without immediate practical effect: the pharmaceutico-historical movement, which affords an indispensable basis for a professional atmosphere and professional activity.

Attempts at pharmaceutico-historical interest manifested themselves at a relatively early date. In 1722 an attempt at a history of pharmacy in Nuremberg ("Versuch einer Geschichte des Apothekenwesens in der freyen Reichsstadt Nuernberg")[36] appeared and shortly after the year 1800 essays on the history of pharmacy formed the introductory part of several textbooks e.g., those of Wiegleb, J. Fr. Gmelin and Trommsdorff. J. A. Buchner's textbook ("Vollstaendiger Inbegriff der Pharmacie"), published in 1822-27, contains a more elaborate sketch. In his history of chemistry (1843-47) H. Kopp pays much attention to pharmacy and in 1853 the Frenchman Philippe published the first comprehensive history of pharmacy. The proper epoch of pharmaceutico-historical research and interest, however, began with the work of the three great German pharmaceutical historians Julius Berendes (1837-1914), Hermann Peters (1847-1920) and especially Hermann Schelenz (1848-1922) whose voluminous "History of Pharmacy" ("Geschichte der Pharmazie"), published in 1904, presents inexhaustible treasures of data and details.[37] Since that time a flood of pharmaceutico-historical literature, including several national histories quoted in earlier chapters, has made its appearance.

In 1883 Hermann Peters took steps toward the establishment of a pharmaceutical museum within the *Germanisches Museum* in Nuremberg.[38] His example found many successors. Haefliger gives a list of not less than 230 European public and private pharmaceutico-historical collections, including museums or monasteries and hospitals with old pharmaceutical equipment.[39] His book is a guide to pharmaceutical antiquities in the *Schweizerische Sammlung für Historisches Apothekenwesen* in Basel, which he has brought together in the incredibly short time since his appointment as professor of the history of pharmacy at the University of Basel in 1924 and which is one of the largest and most systematically arranged collections of its kind. The Wellcome Historical Medical Museum in London, opened in 1913, contains, as a special department, one of the most extensive pharmaceutico-historical collections.

In 1913 the first European society, devoted especially to the history of pharmacy, was founded in Paris: La Société d'Histoire de la Pharmacie. Since its foundation this society has published a "Bulletin" which since 1930 has appeared under the title "Revue d'Histoire de la Pharmacie." Thirteen years later, in 1926, an Austrian, 3 Germans and an American founded, in Innsbruck (Austria), the Gesellschaft für Geschichte der Pharmazie (Society for the History of Pharmacy). This society took up the task of publishing books and pamphlets of pharmaceutico-historical interest. Thus far it has issued about 40 publications, several of them voluminous, which could never have been published without the aid of the Society. In 1934 the society arranged in Basel the

first and only truly international meeting on the history of pharmacy which has taken place. The other meetings of the society (Nuremberg, Vienna, Berlin, Stuttgart) were attended only by German-Austrian, and Swiss members.

In 1923 the Austrian government made the history of pharmacy an obligatory part of the pharmaceutical curriculum and appointed lecturers on this subject at the three universities of the country (Vienna, Graz, and Innsbruck). In Germany lectures on the history of pharmacy have been delivered at the University of Berlin since 1926. In 1935 the new regulation of the German pharmaceutical curriculum required from the candidate in the examination a knowledge of the history of the profession without, however, making obligatory the formal study of this subject. The association of German apothecaries, in which membership has been compulsory since 1933, founded a museum in Munich in 1937. In the English pharmaceutical examination some historical knowledge is also required. The Pharmaceutical Society of Great Britain is about to organize a pharmaceutical museum devoted especially to the history of English pharmacy.

In closing this survey of the history of European pharmacy it is instructive to list the countries in which the system of concessions prevails, and those in which the practice of pharmacy is unrestricted:

1. System of concession: Austria-Germany, Bulgaria, Czechoslovakia, Denmark, Esthonia, Finland, Greece, Hungary, Italy, Jugoslavia, Latvia, Lithuania, Luxemburg, Monaco, Norway, Poland, Rumania, Sweden, Turkey.

2. Unrestricted practice: Belgium, England, France, Holland, Portugal, Switzerland, Spain.

In czaristic or Imperial Russia the number of pharmacies was restricted and the pharmacies were either private property (about 70 per cent.) or owned by communal institutions (about 30 per cent.). Since the establishment of the Soviets all Russian pharmacies are the property of the "townsoviets" (municipalities) and are conducted by pharmaceutical employees or leased to pharmacists.[40]

The international trends mentioned in this chapter are not restricted to Europe. Based upon the tasks pharmacy has to fulfill in the service of mankind, they necessarily are significant of pharmacy wherever it may be practiced.

The community of tasks inevitably has created a specific professional solidarity transcending all national boundaries. This sentiment found its most beautiful and convincing expression after a great American catastrophe. When in 1871 the great Chicago fire destroyed the Chicago College of Pharmacy with all its equipment, the pharmacists of the whole world under the leadership of Professor Attfield, then president of the

Pharmaceutical Society of Great Britain, collected money, apparatus, etc., and it was only by this help that the college could be re-established within a year afterward with better and more complete equipment than before. Even today many books in the library of the Chicago College of Pharmacy bear the bookplate commemorating this generous proof of international pharmaceutical solidarity.

PART THREE

PHARMACY IN THE UNITED STATES

SECTION ONE

THE PERIOD OF UNORGANIZED DEVELOPMENT

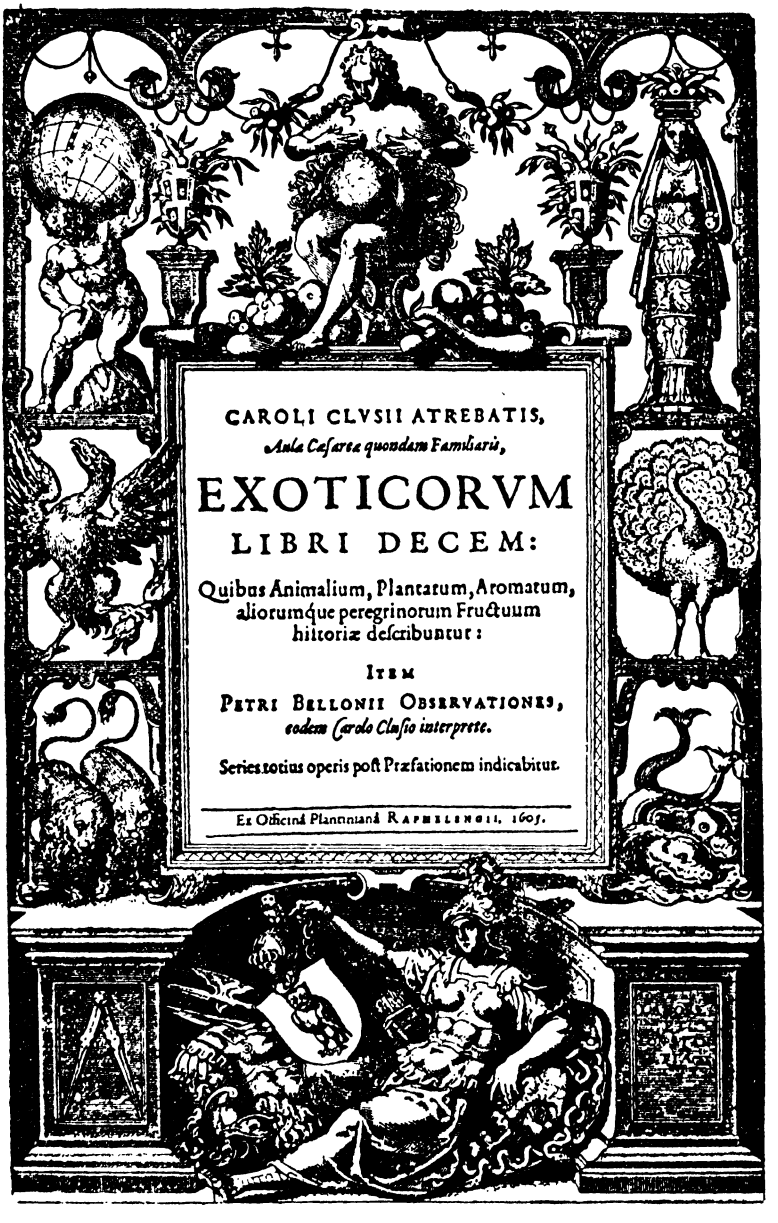


FIGURE 11. Allegorical Title-page of "Exoticorum Libri Decem," by Charles de L'Escluse (Carolus Clusius).

9

THE NORTH AMERICAN COLONIES

WHEN the Italian Cristoforo Colón, called Columbus, sighted land in 1492 in the Bahamas off the coast of Florida he thought excitedly that he had reached the wealth of the East Indies. In common with other explorers of his day he had dreamed of the spices, gold, and gems, and he had hoped to bring them back for his employers, the king and queen of Spain. Columbus died in Valladolid in 1506, and never knew that he had discovered a new world offering to old Europe more than mercantile goods: new homes for many millions of people, a refuge for the persecuted and oppressed, and probably the last opportunity offered to mankind to build up a real civilization to replace that of the warring European nationalisms.

It required centuries before the ideology associated with "America" became strong and sufficiently significant to form a unifying frame-work, a specifically American sentiment. During the first century after the discovery of the new continent a sentiment of this kind could not arise for the simple reason that the endeavors of the European peoples with regard to America were concentrated on the quick, comprehensive, and profitable exploitation of the assumed riches of the country. Even the first settlements were not intended to become agricultural colonies. They were established to organize the fur trade, the export of ginseng, of timber, and of other valuable goods used in the old countries or to be used in exchange for oriental goods. As late as 1608 John Smith in Virginia wrote to the London corporation which owned the land by reason of a charter granted to it by King James I in 1606, as follows: "Here was a land, unlike Mexico and Peru, that would yield only to toil; that held no spoil for the predatory classes of Europe."[1]

With the beginning of the 17th century North America gradually became a land for colonization instead of a collection of colonies designed by European sovereigns for exploitation. South America, the "Mexico and Peru" of John Smith, was ripe for exploitation because of its wealth in easily portable treasures. For purposes of colonization it was at a disadvantage because of its tropical climate and its geologic structure. Hence its peculiar colonial development did not materialize until a new race adapted to these conditions had developed.

Of the colonizing nations of Europe, Spain, France, and England left their early political impress on the civilization that developed within

the territory of the United States of America. Spanish influence was felt in the area now included in the states of Florida, California, and Texas, and is still dominant in Puerto Rico and the Philippines. It is characteristic of the relatively small attention paid to North America by European governments during the first century after the discovery of the new continent that it was not until 1565 that a settlement was founded. This was St. Augustine in Florida settled by the Spaniards. It remained the only abode of white men in this vast area until Spaniards from Mexico settled in New Mexico in 1598.[2]

French influence manifested itself not only north of the St. Lawrence river and along the Great Lakes but penetrated the wilds of Michigan, Wisconsin, and the prairies of Illinois, and drifted down the Mississippi to Louisiana, originally a French territory named in honor of Louis XIV. English civilization remained the dominant factor not only in the thirteen original colonies but throughout the vast domain west of the Alleghanies, and later beyond the Mississippi and the Rockies.

Dutch influence acquired an early footing in New Amsterdam, and continued to play an important part long after this city had become New York. Though Germany does not figure among the colonizing nations, Germans contributed a considerable number of colonists to Penn's woods, as shown, for example, by the name of Germantown, now part of Greater Philadelphia.[3] To a slight extent Swedish influence had gained a footing on the Delaware even before the Dutch and the Quakers took possession.

The origins of medico-pharmaceutical practice in the colonies: The early development of pharmacy in the colonies went hand in hand with medical practice. It would be impossible to assign to each nation its quota in the development of this medico-pharmaceutical practice. Not infrequently it was not even in the hands of medical practitioners, but in those of men of other professions, or of women, who have always played an important part in the primitive and pioneer medical practice of all peoples.[4]

It is naturally of the greatest pharmaceutical and medical interest to learn which indigenous drugs were known and used by the American aborigines. In South America, under European exploitation, the search for aromatics, spices, and medicinal plants started immediately after the discovery of the new continent, but in North America, the land of colonization, this search began almost a century later.

The knowledge of drugs and their medicinal use varied with the cultural levels of the various Indian tribes. The several lists of drugs based on research and inquiry among these tribes differ in the number as well as in the kinds of drugs in question. Such lists have been compiled e.g., by Kremers,[5] by Youngken[6] and most recently by Corlett.[7] The

following quotation from Corlett is restricted to the names of the drugs. The original account enumerating the drugs "of special interest or of some distinctive value" also gives an account of preparations and medicinal uses:

> Angelica (*Angelica atropurpurea* L.), Arbor Vitae (*Thuja orientalis* L.), Balm of Gilead (*Populus candicans* Ait), Bearberry (*Arctostaphylos uva-ursi* [L.] Spreng.), Beth root (*Trillium species*), Blackberry (*Rubus nigrobaccus* Bailey), Black cherry (*Prunus serotina* Ehrh.), Black cohosh (*Cimicifuga racemosa* L.), Bloodroot (*Sanguinaria canadensis* L.), Blue cohosh (*Caulophyllum thalictroides* L.), Blue flag (*Iris versicolor* L.), Blue vervain (*Verbena hastata* L.), Boneset (*Eupatorium perfoliatum* L.), Butternut (*Juglans cinerea* L.), Cardinal flower (*Lobelia cardinalis*), Cascara sagrada (*Rhamnus purshiana* D. C.), Corn smut (*Ustilago maydis* Jul.), Cranesbill (*Geranium maculatum* L.), Dandelion (*Taraxacum officinale* Weber), Dogbane (*Apocynum rosaemifolium* L. and *Apocynum cannabinum* L.), Elderberry (*Sambucus canadensis* L.), Flowering dogwood (*Cornus florida* L.), Ginseng (*Panax quinquefolium* L.), Gold thread (*Coptis trifolia* Salisb.), Golden ragwort (*Senecio aurens* L.), Great Hellebore (*Veratrum viride* L.), Gum plant (*Grindelia squarrosa* [Pursch] Duval), Jack-in-the-pulpit (*Arisaema triphyllum* [L.] Schott), Jalap (*Exogonium Jalapa* [Nutt. et Coxe] Baillon), Jimson weed (*Datura meteloides* D. C.), Joint fir (*Ephedra antisyphilitica* C. A. Mey), Juniper (*Juniperus communis* L.), Mandrake (*Podophyllum peltatum* L.), Mullen (*Verbascum thapsus* L.), New Jersey tea (*Ceanothus americanus* L.), Partridge berry (*Mitchella repens* L.), Pasque flower (*Pulsatilla patens* [L.] Mill), Peyote (*Lophophora Williamsii* [Lem.] Coult.), Pleurisy root (*Asclepias tuberosa* L.), Poke root (*Phytolacca americana* L.), Prickly ash (*Zanthoxyllum americanum* Mill), Prince's pine (*Chimaphilla umbellata* [L.] Nutt.), Puffball (*Lycoperdon gemmatum* Batsch), Pumpkin (*Cucurbita pepo* L.), Purple cone flower (*Echinacea angustifolia* D. C.), Raspberry (*Rubus occidentalis* L.—*Rubus strigosus* Michaux), Red cedar (*Juniperus virginia* L.), Red elderberry (*Sambucus racemosa* L.), Seneca snakeroot (*Polygala Senega* L.), Slippery elm (*Ulmus fulva* Michaux), Solomon's seal (*Polygonatum biflorum* [Walt] Ell.), Sour dock (*Rumex crispus* L.), Staghorn Sumac (*Rhus typina* L.), Smooth Sumac (*Rhus glabra* L.), Sweet flag (*Acorus calamus* L.), Tobacco (*Nicotiana quadrivalvis* Pursch.), Viburnum, maple-leaved (*Viburnum acerifolium* L.), Virginia snakeroot (*Aristolochia serpentaria* L.), Wahoo (*Euonymus atropurpurea* Jacq.), Wild licorice (*Glycyrrhiza pepidota* Pursch.), White oak (*Quercus alba* L.), White pine (*Pinus strobus* L.), Wild bergamot (*Monarda fistulosa* L.), Wild cherry (*Prunus virginiana* L.), Wild indigo (*Baptisia leucantha* L. and G.), Wild mint (*Mentha arvensis* L.), Wintergreen (*Gaultheria procumbens* L.), Witch hazel (*Hamamelis virginiana* L.), Yarrow (*Achillea millefolium* L.), Yellow dock (*Rumex crispus* L.), Yerba santa (*Eriodictyon glutinosum* Benth.).

Of *Erythroxylon coca, Cinchona, Krameria triandra* Corlett says that they grow in the Andean region and are still used by the natives living there.

A more intimate knowledge of the drugs used by the North American Indians and of the uses made thereof by these peoples can be gleaned

from the accounts of explorers of the new continent, also from early medical practitioners, such as the Englishmen William Wood[8] and John Josselyn,[9] the Swede Peter Kalm,[10] the German J. D. Schoepf,[11] the Frenchmen André and François André Michaux,[12] the Americans Th. Mason Harris,[13] Thomas Nuttall,[14] and B. Smith Barton[15] and finally Peter Smith, the so-called "Indian doctor."[16] The studies of H. S. Smith among the Wisconsin Indians are of recent date. His lists of drugs are very comprehensive.[17]

According to Youngken not less than 56 Indian drugs were still recognized in 1925 in the United States Pharmacopoeia or in the National Formulary.

It is of interest that an organized endeavor was made during the early part of the 18th century to transplant valuable medical herbs from Spanish Central and South America to Georgia and that it was the London Society of Apothecaries together with the Board of Trustees for the Colony of Georgia which made this attempt upon the initiative of the well known English physician Dr. Hans Sloane. The botanist Robert Miller, brother of the gardener of the Chelsea garden of the London Apothecaries Society (see p. 102), was appointed and commissioned to secure ipecacuanha, jalap, sarsaparilla, contrayerva, cochineal and the trees producing Jesuit bark (Cinchona), balsam of copaiba and tolu-balsam. The Spaniards, however, guarded their monopoly jealously and it was impossible for Miller to carry out his commission. After 5 years of traveling and intense work without success he died in 1740, and the Society of the Apothecaries withdrew further subscriptions "to promote agriculture in Georgia."[18]

W. O. Richtmann reports another more literary attempt in the same direction. In 1769 John Ellis, a fellow of the Royal Society and the agent for West Florida, published a "Catalogue of Plants that May be Useful in America," comprising 82 different plants, all of them being of medicinal interest.

> The list is to be found in William Stork's introduction of the fourth edition of John Bartram's "Journal." In 1770, Ellis published "Directions for bringing over seeds and plants from the East Indies and other distant countries in a state of vegetation; together with a catalogue of foreign plants worthy of being encouraged in our American Colony." This was probably one of the earliest steps taken along the lines of our present seed and plant introduction work of U. S. Department of Agriculture.[19]

New Spain: As is known to every school child, Columbus endeavored to find an all-water passage to the East Indies in order to make their spices more available. These were used, not only for culinary purposes,

but also in the preparation of medicaments. The terms spicer and drugger were frequently used synonymously. It was but natural therefore that not only Columbus but also those explorers of the new continent who succeeded him should have paid attention to medicinal plants and the drugs derived from them.

During his first voyage (1492/1493) Columbus was accompanied by a surgeon. Neither his name nor his journal have been preserved. The journal which the admiral himself wrote diligently until the day of his return to Palos, was forwarded to the king and the queen of Spain and is now lost. However, Las Casas (1474-1566) still had access to it when he wrote his history of the Indies and gave a detailed abstract.[19a] The second expedition of Columbus included a surgeon and Dr. Chanca, a physician. The latter wrote, in 1493, a letter to the chapter of Seville containing a few remarks on drugs.[20] Of vegetable drugs he mentions cotton, turpentine, tragacanth, nutmeg, ginger, aloes, cinnamon, mirobalans, and mastic.

Neither the accounts of the expeditions of the Spaniards De Soto and Coronado (1539-1542) nor the description given by the German Ulrich Schmidel concerning his journeys and experience in South America (1534-1554)[21] contain anything pharmaceutically noteworthy.[22] The first treatise on American drugs was published by Nicolas Monardes, physician in Seville, under the title "Historia medicinal de las cosas que se traen de nuestras Indias occidentales, que sirven en medicina." The first part thereof appeared in 1565, the second in 1571 and the third together with the first two parts in 1574. It is significant of the great interest devoted to the medicinal and botanical treasures of the new world that very soon new editions followed. As early as 1574 Carolus Clusius published a Latin translation in Antwerp. This Latin issue saw several editions and was translated in turn into English, French, and Italian, and lastly (1893) into German. A good account is given by Stuenzer.[23]

Monardes (1493-1578) had never been in South America. However, living as he did in Seville, one of the principal ports from which expeditions to the Indies were sent out and to which they returned, he had the best opportunity to collect not only much information about new medicinal plants but to secure samples of the drugs in question. A comprehensive account based on experience gained in South America itself was given to the Spanish king by the Toledan physician, Francisco Hernandez. This account became known only in the form of an extract, published by order of the king toward the end of the 16th century by the Neapolitan physician, Recchi. This book has come down to us in the Spanish translation and was published in Mexico in 1615 with the corrections and additions of Francisco Ximenez. In 1651 another edition

with further additions appeared in Rome. The original manuscript of Hernandez, comprising 17 volumes, was preserved in the royal library in Madrid. The greater part of it, including the precious illustrations, was destroyed by fire in 1671. The five rescued volumes were edited in 1790 by Ortega.

A comprehensive account of some of the Spanish American colonies toward the close of the 18th century is to be found in Alexander von Humboldt's "Travels through Equinoctial America" which he undertook with the French naturalist, Bonpland.[24]

The Department of Middle American Research of Tulane University has published a survey of the botanical knowledge of the Maya Indians including over 400 uses of various drug plants.[25] P. C. Standley has described the flora of Yucatan.[26] J. L. Weinland has published an outline of the use of some of the present U. S. P. drugs as compared with their use by the Maya Indians.[27]

The new world drugs which were introduced into the European, especially the official German materia medica before 1600 have been described by Carl Hartwich.[28] Although not restricted to Spanish America most of the drugs mentioned by him are of South American or Central American origin.

New France: From 1535, the year in which Jacques Cartier sailed up the St. Lawrence, to 1617, the year in which the first family effected permanent settlement, New France was visited by explorers, fur traders, and missionaries seeking glory, wealth, and the extension of Christianity. The credit of being the first real French settler in America belongs to an apothecary, Louis Hébert. For this reason he has been designated, next to the explorer, founder, and governor of Canada, Samuel de Champlain, the "father of New France."[29]

It was Champlain who saw the necessity of establishing homes if the French settlement was to be permanent. He finally induced Hébert, who had been with him on his first trip to New France in 1604, to establish his home in Acadia, now Nova Scotia. It is indicative of the pioneer character of Hébert that he again and again left security and his regular profession and followed the voice of what he thought his proper vocation. Born in Paris, the son of a well-known apothecary, he had an apothecary "shop" of his own on the banks of the Seine. According to Birkett[30] he sold it and went to Port Royal with the expedition of Des Monts. Carlton reports that Hébert arrived at Port Royal with 50 other colonists in 1606.[29] When the English destroyed the place and took over the land, Hébert returned to Paris and reopened his shop. However, when his friend Champlain decided to establish a new colony to be called Quebec and asked Hébert to accompany him the courageous apothecary sold his possessions once more and migrated to Quebec in

1617 with his family, his household goods, and a small store of drugs. Hébert well knew from his previous experience that he would have to devote himself to husbandry. We are told of his cattle and of his apple trees, "the first to be planted in America."[31] He also made a study of the indigenous grapes, which he cultivated and improved.

On the other hand, the fur company, which had been induced by Champlain to support Hébert and his family for two years, had required his bond for free medical attention at all times to the settlers and to the clerks employed by the company. Thus, devoting his time primarily to the cultivation of the soil and to the study of the native plants of his new home, Hébert put to good use his pharmaceutical skill as well as his supply of drugs brought from France. With and without contract obligation, he tried to help in Quebec as he had previously helped in Port Royal.[32]

Hébert's activity was cut short after a period of ten years, his death being the result of an accident. He was succeeded by Giffard, a surgeon, who also followed Hébert's example and cultivated the soil. It may be mentioned that Hébert was for a time royal procurator and received, simultaneously with the grant of a large fief, the title of Sieur D'Espinay. Canada honored the memory of this earliest and eminent pioneer by erecting a monument to him in Quebec in 1918.

> His work as the first pharmacist to settle in North America is commemorated by a tablet in the town hall of Annapolis Royal, Nova Scotia, erected by the Nova Scotia Pharmaceutical Association and unveiled by the Canadian Pharmaceutical Association, August 2, 1930.[33]

The activity of the sisters hospitaliers and of the Jesuit missionaries was of greatest importance for the development of early medicine and pharmacy in New France. Four of the most important documents connected with the early history of pharmacy in New France are lists of drugs and medicaments sent to Paris between the years 1664 and 1668 by the sisters of the hospital at Quebec with the request for new supplies. These lists reveal a rather extensive materia medica for so early a period in the development of a distant colony.[34] It may also be assumed that the colonists were supplied from any surplus in the medicine chests of vessels whose masters were careful to replenish these chests before leaving French ports.[35]

Whereas both the apothecary Hébert and the surgeon Giffard as farmers, and the sisters hospitaliers, of necessity resided permanently in their respective homes, the Jesuit missionaries, in large part at least, led an itinerant life among the Indians and the "coureurs de bois" (trappers), though some of them occupied semi-permanent stations at

such outposts as De Pere, Sault Ste. Marie, etc. With the advancement of the colony some of them occupied permanent positions at colleges and other institutions. Thus the "Catalogue of Persons and Officers in the Society of Jesus for the Province of France at the end of the year 1749," under the heading, "Missions of North America in New France," mentions two pharmacopoles or apothecary brethren, viz.: Charles Boispineau, of Aquitaine, stationed at the college of Quebec, and Jean Francois Parisel, whose residence is given as (New) Orleans.

It can not be doubted that the itinerant missionaries made the best use of such medical and pharmaceutical knowledge as they possessed in befriending the red man. Of Father Hennepin, who was a member of La Salle's party which explored the Great West in 1680, specific instances of such practice are recorded.[36] In their "relations" to their superiors these Jesuit missionaries also occasionally mentioned the use of drugs by the Indians. It was on one of his expeditions to the south of the Great Lakes that the Father was taken by his Indian guides to a spring that was not only salty, but which on the surface revealed a film of oil. The salt water was used by the Indians as a purgative, the oil as a remedy against rheumatism.[37] It was another Jesuit, Father Lafitau, who discovered ginseng in Canada and wrote a detailed account of this plant and drug, published in Paris in 1718.[38]

G. W. Cable in his Creole stories has given an interesting account of the social conditions of the former French colony Louisiana toward the close of the eighteenth and the beginning of the nineteenth century, an Alsatian apothecary being one of his heroes.[39]

In 1762, by the treaty of Fontainebleau, Canada was ceded to England. Louisiana came to Spain only to be transferred back to France in 1800. Scarcely 3 years later, in 1803, the territory of Louisiana, including much more than the present state of Louisiana, became by purchase a part of the United States of America. Thus ended New France as a political unit, though the romantic history of the French settlers and *coureurs de bois* continued not only on the St. Lawrence but throughout the Great Lake region and down the Mississippi.

The short period of Spanish government in Louisiana brought to North America the first legal definition of pharmacy as a separate branch of medicine. On February 12, 1770, the Spanish governor explained the Franco-Spanish point of view in an edict intended to regulate the practice of surgery, as follows:

> Medicine . . . embraces three parts, namely: medicine proper, which is the science of recognizing diseases and the relation which they have with remedies, and of prescribing the latter together with the diet. The other two parts, which are surgery and pharmacy are

its attendants and have their special field. Surgery includes the use in general of hands and of external remedies. Pharmacy is concerned, generally speaking, with the preparation of remedies.[40]

It is noteworthy that this edict was published, not in Spanish, the language of the governor at this time, but in French.

New Sweden and New Netherlands: New Sweden and New Netherlands were short-lived political units on the North American continent. The Dutch were the first to settle on the territory which now is New York. In September, 1609, Henry Hudson on board a Dutch vessel and in the service of the Dutch East India Company, sailed up the river to which his name was given. Incidentally, we may remind ourselves that in July of this same year Champlain penetrated the lake that bears his name. In 1613 the Dutch built a fort at Albany, in 1623 the explorers and fur traders were followed by the first settlers, sent over by the Dutch West India Company and consisting in large part of Walloons (Dutch of French descent); and in 1626 Peter Minuit bought the island of Manhattan from the Indians for sixty guilders or about $25. The colony was prosperous and an example of tolerance, permitting the settlement of persons of all nationalities and faiths.

In 1638 Sweden founded a colony on the Delaware and in 1654 this settlement comprised the territory of the present state of Delaware and parts of Pennsylvania, New Jersey, and Maryland. However, the settlers were of Finnish rather than of Scandinavian origin.[41] In 1655 Stuyvesant, the governor of New Netherlands, captured New Sweden and united it with the Dutch colony. A few years later, in 1664, this greater New Netherlands had to suffer a like fate at the hands of the English. It was captured by an English fleet with the Duke of York on board and thenceforth "New York" became the name of the former New Amsterdam. "In the further course of time, intermarriage of both Dutch and Swedes with the English settlers blended the three races in a common strain."[42]

One medical person is known to have come over from Sweden to the new colony. In the colony's budget of 1642 the barber-surgeon Hans Jancke is mentioned.[43] The same man is reported as one of the passengers of the ship Mercurius which arrived in the Delaware river two months after the capture of New Sweden by the Dutch. It seems, therefore, that he had left the colony for a while but had returned in 1655.

The first known surgeon in New Netherlands was Herman Meynders van den Boogaerdt who arrived in New Amsterdam in 1631.[44] In 1643 he was appointed commissary of stores at New Amsterdam and in 1645 at Fort Orange. It is not reported whether he dealt in drugs or not. Of another surgeon, Gysbert van Imbroch (van Emburgh) who died in 1665, i.e., one year after the colony became English, it is known that he

"kept a shop at New Amsterdam" in 1653 and served as a "shepen" of Wiltwycks from 1663 to his death.[45] The New Netherlands Register reports:

> Besides being the local physician and pharmacist, he kept a general store, and the inventory of his estate includes a wide variety of objects, from high priced books down to the commonest necessaries of life.[46]

It is not known whether Imbroch's "shop" at New Amsterdam was a drugstore. It may have been a surgeon's and barber shop. The "general store," however, carried on in Wildwycks (since 1669 Kingston) from 1663 to 1665, was doubtless one of the first, if not the first drugstore in North America, unless the abode of Hébert be so regarded.

Another medical person of pharmaceutical interest in New Netherlands was the surgeon Hans Kiersted from Magdeburg (Germany) who came to New Amsterdam with governor Kieff in March, 1638. For a long time he was in the employ of the Dutch West India Company and while nothing is known about a drugstore kept by him some of his recipes have survived him. "Many of his descendants have been identified in the medical profession. His great-great-grandson, the late general Henry T. Kierstedt, of Harlem, at his well known drugstore on Broadway dispensed the 'Kierstedt ointment,' made from a recipe left by Dr. Hans."[47] This "late general" Henry T. Kierstedt was president of the American Pharmaceutical Association from 1860-1862, the only president holding the office for two years.[48]

No other and more detailed reports or relics of pharmaceutical interest have come down to us either from New Sweden or from New Netherlands. The Spaniards, the French, the Swedes, and the Dutch, were all in North America only as pathfinders for the British. "John Bull," says J. Morgan, "is a winterapple which outlasts the varieties that ripen more quickly."[49]

Pharmaceutical life in North America began in New England.

New England: In 1602 Bartholomew Gosnold landed in Massachusetts. Gosnold's crew prepared and loaded the first cargo of New England's exports. "It consisted of the bark and pith of the sassafras tree."[50] The fact that the English and their rule and not the Frenchmen or the Spaniards, the Dutch, or the Swedes succeeded in North America is due to two reasons: from the very beginning they cultivated the soil; in addition they were sufficiently numerous to accomplish the task. During the seventeenth century there were in England, Scotland, and Ireland masses of people with the urgent desire of changing their native country for any other land promising them liberty of faith and the possibility of

a livelihood. They came and they depended on their own individual initiative.

> The English unlike their Spanish and French competitors started their colonization of the New World as a private not as a governmental enterprise . . . They brought with them to Jamestown, to Plymouth, to Boston, to St. Mary's, to Philadelphia, not a royal soldier, or one royal official, nor a penny out of the royal treasury.[51]

In 1606 King James I granted the London corporation a charter which gave to it the ownership of Virginia, at that time all the unoccupied country between the settlements of the Spanish in Florida and those of the French in Canada. In 1607 the first English colonists sailed into Hampton Roads and in 1614 Captain John Smith coined the very name "New England". The decisive dates, however, for the English colonization are 1620 and 1628. In 1620 the so-called Pilgrims sailed on board the Mayflower from Plymouth, landing, by accident, not within the limits of Virginia as they should have done according to their patent, but at the place which they called Plymouth in remembrance of their English port of embarkation. In 1628 the Puritans with John Endicott settled and founded Salem, followed a year later by 400 additional colonists and in 1630 by the main body with governor John Winthrop, who founded Boston in the same year. This man and this town became the two most important landmarks for early American cultural life, including medicine and pharmacy.

"Medicine was promulgated, for the first hundred years of colonial America, by three types of individuals: the governors, the churchmen, and the educators."[52] As always in primitive and in pioneer society, it was practiced to a large extent by the housewives.

The housewives of the early English emigrants brought their peculiar kind of knowledge and practice over from their native country. Gervase Markham's books, "The English Housewife" and "The English Husbandman," also the herbals of Parkinson and John Gerard, written some years before the Pilgrims left England, were very popular and the plants recommended in them were cultivated in the gardens of Old and New England.[53] In addition to these European plants the New England housewives as well as the other people practicing medicine within the colonies used a gradually increasing number of native herbs. The kinds of native drugs employed in the first decades of the settlement we learn from William Wood's "New England's Prospect" and John Josselyn's "New England's Rarities" previously mentioned (see page 128). According to Will T. Bradley[54] 30 of the 56 Indian drugs which Youngken lists as still being recognized either in the United States Pharmacopoeia

or in the National Formulary were used by the Indians of New England.

The first governor of Massachusetts colony, John Winthrop senior (1587-1649), also his son John Winthrop junior (1606-1676), first governor of Connecticut colony, are the most outstanding examples of North American governors interested in and employing the practice of medicine. The elder Winthrop was in frequent communication with London and apparently often asked his friends in England for advice on medical topics. In 1643 he received from London a list of "Receipts to cure various disorders,"[55] sent to him by Edward Stafford, probably the son-in-law of Elias Ashmole, the great Oxford collector. These "receipts" are mostly of household character "taken from John Gerard's herbal."[56]

The younger Winthrop was not only a political leader of importance but the outstanding figure in the history of science in North America during the seventeenth century. He was versed in all the sciences of his time and "it is doubtful if there was any doctor of medicine in the American colonies during the seventeenth century who could equal Winthrop in the extent of his medical practice, in the number of his acquaintances among the leading physicians and chemists of Europe, or in the completeness of his laboratory and library."[57] The great interest Winthrop junior took in chemistry makes it understandable that in his medical practice he used many chemicals such as saltpetre, preparations of antimony and mercury, tartar, copperas, white vitriol, sulphur, and iron, in addition to red coral, powdered ivory, rosin, some American and European vegetable drugs, and several galenicals. It is reported that he prepared some of his chemical compounds and galenicals himself. Hence, he was one of the first to do real pharmaceutical work in North America.

It was through Winthrop junior that the famous sympathetic wound-powder of Sir Kenelm Digby, consisting chiefly of dried green vitriol and supposed to heal by being applied to the knife or object which produced the wound, was introduced into America. A protégé of Winthrop was George Starkey, a Harvard college graduate of the class of 1646, who won great reputation as a chemical practitioner and invented numerous remedies of which his oil of sulphur was the best known. Having built a furnace in Boston, he wrote to Winthrop asking him for "a little mercury and antimony." These two substances, of which especially the latter had been the subject of many a quarrel in Europe about this time (see p. 62), "were the principal bases of the chemical remedies used in America for the next two centuries." For the period prior to 1750 we have a very significant example. The alternate administration of large doses of calomel and of a mixture of powdered antimony, cream of tartar, and brimstone through several weeks as pre-

paratory treatment before the inoculation of a patient with small-pox, was introduced in American medicine by Dr. John Muirson of Brookhaven in 1731, and was used extensively for fifty years, finding its way to Europe. The general belief was that this "method of mercurial inoculation for smallpox" guaranteed a mild attack of the disease.[58]

In 1675, a year before the death of John Winthrop junior, the so-called King Philip's war broke out. The Indians under their "king" Philip fought desperately and there was much need of medicaments among the troops from the Bay colony. A letter of Will Locke, a surgeon who had joined the troops, written in 1676 to Mr. Rawson senior, secretary of Massachusetts Bay colony, contains a list of medicaments which the writer urgently demanded. Most of these items are contained in the London pharmacopoeia of 1650. Winthrop senior used chiefly household remedies. Winthrop junior selected from all the fields of knowledge and experience the remedies which his superior judgment considered suitable. With surgeon Locke the medico-pharmaceutical officialism of European origin made its first documented appearance.

> In all probability the articles were not compounded in the colonies but imported from England. A list of the ingredients necessary to compound the several galenicals called for reveals clearly that such was in all probability the case, for it could scarcely be expected that the "shop" or office of a colonial physician, no matter how extensive his medical practice or his drugstore, would contain one-half of the simples necessary.[59]

Judd tells in his history of Hadley that drugs and medicines were imported from England into Boston and kept for sale soon after the settlement of that town. However, they could not have been stocked in quantity in the seventeenth century except probably during the Indian wars. Where a professional physician was not employed imported medicines were not likely to have been used extensively.

There were not many "professed physicians" in the New England colonies until 1700. The first apothecary who entered New England came to die rather than to live there. This Englishman, Giles Firmin of Sudbury, arrived at Boston probably toward the end of 1632 and died sometime between March and October 1634. Nothing is known of Firmin's opening a shop in Boston. Presumably he practiced medicine "as one of Boston's few physicians. His son became a physician as well as an apothecary."[60] It may be recalled that during this period the apothecaries in England became more and more general medical practitioners (see p. 92). The primary occupation of this first English apothecary on North American soil, however, seems to have been preaching and that by vocation as well as by necessity. Even Firmin junior is quoted

as having written to Governor Winthrop: "I am strongly set upon to study devinitie, my studies else must be lost, for physic is but a meene helpe."

Indeed, most of the male medical practitioners of the early colonial days seem to have resorted to other callings for a livelihood. Holmes, in speaking of the early medical men of the Massachusetts colony,[61] states that among the settlers who came over before 1692 he found the names of 134 medical practitioners. "Of these twelve, and probably many more, practiced surgery; three were barber-surgeons . . . Six or seven, probably a larger number, were ministers as well as physicians . . . One was not only doctor, but also schoolmaster and poet. One was a butcher, but called himself a surgeon in his will, a union of callings which suggests an obvious pleasantry." In other colonies, particularly in Pennsylvania, several of the early physicians occupied public positions in the various departments of the colonial government.

Whatever else the early medical practitioners may have done to earn their livelihood, in one particular they were no doubt all alike with only a few occasional exceptions—they dispensed their own medicines unless they directed the relatives or friends of the patient to prepare such potions from indigenous or cultivated herbs or roots.

> The apothecary shop, as it existed at a later period in the larger cities of the American colonies, was usually the dispensary of a more or less progressive or successful medical practitioner who occasionally deigned to enlarge on his otherwise meagre income by the sale of sundry articles like spices or tea, which at that time were counted among the luxuries of the more settled portions of the country.[62]

That the legislators in the early times of American colonization considered the dispensing of drugs by the medical practitioners as obviously necessary, is proved by many official statements.

> Virginia in 1639, 1646, 1658, 1662, and 1692 enacted laws substantially to the effect that any "physician or chirurgeon," whose fee seemed exorbitant, could be brought before a court where he had to "declare upon oath the true value, worth and quantity of his drugs and medicines administered."[63]

The "general store" of the surgeon Gysbert van Imbroch in Wildwycks (Kingston) mentioned above (see page 134) was doubtless an enlarged dispensary. However, William Davis (Davice) is usually considered the earliest owner of a drugstore in North America. The basis for this assumption is an official record of 1646. According to it the

selectmen in Boston ordered, for the benefit of the apothecary Davice, that a payle, or fence, be erected before his hall window.

From 1640 until the end of the seventeenth century European emigration seems to have ceased. With the domination by the Puritans in England the conditions that had caused English emigration changed. Indeed for several decades more people returned to England than came from there. About 1700 the number of immigrants again increased. In 1681 the first Quakers landed in Pennsylvania, the proprietary colony of their protector and brother in the faith, William Penn, who followed them in 1682. In 1694 the German pietists came to Pennsylvania and founded Germantown. In 1710 thousands of Palatine Germans left Europe, partly in consequence of the devastation of their native country by the armies of Louis XIV of France, partly because of religious persecution. They landed in New York and settled there, and accepting the invitation of William Penn, in Pennsylvania, and in North Carolina. German Moravians, whose faith was a "variation of Quakerism or Puritanism," settled in Pennsylvania and Maryland. Count Zinzendorf, their later leader, "christened" Bethlehem in Pennsylvania in 1741. "For several years Philadelphia received yearly as many as 12,000 immigrants from Ireland, mostly Protestants, so-called Scotch-Irish. Forty-five ships from Irish ports unloaded their human cargoes upon Boston between 1714-1720."[64]

This increase in population, naturally, had its effect on general trade as well as on the trade in drugs and such articles as were usually sold in drug stores. As early as the first decades of the eighteenth century there must have been a considerable number of apothecary "shops" or drugstores in North America. On December 20, 1721, the physician Dr. William Douglas wrote that there were 14 apothecary shops in Boston. It was relatively early that advertisements of the owners of such stores appeared in the daily and weekly newspapers. The well-known physician Zabdiel Boylston (1679-1766) who was the first medical practitioner in America to employ inoculation against smallpox, and of whom Viets says that "he became the most meritorious physician of his day in America,"[65] was an industrious advertiser of his drugs. In 1723 and 1724 he offered in the Boston Gazette "good cassia fistula, good saffron and good jalap root, juniper berries and other druggs and medicines at reasonable rates." In 1721 "Robert Gibbs at his apothecary shop in Corn-Hill-Street, Boston" offered English Starch, fresh cinnamon and mace and "all sorts of painters colors." Thomas Aston, "next door to the governor's house Boston" offered in 1732 "all sorts of drugs and medicines," a series of spices, tea, coffee, etc., calling himself "apothecary and grocer." In 1737 the same man advertised drugs and apothecary's wares "imported in the last ship from London." These

references to the import or "fresh" import of drugs from London are met again and again. Proprietaries are often advertised, e.g., Bateman's elixir, Goodfrey's British oyl, Duffies' elixir and Scotch pills. In 1752 an advertisement is devoted to Turlington's balsam, "prepared and sent by Mr. Turlington, the patentee, to John Vintenon . . . in Boston." In 1759 B. Church junior in Boston "just arrived from London" offered to "town and country physicians etc. . . . the best medicines at the most reasonable rate, also some noted modern authors in physick, surgery and midwifery."

In these advertisements the shops are mostly referred to as "apothecary shops." Some of them are designated with special sign names. In 1733 there occurs an advertisement of "William Rand, apothecary at the unicorn." In 1764 another of Ph. Godfrid Kast "at his shop at the sign of the lyon and mortar, in Salem."

The greatest variety of goods, advertised in the Boston Gazette during the first half of the eighteenth century, in connection with drugs, is to be found in the advertisements of Silvester Gardiner (1708-1786), "one of the outstanding New England physicians before the American revolution."[66] On several occasions Gardiner offered (1748-1750) "all kinds of apothecary and grocery ware by wholesale and retail, dye stuff, painters colours, linseed oyl, etc" and a series of nostrums "by appointment of the patentees." That Gardiner "established the first apothecary shop in 1744" in New England (H. R. Viets) is obviously wrong. It may be that his shop was one of the most prosperous. It is indicative of the amount of imported drugs that Gardiner's stock of drugs filled over 20 wagons when it was sold at public auction after Gardiner's escape to England during the Revolutionary War.[67]

In New York the New York Gazette, the New York Weekly Post, and the New York Journal are sources for advertisements of seventeenth century apothecaries. As far as drugs are mentioned by name they are the usual chemicals and galenicals used in Europe in this period. A very characteristic advertisement appeared under the date of August 3, 1769 in the supplement to the New York Journal or General Advertiser. It is scarcely possible to offer a greater variety of the most different kinds of merchandise together with drugs and medicines than was here advertised by G. Duyckinck "at the sign of the looking glass & druggist pot."[68]

In Philadelphia the Pennsylvania Gazette was a popular means for advertising. It was founded by Benjamin Franklin in 1729 and extensively used by himself. About the time of his marriage (1730) Franklin opened a store and offered in his "Gazette" all "commodities varied from needles and pins to horses and slaves." Among these "commodities" we find advertised coffee, tea, chocolate, palm oil, saffron, spermacety, crown soap, powdered mustard, linseed oil, patent medicines

and "seneca rattlesnake root, with directions how to use it in pleurisy." Franklin doubtless prescribed over the counter.[69]

For pharmacy this participation in the drug business by one of the most eminent and influential Americans during the 18th century had its favorable consequences. Franklin retired from business in 1749, but he never lost his interest in medicine and pharmacy. It was he who, having dabbled in both professions without being educated in either, was the first to bring about an official practical example for the separation of pharmacy and medicine in America. In the hospital, founded on his initiative, he appointed an apothecary whose only task was that of preparing medicines. There are several other proofs of Franklin's interest in pharmacy. Thus in 1770, he sent from London to his friend John Bartram, the famous American botanist, "some of the true rhubarb seed." According to Van Doren that was the first attempt on American soil to cultivate the Chinese rhubarb plant, yielding the medicinally used rhizome.[70]

In early 18th century Philadelphia, as in the other larger cities of the American Colonies, the number of drugstores owned by pharmacists and devoted exclusively to supplying medicines and medicinal preparations to physicians and to the sale of household remedies was very small.[71] S. Troth mentions Evan Jones, located in 1730 in Philadelphia at the sign of "Paracelsus' Head."[72] In 1729 Christopher Marshall established himself in Philadelphia. His biographer calls him "an apothecary, druggist, botanist, and chemist." Marshall was ancestor and founder of a Philadelphian apothecary dynasty.[73]

Pennsylvania was the first American colony to have a pharmacy whose owner conducted his business according to the German model and designated it "Apotheke." It is reported that immediately after the foundation of the Moravian settlement in Bethlehem, in 1741 (see p. 139) the brethren, among other institutions for mutual assistance, operated a pharmacy under the direction of the German physician Dr. Friederich Otto, who in 1750 turned over the management of the "Apotheke" to his brother Matthes Otto. The pharmacy was in the possession of the Moravian church community until 1796, when it was purchased by Dr. Freytag.[74] Thanks to Schoepf, we know of another German pharmacy, existing in Philadelphia around 1780, where the German farmers and settlers in Pennsylvania could obtain all the domestic remedies to which they had been accustomed in the old country.[75]

Influenced by the initiative of private individuals and not by governmental action, the English colonies enacted only those laws which were dictated by immediate needs of these individuals. It is but natural that the laws mirror English custom and spirit. It was not until 1736 that an English-American colony found it necessary to deal legally with

pharmacy. So far as known, the first North American law concretely mentioning the apothecary and having a direct bearing on pharmacy is the Virginia "act for regulation of the fees and accounts of the practicers in physic," issued in 1736. As David L. Cowen points out, this act contains such a wealth of information about the pharmaceutical situation in colonial America that it should be quoted.[76]

"I. WHEREAS the Practice of Physic, in this Colony, is most commonly taken up and followed, by Surgeons, Apothecaries, or such as have only served Apprenticeships to those Trades, who often prove very unskillful in the Art of a Physician; and yet do demand excessive Fees and exact unreasonable Prices for the Medicines which they administer, and do too often, for the Sake of making up long and expensive Bills, load their Patients with greater Quantities thereof, than are necessary or useful, concealing all their Compositions, as well to prevent the Discovery of their Practice, as of the true Value of what they administer; which is become a Grievance, dangerous and intolerable, as well to the poorer Sort of People, as others, and doth require the most effectual Remedy that the Nature of the Thing will admit:

II. Be It therefore Enacted, by the Lieutenant-Governor, Council, and Burgesses of this present General Assembly, and it is hereby Enacted, by the Authority of the same, That from and after the Passing of this Act, no Practicer in Physic, in any Action or Suit whatsoever, hereafter to be commenced in any Court of Record in this Colony, shall recover, for Visiting any sick Person, more than the Rates hereafter mentioned.

(In the then following list the "Rates" allowed "those Persons who have studied Physic in any University, and taken any Degree therein" are about double as high as the fees allowed "Surgeons, and Apothecaries, who have served an Apprenticeship to those Trades.")

III. AND, to the End the true Value of the Medicines administred by any Practicer in Physic, may be better known, and judged of, Be it further Enacted, by the Authority aforesaid, That whenever any Pills, Bolus, Potion, Draught, Electuary, Decoction or any Medicines, in any Form whatsoever, shall be administred to any sick Person, The Person administring the same shall, at the same Time, deliver in his Bill, expressing every particular Thing made up therein; or if the Medicine administred, be a Simple, or Compound, directed in the Dispensatories, the true Name thereof shall be expressed in the same Bill, together with the Quantities and Prices, in both Cases. And in Failure thereof, such Practicer,

or any Apothecary making up the Prescription of another, shall be nonsuited, in any Action or Suit hereafter commenced, which shall be grounded upon such Bill or Bills: Nor shall any Book, or Account, of any Practicer in Physic, or any Apothecary, be permitted to be given in Evidence, before a Court; unless the Articles therein contained, be charged according to the Directions of this Act.

IV. AND be it further Enacted, by the Authority aforesaid, That this Act shall continue and be in Force, for and during Two Years, next after the Passing thereof, and from thence to the End of the next Session of Assembly."

Influenced if not drafted by an academically educated and graduated physician, this act reflects the attitude of the London physicians of this period toward the medical ambitions of the apothecaries. On the one hand, it is contemptuous in its judgment of both surgeons and apothecaries who have only served an apprenticeship and is in a way an answer to the denial of the necessity of academic education as a basis for the practice of medicine by the London apothecaries in 1724 (see p. 92). The act, on the other hand, reluctantly recognizes the apothecary as a medical practitioner. Since only the fees of graduate physicians and those of surgeons and apothecaries who had "served an apprenticeship" are enumerated, the conclusion seems to be justified that only such skilled apothecaries as were eligible to practice in Virginia could legally demand remuneration for services mentioned in the act. Of special importance is Section III of the act. According to Cowen "the bill of particulars took the place of the practitioner's oaths of the earlier laws, and such particularization often became an integral part of later medical legislation throughout the country." New, however, and indicative of the European academic training of the author of the act is the reference to "dispensatories." According to Cowen, "this is the first legal recognition of such compilations" in the colonies at a time when no pharmacopoeia or dispensatory had yet been published in America. There is another reference in the act to which attention should be directed, viz., that to "any apothecary, making up the prescription of another." Up to this time this is the first official statement that there may have been medical practitioners who, at least at times, wrote prescriptions instead of dispensing their medicines themselves. It may be assumed, therefore, that the most significant pharmaceutical task, the filling of prescriptions of medical practitioners, was carried out by apothecaries in North America before 1736.

The first legal mention of the term "druggist" besides "apothecary" appears in a South Carolina act of 1751 prohibiting "any physician,

apothecary, or druggist" from employing any slave "in the shops or places where they keep their medicines or drugs." According to Cowen the terms apothecary and druggist are here not used interchangeably, but with the intention of differentiation, "since such a differentiation is definitely known to have been the practice in colonial America."[77] The designation "druggist" was usually applied to people importing drugs and selling them at wholesale.

The above quoted Virginia act of 1736 contains only a general confirmation of the fact that apothecaries in colonial America sometimes must have had the opportunity to "make up prescriptions" brought or sent to them by medical practitioners. However, the first American record, we have of the appointment of an individual apothecary to fill prescriptions other than his own or those of his preceptor is to be found in the "Account of the Pennsylvania Hospital, from Its Rise To the Beginning of the Fifth Month, called May, 1754," written by Benjamin Franklin, then the clerk or secretary of the board of trustees of this institution (see also p. 141). In this interesting account we find the following paragraph:

> The practitioners charitably supplied the medicines gratis till December, 1752, when the managers having procured an assortment of drugs from London, opened an apothecary's shop in the hospital; and it being found necessary appointed an apothecary to attend and make up the medicines daily, according to the prescriptions, with an allowance of fifteen pounds ($75) per annum for his care and trouble, he giving bond, with two sufficient sureties, for the faithful performance of his trust.

Jonathan Roberts, who was warmly recommended by Dr. Thomas Bond, was appointed as the first apothecary to the hospital, and served the institution faithfully and well until the spring of 1755, when he resigned to accept more remunerative employment.

John Morgan, who was an apprentice of Dr. John Redman, succeeded as the second apothecary at the Pennsylvania hospital. He was appointed May 19, 1755, and served until the following spring, when he resigned in order to complete his medical education. His successor was John Bond, a nephew of the Dr. Bond mentioned above.

It was the former hospital apothecary John Morgan who, ten years later and after 5 years of study and experience in London, Edinburgh, Paris, and Italy, attempted to make the continental practice of writing prescriptions, or, as he called it in his "Discourse upon the Institution of Medical Schools in America,"[78] "the regular mode of practicing physic," a generally recognized American custom. In this same discourse, which was held as an introductory lecture at the inauguration

of a medical school in connection with the College of Philadelphia and which was written by him during his stay in Paris and Italy, Dr. Morgan recommended the complete separation of pharmacy and surgery from the practice of medicine. He said: "We must regret that the very different employment of physician, surgeon, and apothecary should be promiscuously followed by any one man: They certainly require different talents."

Morgan's prime object in advising the separation of the several branches of medical practice was doubtless to improve the entire profession by having each department successfully cultivated. "The knowledge of medicine will then be daily improved; and it may be practiced with greater accuracy and skill."

To the objections that were raised to this idea which was strange and from a business point of view, inconvenient to most of the American medical practitioners of this time, Morgan made the following reply:

> Practitioners in general business never do, or can do, the business of an apothecary in this place themselves. They have apprentices for the purpose. After visiting the sick, do not their apprentices make up their prescriptions? I should ask, is not an apothecary acquainted with the art of compounding and making up medicines as skillful in it as an apprentice? Is not a man educated in the profession to be trusted in preference to one who is only learning the business?

On his return from Europe Dr. Morgan was accompanied by Mr. Leighton, an accomplished apothecary, who had been educated in Great Britain, and who brought with him a large assortment of medicines, largely from Sylvanus and Timothy Bevan, in London, and was therefore prepared to fill all prescriptions that might be presented. However, the fact that no mention is made of Mr. Leighton by the annalists of the times, suggests that he did not continue long in business. The time was not yet ripe for an effective separation between the professions of medicine and pharmacy in the American colonies. It is likely that some physicians here and there unostentatiously adopted Morgan's method of prescribing. However, according to Wilbert,[79] it was not until 1774 that Morgan had a follower, employing and defending his method publicly and on principle: Dr. Abraham Covet in Philadelphia. Another propagandist for the separation of medicine and pharmacy in America was Dr. John Jones, the first professor of surgery in the New York Medical School. Kredel and Hoch[80] report a resolution adopted by a Virginia Club in Edinburgh. This club consisted of students who, upon completion of their studies, expected to return to their native country. According to this resolution, the members of the club obligated them-

selves, "for the honor of their profession not to degrade it by hereafter mingling the trade of an apothecary or surgeon with it."

It was English spirit and English custom, or in other words the English "laisser faire" which, in spite of the sometimes very large influx of people of other nationalities, dominated absolutely the development of American pharmacy in its colonial period. This inertia could not be overcome immediately either by ideas brought from the European continent or by such men as Morgan through the progressive Scottish University of Edinburgh (see p. 144).

As in England of that period, American pharmacy showed little scientific life of its own. The first pharmaceutical publication in North America, a tract with the title "Electuarium Novum Alexipharmacum," was written in 1732 by a clergyman, the Reverend Thomas Harward. The first teacher of pharmacy and pharmaceutical chemistry was the often-mentioned Dr. John Morgan. He taught these subjects as well as the theory and practice of medicine and finally materia medica in the first medical school in America, founded at his initiative as part of the College of Philadelphia, later the University of Pennsylvania.[81] In 1769 the professorship of chemistry and with it the teaching of pharmacy was given to Dr. Rush.

It had to be proved that pharmacy, i.e., pharmaceutical knowledge and pharmaceutical practice are important for public welfare before professional pharmacy could be established in America. This proof was supplied during the Revolutionary War.

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THE REVOLUTIONARY WAR

THE Revolutionary War in the North American Colonies broke out in 1775 as the immediate consequence of the stamp act, the sugar taxes, and the taxes on tea, imposed by England. But the resistance of the colonists from the very beginning, to these acts and taxes, was due to the fact that the American settlers never had felt themselves "colonists" depending on and subject to the government of the mother country. They themselves or their ancestors had come into this country upon their own initiative, without any governmental support, and for the most part to escape oppression in their native country. Thus a feeling of independence was predominant in the North American "colonies," and this spirit was incompatible with any attempt at tutelage and at exploitation by a government on the other side of the ocean.

> A turning point in world history occurred during the years 1775-83, when it was decided whether an accidental despot or all the people should rule the earth. The contest, known to us as the American Revolution, waged by insignificant armies, takes on enormous importance.[1]

The participation of large numbers of medical men in any revolutionary war has been looked upon as proof of its democratic character. In the American Revolution this participation was as extraordinarily large as it was in the German revolution of 1848, in consequence of which so many educated men came to this country.

> In the American revolutionary war medical men were to be found wherever leadership was needed, in the Halls of Congress as well as in the line of the army. Six doctors signed the Declaration of Independence, half a dozen became brigadiers, several major generals, commander in chief, and secretary of war.[2]

To what extent were these "medical men" or "doctors," as they are referred to by Duncan, learned physicians?

> At the close of the colonial government there were two American colleges: one in Philadelphia, founded in 1765; the other in New York, founded in 1768. The operations of both were suspended by the war. Up to that time they had conferred less than

PHARMACOPOEIA

SIMPLICIORUM

ET

EFFICACIORUM,

IN USUM

NOSOCOMII MILITARIS,

AD EXERCITUM

Fœderatarum *Americæ* Civitatum

PERTINENTIS;

HODIERNÆ NOSTRÆ INOPIÆ RERUMQUE ANGUSTIIS,

Feroci hoſtium ſævitiæ, belloque crudeli ex inopinatò patriæ noſtræ illato debitis,

MAXIME ACCOMMODATA.

PHILADELPHIÆ:

EX OFFICINA STYNER & CIST. M DCC LXXVIII.

FIGURE 12. Title-page of the Lititz Pharmacopoeia.

> fifty medical degrees. . . . The great majority of the physicians of the colonies had obtained their medical education by a system of apprenticeship lasting from three to seven years. A favored few, like Rush, Morgan, Shippen and Church, had been able to resort to the celebrated schools of Europe . . . Some medical graduates had emigrated to the colonies.[3]

With this statement the answer to the above question is given. At the time of the Revolutionary War, i.e., about forty years after the somewhat contemptuous classification of medical persons without academic education in the Virginia act of 1736 (see p. 142), the overwhelming majority of the North American medical practitioners still consisted of "surgeons, apothecaries, or such as have only served apprenticeships to those trades."

It should be noted that if there was any distinction at all between the kinds of practice carried on by these men, it was dictated by their own volition or by general circumstances and not by a special kind of education or examination. It was up to them whether they preferred to act as physicians or as surgeons or finally as apothecaries and how to label themselves. In their "apprenticeship" they had learned the practice of all these branches of medicine and for the most part they tried to make the best of all of them. As previously stated almost all medical practitioners of this period dispensed their prescriptions themselves and many of them conducted an open shop (see p. 138). Not infrequently it was one of the few physicians with academic education and degree, such as Silvester Gardiner, who was especially successful in the drug trade and in his "shop."

The outstanding soldier and American military hero, Hugh Mercer,[4] was a graduate of the Scottish university of Aberdeen. The fact that he during his entire career as medical practitioner conducted an open apothecary shop (first in Greencastle—now Mercersburg—Pennsylvania, and later in Fredericksburg, Virginia), made him an apothecary just as much or as little as Benjamin Franklin became an apothecary by dealing in drugs and patent medicines in his store (see p. 140).

During this period the designation "doctor," especially so far as American born practitioners were concerned, was rarely a university degree. There were some practitioners without academic education who later on received an honorary doctor's degree, e.g., Samuel Danforth,[5] John Brooks,[6] and Isaac Senter.[7] Mostly, however, the title was one of courtesy applied to all kinds of medical men including the apothecaries.

Before the Revolutionary War and for some time thereafter the representatives of the drug trade belonged to one or the other of the following three classes:

1. Persons who had served a more or less lengthy apprenticeship with a medical practitioner whose prescriptions they had learned to compound, and who had greater confidence in their commercial talents and prospects than in their medical accomplishments;

2. Those who had been trained as apothecaries, chemists, or druggists, also as "apothicaires" or "Apotheker" in their native countries in Europe. Most of these, however, preferred medical practice combined with dispensing; and

3. Storekeepers who specialized more or less in the drug trade without having had any special pharmaceutical training.

In his "Medicine in Colonial Georgia," Joseph Krafka, Jr. mentions as having settled in Georgia before the Revolution, the Scottish "Dr. Patrick Tailfer . . . an apothecary who came to the colony in its first days;[8] . . . John Reimer, Swiss pharmacist; Henry Garret, chymist."[9] Although he gives to these men their European pharmaceutical designations brought over by them from Scotland, Switzerland, and England respectively, he ranges all of them among the medical practitioners.

During this same period the medical situation in England was much clearer. The physicians had to be examined and graduated. The apothecaries, although entitled to attend the sick, considered themselves the legitimate representatives of the art of pharmacy and tried to defend their assumed monopoly (see p. 93).

The medical service in the British army corresponded with this situation. Only a graduate of one of the great universities or of the College of Physicians of London could become an army physician.[10] The surgeons and the apothecaries had to prove their professional education, and their service in the army was restricted to their special field. In this connection it should be pointed out that the medical service within the German ("Hessian") corps of the British North American army represented the distinct separation between the different branches of medicine guaranteed by the German authoritative system.

The medical staff of the British army consisted of physicians and surgeons of different rank with administrative or with practicing functions, purveyors, apothecaries, and mates. In the British army mention is made of the apothecaries Robert Bishopp, George Brown, Michael Croker, Arthur Edwards, Richard Huddleston, John Johnston, Benjamin Mace, Daniel Maudeville, William Payne, Richard Proctor, John Watson, Gregory West. Furthermore, there was a surgeon John Rush "appointed apothecary to the general hospital." Among the medical staff of the German troops in British service the "Apotheker" Becker, Keller, Rudolph, and Schirmer are enumerated.[11]

It was only natural that the medical service in the British army should serve as pattern for the Colonial army. "That of the continental army

(continental in the meaning of North American) was a fair imitation of it," says Duncan.[12]

This imitation was by no means restricted to the form of the British military medical service. Of the four medical directors of the American revolutionary army who succeeded and denounced each other with the utmost jealousy and vehemence,[13] the first three, i.e., Benjamin Church,[14] John Morgan,[15] and William Shippen[16] were, like their English colleagues, academically educated and graduated men. The fourth, John Cochran,[17] was a man of approved theoretical knowledge and interest. The proof of a professional education required from the surgeons in the British army found its parallel in an obligatory examination introduced in the Continental Army as early as May 8, 1775.[18]

> Although regimental and hospital surgeons were in demand, examinations of a somewhat rigid character were, as a rule, insisted upon as a prerequisite for appointment.[19]

There is no evidence of any examination or proof of skill required of the apothecaries active in the American revolutionary army. Compared with the surgeons their number was small and apparently there was no complaint concerning their activity throughout the war. Moreover, as early as October, 1775, a man whose knowledge of and understanding for the special tasks of pharmacy had already stood the test became director general of the military hospitals and chief physician of the army. This man was Dr. John Morgan.

On July 17, 1775 the Continental Congress passed a resolution establishing an army hospital with a staff of a director general and chief physician, 4 surgeons, 1 apothecary, 20 mates, etc. According to this resolution it was the duty of the "surgeons, apothecaries and mates to visit and attend the sick, and mates to obey the orders of the physician, surgeons, and the apothecary."[20] The appointment of the apothecary and the surgeons was left to the director general.

This resolution does not show any differentiation of duties performed by the apothecary and the surgeons. It was up to Morgan to point out and to secure this differentiation.

A letter, written July 28, 1776, by Morgan to Dr. Potts, at that time director of a department hospital, is very characteristic. Morgan writes that he had given "a warrant to Mr. Andrew Craigie, to act as an apothecary" under Potts and expresses the opinion that Potts will find this appointment "particularly useful," because of the necessity of experience in the apothecary business. "Without such a one I know not how you could either procure sufficient medicines for your department or dispense them when got." Morgan admonishes Potts, "to make it a part of the duty of the mates to assist the apothecary in making up and

dispensing medicine." He states that "the apothecary to all intents is to be looked on in rank as well as pay in the light of a surgeon and respected accordingly and if he is capable he should in return do part of the surgeon's duty." Morgan ends his letter telling Potts that "Mr. Craigie has leave of absence for about 11 days and will then join."[21]

The "making up and dispensing medicine"—this is according to Morgan the prime task of the apothecary in the army. On April 7, 1777 Congress passed a resolution effecting the reorganization of the medical department of the army. The plan upon which this reorganization was based was prepared by William Shippen and John Cochran. However, it bears some marks of Morgan's mind and experience. Here for the first time in the history of American pharmacy the duties of the apothecary are officially stated and restricted exclusively to professional pharmaceutical tasks. The paragraphs concerning pharmacy read:

> That there be one apothecary general for each district, whose duty it shall be to receive, prepare, and deliver medicines and other articles of his department to the hospitals and army, as shall be ordered by the director general, or deputy director general respectively.
>
> That the apothecaries (general) be allowed as many mates as the director general, or respective deputy director general, shall think necessary.[22]

The country was divided into four districts. The Southern department, however, had an administration of its own and did not adopt the title "apothecary general." Thus there were three bearers of this title at the same time in the army, while the Southern department had an "apothecary" on its medical staff. In addition there were allowed and appointed second apothecaries. It is of interest that according to payment the apothecaries general ranked between the senior surgeons and the second surgeons.

A further reorganization of the military medical department, as revealed in a resolution dated October 6, 1780, abolished the different departments and concentrated all authority in one medical staff. The title "apothecary general," borne by several persons of the same rank disappeared. There was now one "apothecary," to be appointed like the other principal officers directly by Congress, with five assistants. Andrew Craigie became this "apothecary" and kept this position until the end of the war.[23]

In the "list of medical men who took a part in the American revolution,"[24] which its author considers incomplete despite the fact that it contains about 1400 names, the following are of pharmaceutical interest:

1. Apothecaries general: Andrew Craigie, Massachusetts; C. Henry

Flagg, South Carolina (served first as a surgeon); Giles; Israel Root, Connecticut; Josiah Root, Connecticut.

2. Assistant apothecary general: William Johonnot, France.

3. Apothecaries: John Crane, South Carolina; B. John Cutting, New York; Joseph Prescott, Massachusetts (served first as a surgeon's mate).

4. Deputy apothecaries: Evan Lewis, South Carolina; Patrick Carnes, South Carolina.

5. Druggist: William Smith, Pennsylvania ("Continental druggist").

6. Persons "furnishing medicine"; Aubury; Robert Bass; Benjamin Dyar; Lothrop; Isaac Thom; Samuel Treatre; George Wood.

7. People concerned with saltpetre: Christian Vaught ("made saltpetre"), Robert Harris ("made powder"), Josiah Gilman ("inspector of saltpetre")!

The "continental druggist" owed his appointment to a resolution of Congress, "that a druggist be appointed at Philadelphia whose business it shall be to receive and deliver all medicines, instruments, and shop furniture for the benefit of the United States."[25]

Of the persons encountered under the sixth classification it cannot be said whether they were mates assisting the apothecaries or people assisting the appointed "continental druggist" in his wholesale business.

As "assistant apothecary general" Duncan's list of medical men mentions one apothecary, coming from France. There were, however, French auxiliaries under the command of General Rochambeau in North America with their own medical staff, consisting of physicians, surgeons, and apothecaries. The "pharmacien en chef," C. H. Ferraud, after his return to France was given the honorary title "apothecary major of the battlefields and the armies of the King" in acknowledgement of his services.[26]

The usual title for the French military chief pharmacist was at that time "apothicaire-major general" (see p. 68). In all probability the American title of apothecary general has its origin in this French usage since the English army did not have such a title.

Bouvet makes the following statement about the participation of French apothecaries in the American Revolutionary War:

> There were French *apothicaires* among the civil personnel, the military service, the surgeons of the navy and even among the soldiers. Ten French *apothicaires*—Augé, Chefdieu, La Chesnaye, La Crampe, Métayer, Rollandeau, Rosancelin, Souchet, Tarrault, Tual—died for the noble cause which they defended.[27]

There is some mystery surrounding Andrew Craigie, the apothecary general. Nothing is known of his professional training and what his proper profession was. On May 14, 1775 "Mr. Andrew Craigie, who had

been made commissary of medical stores, was directed to impress beds, bedding, and other necessities for the sick."[28] The appointment was in accordance with a resolution by the committee of safety of the Province of Massachusetts April 30, 1775. A few months later, July 4, 1775, the Massachusetts Provincial Congress appointed Craigie "being informed of his skill in medicine . . . to be medical commissary *and apothecary* to the army raised by this Congress."[29] Although restricted to the Massachusetts troops, this was the first official appointment of an army apothecary in America. There is no evidence whether this appointment was confirmed or renewed by the first Director General of the entire army, Dr. Church, in order to make it valid. It is certain that Craigie held his position at the continental hospitals at Cambridge and Roxbury with John Brown Cutting as assistant apothecary when Dr. Morgan succeeded Dr. Church on October 17, 1775. According to Kebler, Morgan forced Craigie "out of office" about the middle of January, 1776, using the fact "that Congress knew not his appointment" as reason (letter of Cutting addressed to Morgan) and reinstated him January 1, 1777.[30]

However, the letter of Morgan quoted proves that on July 28, 1776 Craigie must still have been in his old office and was ordered "to join" Dr. Potts in about eleven days. It is the more likely that he did, since later on he was on good terms with Dr. Potts. Thus it seems very probable that Morgan did not force Craigie "out of office" but merely transferred him for a limited period.

It was Dr. Potts with whom Craigie later on discussed the idea of general department laboratories and storehouses for the medicinal needs of the army. In a letter, dated May 1, 1778, Craigie wrote to Dr. Potts that "the department is at present in chaos," and added the following statement:

> I beg leave to query whether this will not be the plan. To have the principle store at Carlisle, where all the medicines shall be prepared and the chests completed. Under the supposition that the general hospitals will be more collected and the number lessened, I would propose that an apothecary attend each with a complete chest of medicines; that the surgeon and physician general of the army be attended by an apothecary with a good chest . . . I would have an issuing store at a convenient distance from the army, from which the hospital and regimental chests might occasionally be replenished.[31]

That Craigie's proposal found acceptance and support is confirmed by a later report "that hospital drugs were prepared and compounded mostly in apothecary general Craigie's shop at Carlisle, Pennsylvania."[32]

It is significant that after the war, Craigie entered the wholesale drug business. "During his service in the revolutionary army Craigie acquired a large fortune, buying up government promises and other speculations . . . He was the modern wholesale druggist, a century ahead of his time."[33] The commercial abilities of this first and most prominent apothecary were at least as great as his pharmaceutical skill.

It is naturally of interest to learn what drugs and medicines were at the disposal of the revolutionary armies. Doubtless at different times and places, a very obvious scarcity of the most necessary drugs was suffered. At first the principal support came from the stores of the "continental druggists."[34] Furthermore there was the opportunity to seize British stocks, e.g., in Boston in 1776,[35] and in all probability some were imported in spite of the attempted blockade by the British. As time went on, the military medical organization improved and a more regular and satisfactory supply was secured.

One of the most evident fruits of this improvement and, at the same time, a firm basis for its continuance was the publication of a small booklet, modest in its appearance as well as in its intentions. Nevertheless it proved a landmark in the history of American pharmacy: the so-called "Lititz Pharmacopoeia," published first in 1778.

An inventory of the "medicines in the store of the general hospital," made at the request of Dr. Morgan and "signed by Andrew Craigie, apothecary, December 1775"[36] gives an idea of the drugs more or less incidentally in stock at that time in the general hospital. With the following exceptions, the quantities were very small: e.g., snakeroot (162 pounds), ginger (64 pounds), juniper berries (20 pounds), camomile flowers (24 pounds), rhubarb, and cinchona. More typical and definite is the list of medicaments contained in the "standardized field boxes" which every regiment of the brigades under the command of the generals Patterson, Leonard, Poor, Glover, Scott, and Woodward received from apothecary Cutting at Yellow Springs between April 19 and May 3, 1778.[37] The best and most complete insight, however, is given by the "Lititz Pharmacopoeia" just mentioned. This booklet illustrates in the most perfect way the choice of items suggested by the general, particularly English medical knowledge, the American experience, and the difficulties arising from the actual situation of a nation at war and restricted in its imports.

The designation "Lititz Pharmacopoeia" originated in the fact that the booklet was written, at least partially, in the Moravian village of Lititz, the preface being dated Lititz, March 12, 1778, and was first used in the military hospitals of Lititz and Bethlehem. The real title reads: *Pharmacopoeia Simpliciorum et Efficaciorum, in usum nosocomii militaris, ad exercitum foederatarum Americae civitatum pertinentis;*

hodiernae nostrae inopiae rerumque angustiis, feroci hostium saevitiae, belloque crudeli ex inopinato patriae nostrae illato debitis, maxime accommodata. (Pharmacopoeia of simple but nevertheless efficacious remedies for the use of the military hospital, belonging to the army of the United States of America. Especially adapted to our present poverty and straitened circumstances, due to the ferocious inhumanity of the enemy, and cruel war unexpectedly brought upon our fatherland). The author of this "pharmacopoeia" or more truly emergency military hospital formulary, was in all probability Dr. William Brown, an American graduate of the University of Edinburgh.[38]

Since 1938 a publication has been available, containing a reprint of the original Latin text, an English translation, and a comprehensive comment.[39] According to the comment the formulary is based on the London and Edinburgh pharmacopoeias. Of greatest interest is the following statement of the comment: "It was not only the matter of expense, but a question of whether certain drugs and medicaments, no matter how desirable, could be had at all; also, whether others, obtainable in limited amounts, could be had in sufficient quantities to satisfy the demands of all the hospitals. Hence, provision was made in a number of instances of official substitution of therapeutically equivalent substances."

These official substitutes are not without historic precedents. The official books of the 16th and 17th centuries in Europe very often named substitutes in case the drug in question were not in stock. Sometimes complete lists of such substitutes were annexed under the headline *Quid pro quo* or *De succedaniis.*[40] The first known list of this kind is 1800 years old. Its author was Galen.[41]

The comments on the "Lititz Pharmacopoeia" give a table of the recommended substitutes and a "list of simples," compiled from the preparations contained in the book. From this it can be learned which American drugs were being utilized, which chemicals probably were being manufactured in the thirteen colonies which at that time constituted the original United States, and which drugs and chemicals can be assumed to have been imported in spite of the blockade.

> There are distinguished by an asterisk the formulas of medicaments which must be prepared and compounded in a general laboratory; the others are to be mixed, as needed, in our hospital dispensaries (Introductory remark in the "Lititz Pharmacopoeia" in the translation by Sister Mary Francis Xavier in the mentioned reprint).

This remark is the first official mention of a large scale manufacture of pharmaceutical products in America. The plan was not to burden the apothecary in the hospital with the preparation of compounded medicines

which could not be made *ex tempore*, i.e., not only "as needed," but also quickly and without special effort as to time and means. A comparison of the preparations with and without asterisks makes it evident that there was no differentiation as to the professional skill required.

The "Lititz Pharmacopoeia" was published at about the same time as the proposal of the apothecary general Craigie concerning the establishment of a "principle store at Carlisle" was realized (see p. 154). This "principle store" was in all probability the "general laboratory," mentioned in the "Lititz Pharmacopoeia." Thus the first known and officially recognized American manufacture of pharmaceutical products on a large scale was established according to the proposal of an apothecary, under his direction, and for the public welfare.

The fact that a second edition of the "Lititz Pharmacopoeia" was published in 1781 is evidence that it had proved its practical usefulness.

Still another pharmaceutical event of general interest owes its initiation to the revolutionary war. According to Wilbert, a considerable amount of opium was produced in this country during the revolutionary war.[42]

In a summary of the importance of the Revolutionary War for pharmacy as a profession, three events are especially prominent: (1) Eight years of successful pharmaceutical activity, separated from medicine but equally recognized and treated with the same official appreciation; (2) the first known American manufacture of pharmaceutical products on a large scale, initiated by an apothecary to meet national needs; and (3) the first practical attempt at a uniform and obligatory formulary as basis for satisfactory and reliable pharmaceutical work.

The importance, and indeed the necessity of professional pharmacy for public welfare had been proved by the tests to which it had been put by the Revolutionary War.

II

THE YOUNG REPUBLIC AND PIONEER EXPANSION

THE Revolutionary War was over. The American people were free. The question then was, free from what and for what? The first part of this question may easily be answered. The American people had severed their connection with Great Britain, hence with Europe and had gained the liberty to work out their own destiny. This destiny, however, was not apparent at the time, although it had found its basic and perhaps prophetic expression in the declaration of the inborn and eternal rights of men, the essence of the Constitution of the United States.

The United States was the first nation of the world to evolve not out of the organization of kindred tribes nor out of dynastic imperialism but as a result of the free decision of peoples of varying descent. It had not only won a victory but a task had been assigned simultaneously to it. This task was to prove that liberty of the individual was within and not beyond the limits of human nature and of political wisdom.

After the war the first and immediate necessity for the new nation was to find a firm basis for the existence of professions and trades and for the individual and to derive the greatest possible advantage from the natural resources of the country.

The fact that this "war of independence" and the new nation emerging from it had not only a special and alluring ideology but seemed to open a limitless country to all peoples, awakened the interest of the whole civilized world, overcoming in large part the destructive consequences which every war involves. Thousands of former enemies, especially the German soldiers in English service, remained in America. Others stayed for a while to explore the country and to study its resources and possibilities. One of the latter, Dr. Schoepf, travelled through the country for more than a year and published, in 1787, a book about the indigenous American materia medica under the title "Materia Medica Americana Potissimum Regni Vegetabilis" (American materia medica primarily of the vegetable kingdom).

Schoepf's journey was only one of the successful botanical and medico-botanical exploring expeditions through North America which were undertaken by foreigners in the years following the Revolutionary War (see p. 128). They were supported and supplemented by intensive research on the part of American botanists.

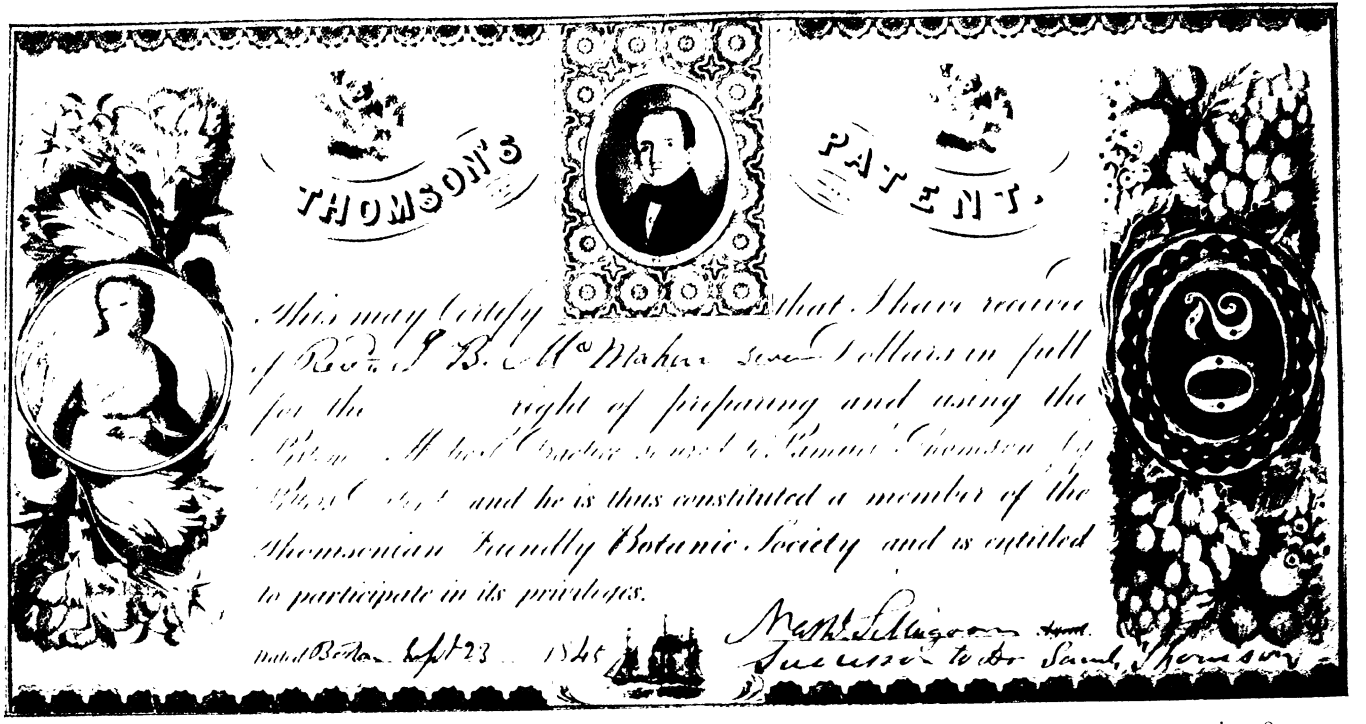

FIGURE 13. Facsimile of Thomson's Patent. From the Original in the Lloyd Library. Thomson took his first patent in 1813.

Botany and especially medicinal botany had been cultivated in North America during early colonial times. Thus there was a fund of experience upon which to build.[1] Schoepf's "Materia Medica Americana" is based largely on the observations of the excellent American botanist G. H. E. Muehlenberg and the work of Bartram, Clayton, Colden, Kalm, Catesby, and others.[2] In a letter written to Muehlenberg from Baireuth (Germany) April 3, 1786, Schoepf states that he has prepared a "Materia Medica Americana" containing the descriptions of about 400 North American plants and continues as follows: "My lists make it certain that North America owns a rich indigenous materia medica in her plants and can find all she needs, apart from a few East Indian spices and plants, on her own soil . . . I almost may flatter myself in writing this little book to have rendered sufficient services to America to be pardoned for my assistance in combatting her."[3]

Schoepf was not the only one who took advantage of the diligent, comprehensive and unselfish work of Muehlenberg. Numerous European and American botanists, among them Benjamin Smith Barton, author of the "Collections for an Essay Towards a Materia Medica of the United States"[4] and Manasseh Cutler,[5] author of the first scientific treatise on New England botany, were in close scientific contact with Muehlenberg.

The treatise of Barton on American materia medica was not only the first of its kind written in English but simultaneously a criticism on the work of Schoepf. Evidence of the inspiration which Barton imparted to research on the medicinal value of American plants is to be found in numerous theses of medical graduates of the University of Pennsylvania where he taught natural history and botany.

It is of interest that Muehlenberg considered the apothecary the authority to be consulted for information about "indigenous officinalia" as to their strength as well as their common names. Twice in his notebook he mentions the necessity of consulting an apothecary for this purpose.[6]

All this valuable scientific work enriched not only American medical and pharmaceutical science and practice but the international materia medica. It was supplemented by the observations of unscientific empirics. These observations of laymen formed the basis of sectarian movements which later on were subjected to scientific verification. Supplemented by the results of the early research work previously mentioned, they played an influential and important part in American medicine and pharmacy.

In his essay "Some Early Botanical and Herb Gardens," Wilbert states that the first gardens in North America devoted largely, if not entirely, to the cultivation and study of medicinal herbs were established and used by members of religious sects.[7] It was the fate of the medicinal

employment of plants in America to be associated again and again with some sectarian movement.

About 1800 Samuel Thomson entered the scene. Thomson was a man whose personality and work gained nation-wide recognition in spite, or perhaps, because of the simplicity and the lack of originality of what he thought and called his system. This uneducated man, son of a farmer and originally a farmer himself, whose early desire to become an apprentice to a doctor could not be realized on account of his dire lack of education, revived the fundamentals of the theory of Galen (see p. 14) and used them for his own, the "Thomsonian system." His doctrine reads like a slightly modified abstract from Galen's writings when he states: "I found, after maturely considering the subject, that all animal bodies are formed of the four elements, earth, air, fire and water . . . that a state of perfect health arises from a due balance or temperature of the four elements."[8]

Thomson's common procedure consisted in emesis produced by the administration of Lobelia inflata, in the abundant use of the vapor bath and of such vegetable remedies as the case might seem to require.[9]

In 1813 Thomson took his first patent on six of his remedies which were sold as "patent-medicines," numbering them with the numbers 1 to 6 as follows: "No. 1, Emetics (Lobelia, typical); No. 2, Stimulants (Capsicum, typical); No. 3, Astringents (Bayberry, typical); No. 4, Bitters (Balmony, typical); No. 5, Restorative Tonics (Peach, typical); No. 6, Antiseptics (Myrrh, typical). The sixth was Thomson's compound tincture of myrrh and capsicum which became famous and generally known as 'Number 6.' "[8]

Even before Thomson practiced there were so-called "botanic physicians" or "root doctors," e.g., the "Indian doctor" Peter Smith (see p. 128), others quoted by Thomson,[10] and a German physician, Dr. Jacob Tidd, of Amwell, in New York.[11] However, none of them made propaganda for their special kind of practice.

It was the French-born botanist Constantine Smaltz Rafinesque who laid the theoretical foundation for a new and more scientific botanico-medical movement which was established by Dr. Wooster Beach and which was destined to amalgamate the Thomsonian system and school: the so-called "reformed system of medicine" which later on was designated the "eclectic system of medicine."

C. S. Rafinesque, who in 1817 was appointed to the chair of botany in Transylvania University and who several years later made Philadelphia his final residence, published between 1828 and 1830 a "Medical flora; or Manual of Medical Botany of the United States of North America," which Wilder considers "the first hand-book in this country that could, to any considerable extent, meet the wants of the intelligent

botanist and physician."[12] As the objective of his work Rafinesque announced his desire to serve the "daily use of medical students, physicians, druggists, pharmacians (here the French origin of the author becomes obvious!), chemists, botanists." He stated that "pharmacy, by the aid of botany and chemistry, has become a science" and that "druggists and chemists" must be able "to distinguish the genuine kinds and detect the frauds of the collectors and herbalists."[13] Rafinesque also laid down rules for the pharmaceutical treatment of plants in order to get efficient medicaments.[14]

The scientist Rafinesque naturally welcomed the scientific turn which the botanico-medical movement was given by Dr. Beach. "I belong, like yourself," he wrote to Dr. Beach, "to the Reformed Practice of Medicine, and agree with you much better than with the Thomsonian, Homoeopathic, and Botanical Empirics."[15]

The name "eclectics" was taken by the followers of Beach from Rafinesque's classification of medical practitioners, in which the "eclectics" are defined as "those who subject and adopt in practice whatever is found beneficial, and who change their prescriptions according to emergencies, circumstances, and acquired knowledge."

This definition holds true for the old eclectics who did not recognize any dogma. However, the American eclectic medical practitioners clung to one dogma, namely the rejection of a large number of remedies of mineral origin, particularly all mercury compounds. Nevertheless, compared with the Thomsonians they were liberal.

> The materia medica of the early followers of Samuel Thomson consisted of botanical products and combinations thereof. The aim was to exclude all poisons, in which list lobelia was not by them included. Their remedies, therefore, excluded such energetics as podophyllum, sanguinaria, rhus, etc., which became important agents with Beach and his followers, the Eclectics. Whilst the Thomsonians rejected mineral salts and the inorganics, these substances were conservatively employed in Eclecticism.[16]

The development of the Thomsonian as well as of the modern eclectic school of medicine is of greatest general interest.[17] This typically American movement, originating in the period of reconstruction after the Revolutionary War and an offspring of its atmosphere, has had a greater influence on pharmacy, its science and its practice than is generally realized.

The influence on the science of pharmacy is evident. Many plants and plant preparations listed in the "United States Pharmacopoeia," the "National Formulary," or other books of reference, owe their introduction into medical practice to the eclectic school of medicine.

> It is certain that the persevering and careful study that the adherents of this school have made of the action of several American plants has been very profitable to medicine in general. Many plants of which the eclectics alone first availed themselves have ended by becoming the common property of the entire medical profession.[18]

One of the outstanding figures in American pharmacy, the late John Uri Lloyd, devoted the greater part of his life and effort to scientific pharmaceutical work in the service of eclectic medicine.[19]

The influence of the botanico-medical movement on the practice of pharmacy goes back to Samuel Thomson, the founder of the new school or sect. He and his cause became a touchstone for the meaning of constitutional "liberty." This question had to be answered: which was of greater importance and broader general consequence, the recently acquired and legally guaranteed "liberty" of the individual to take up any profession, or the protection of the people from the dangers arising, particularly in the field of medicine, from the unchecked activity of individuals practicing their profession by no other standard than their own belief in their ability and a modicum of empiric practice?

This question always becomes acute and must be decided whenever and wherever "liberty" is introduced as the inborn right of the individual. This happened in France after the great revolution and in Germany (Prussia) with the introduction of the so-called Gewerbefreiheit (liberty of trades). In both countries the idea of protection of the people proved to be stronger than the dogma of liberty. So far as pharmacy is concerned, the attempts made in France in 1791 (see p. 62) to introduce the unrestricted liberty of practicing pharmacy without educational requirements were short lived. This was true also in Germany in 1810 and 1811 (see p. 72). Even the customary English "laisser faire" attitude, although confirming the right of practicing medicine and pharmacy to persons who had previously practiced these callings (see p. 93), did not recognize the liberty of everyone to do so. The American people, their legislators and their courts decided otherwise. The meaning of American constitutional liberty proved to be and probably at this time had to be dogmatic.

What this meant to the formation and cultivation of the professions definitely concerned with healing becomes evident from the fact that for decades the attempts by physicians to regulate the practice of medicine through educational requirements, examinations, and licenses, and to control the professional conduct of the practitioners proved futile. True, regulations requiring the licensing of medical practitioners had been issued before the Revolutionary War in New York (1760) and New Jersey (1772). In 1781 such a law was promulgated in Massa-

chusetts. In 1791 the Medical Society of New Hampshire was granted not only the right to license physicians but also the right to regulate the practice of medicine. Other states followed with similar laws.[20]

> The passage of laws restricting medical practice reached its highest point in 1825; and thereafter, due to the attacks of the empirics and the realization by the profession of the futility of regulation, practically all laws were repealed.[21]

If such was the situation for medicine, what had pharmacy to hope for in the matter of recognition and protection of its professional aims?

Here we find one of the many paradoxes of history. The same circumstances which for a long time made impossible an homogeneous pharmaceutical profession in America, on the other hand intensively promoted the development of pharmacy as a calling, independent of medicine.

As previously stated, many English patent medicines had been imported into America. They were not only very much used without medical advice but also liberally employed in regular medical practice and sold in the shops of the physician-apothecaries. Then on April 10, 1790, Congress enacted an American patent law. When in 1796 the first United States patent to deal with therapeutic matters was granted to the physician, Elisha Perkins, for his so-called metallic tractor, an electro-galvanic device,[22] the unceasing fight between the American medical profession and patent medicines was begun. Commercially, the invention was a success. Its repercussions in medical circles, however, were enough to effect Perkins' expulsion from the Medical Society of Connecticut, and to set down a rule that physicians were neither to invent nor sell secret remedies. Some physicians, however, like Perkins, continued in spite of their professional proscription. Unprofessional practitioners, like Thomson, immediately availed themselves of the possibility (given to them by the new patent law) of monopolizing their specialties. Having secured a patent there was no reason for the inventors to restrict their remedies to their own medical practice. Now the whole country was within reach if they could appeal to the people and make their remedies available to all. The first purpose was served by the newspapers which at this time reached a sufficient number of readers. The second end could be attained through the many stores, well distributed all over the country, which were or could be considered the representatives of the trade in drugs and remedies. Thus the trade in English and American patent medicines became the backbone of the American retail drugstores. Imitations of English patent medicines were prepared on a large scale by American wholesale druggists,[23] and labeled with deceitful likeness to the originals. The development of patent medicines and

the American drugstore went hand in hand and together their influence gradually did away with the open shops of the medical practitioners.

European pharmacy originated and developed in general as the trustee of professional medicine, the unprofessional aspects being a sideline. The development of American pharmacy as an independent trade was effected to a very great extent by unprofessional medicine, the professional aspects being a sideline of this trade. Much of the peculiarity in the evolution of American pharmacy finds its explanation in this fact.

However, a group of individuals fighting for higher aims, finally created a professional American pharmacy. These people came mostly from the wholesale business.

As long as the retail business in medicines was primarily in the hands of the physician-apothecary, the wholesale business in drugs was the only domain of the chemists and druggists proper. They provided the country physicians with the imported or indigenous drugs and chemicals, needed by these men in their practice, and they were naturally held responsible by their clients if the expected effect of the drugs was not realized. Furthermore, the Revolutionary War had taught the wholesale druggists the advantage of domestic manufacture of products previously imported. Thus in order to be able to discriminate the pure from the adulterated, they became highly interested in a better knowledge of drugs and chemicals and in the manufacture of galenical and chemical preparations. The interest in real pharmaceutical activity had begun.

Advertisements of the period immediately after the Revolutionary War reveal this active interest in professional pharmaceutical knowledge. Thus Th. Br. Atwood, owner of "Atwood's medicinal store" in New York announced in 1784 "the latest arrivals from Europe" in the New York Packet and simultaneously made known that he would like to engage a partner. "The want of capital, with good security, will be no objection to a man of abilities. He must understand pharmacy thoroughly, and he should be grounded in chemistry."[24]

Effingham Lawrence in New York, advertising in the Daily Advertiser the receipt of "a large and general assortment of genuine drugs and medicines from London and Amsterdam" asked for "a person well acquainted with practical chemistry."[25]

The advertisements quoted above refer to imports of drugs. These imports were very comprehensive and sometimes details were given in prose and rhyme.[26] A good insight into the kind and the amount of drugs usually imported by the American druggists may be found in two invoices of 1785 concerning shipments of drugs from London to the Marshall brothers, and to M. Bartram respectively, both of them druggists in Philadelphia. Reproductions of these invoices with comments are available.[27] They supplement the authentic colonial lists of drugs

previously mentioned—the "receipts" used by John Winthrop senior (see p. 136), Locke's drug list (see p. 137), the "Lititz Pharmacopoeia" (see p. 155) and Le Coste's "Compendium." Together they make possible a comparative study of the drugs used in the North American settlements until the close of the 18th century.

It was during the period of reconstruction that the wholesale druggists began to issue printed lists enumerating the goods they had in stock. The title of one of these lists, issued in Boston in 1795, reads: "Catalogue of drugs and medicines, instruments and utensils, dyestuffs, groceries, and painters' colours, imported, prepared, and sold by Smith and Bartlett at their druggists store and apothecaries shop." This title is the best possible illustration of the combination of import and manufacture, of wholesale (druggist's store) and retail business (apothecary's shop), operated at this period by the prominent American druggists. A remark at the end of the catalogue states that "physicians' prescriptions will always meet an exact and particular attention."

The list, consisting of 22 small octavo (pocket size) pages is comparable to a very modest extract of the *prix courants* of the famous French pharmacist and manufacturer, Baumé (see p. 68). The *prix courants* of Baumé, however, gives, in accordance with its title, the articles with their prices, whereas the American catalogue merely enumerates the articles. The American economic and trade situation at this time was not sufficiently stabilized to make fixed prices workable.

Some of the wholesale druggists very early started the manufacture of chemicals, thus establishing a basis for large American chemical and pharmaceutical industries.[28] Again the name of Marshall of Philadelphia appears. The firm of Christopher, Jr. and Charles Marshall, sons of and successors to the founder of the store, the druggist Christopher Marshall, Sr., "had, as early as 1786, entered quite extensively into the business of making muriate of ammonia and Glauber's salt." The Philadelphia druggist John Harrison began in 1793 the manufacture of various chemicals, notably of sulfuric acid. Other druggists took up similar lines of manufacture.

People working as apprentices or clerks in such establishments of necessity acquired pharmaceutical knowledge and skill and finally professional pride and aims.[29] The number of apprentices was large. In the store of Marshall it ranged from six to twelve. Accustomed to real pharmaceutical work these men later on became the pioneers of professional retail pharmacy and to some extent the first pharmaceutical teachers of pharmacy for pharmacists.[30]

The parallel to the development in England is evident. Here too wholesale druggists were the initiators of professional pharmacy during the first half of the 19th century, filling in this way the niche left

vacant by the definite transformation of the apothecaries into medical practitioners (see p. 93). The main difference was that the establishment of the Philadelphia College of Apothecaries in 1821 represented the first obvious manifestation of a pharmaceutical profession in America whereas the organization of the Pharmaceutical Society of Great Britain in 1841 implied a revival.

Furthermore American pharmacy owes to a wholesale druggist, Joseph Johnson, M.D., of the University of Pennsylvania, the only known case previous to the foundation of the Philadelphia College of Apothecaries, of a pharmaceutical examination as a prerequisite for a pharmaceutical license. Johnson's interests were doubtless devoted more to chemistry than to medicine, his doctor's thesis being "An experimental inquiry into the properties of carbonic acid gas or fixed air." In 1797 he bought, in partnership with Dunlop, the "drug and apothecary business" of Dr. Elisha Poinsett in South Carolina. The business must have been very extensive because in August, 1797 the two partners advertised for sale enormous quantities of drugs. Johnson's medical degree made it possible for him to become a member of the Medical Society of South Carolina, of which he was, for a time, president. In 1817 the legislature of South Carolina passed an act obliging each apothecary to obtain a license from "the medical society of South Carolina or board of physicians" thus endowing these bodies with "the power to examine any apothecary, who may apply to them for a license." In 1818 a Mr. Richard Johnson was granted the license "to pursue the business of druggist." He was examined "1. on the definition of chemistry and pharmacy, 2. on the preparation of mercury and phosphorus, 3. on the preparation of phosphate of antimony and tartar emetic, 4. on the doses of Laudanum, tartar emetic, ipecac, and Fowler's mineral solution of arsenic, 5. on the mode of making the common plaster and on mixing the ol. ricini with water." One of the examiners was the medical wholesale druggist Dr. Johnson.[31]

Thus during the period of reconstruction after the Revolutionary War the groundwork was laid for a large number of commercial drugstores, also for a few stores with professional aims. In place of the six drugstores not owned by physicians which existed in Philadelphia about 1750, there were twenty in 1785[32] at which time the population numbered 40,000. Kellocks' New York directory of 1786 when the city had a population of 23,600 mentions six "druggists and apothecaries" besides one "physician and apothecary" and one "surgeon and apothecary."[33] Of special interest is the separation of the medical men with open shops from the "druggists and apothecaries" proper. In 1821 in Philadelphia and its outlying districts with a population of 137,000 there were about 130 stores "identified with the trade in drugs."[34] In Boston

with a population of 43,000 there were at the same time 7 wholesale and 23 retail stores,[35] the wholesale establishments also selling at retail.

The gradual separation of pharmacy from medicine was almost complete so far as the drugstores were concerned. The open shops of the physicians had disappeared, but only a very few of the medical practitioners surrendered the dispensing of medicines within their practice. As late as 1819 this custom was so self-evident to the physicians that the president of the New York College of Physicians and Surgeons, Dr. Samuel Bard, in his "remarks" submitted to the regents of the University of New York, thought it unnecessary for the students of medicine at the New York medical school to attend a course in materia medica because, according to the rules of admission, the candidate before entering the school must "have studied three years with some regular practitioner." In this time and in that way the candidate would learn, says Dr. Bard, "better than in any other school, the nature, powers, and doses, of all the remedies in common use, by daily handling and preparing them in putting up the prescriptions of his teacher."[36]

It is of interest to note that in 1819 it required "but one course and only one session" of study at the medical school of New York to make a person having "studied three years under some regular practitioner" a medical graduate with the degree of a doctor of medicine.

> Partnerships were often formed between the physician and the apothecary with resultant division of labor, but without sacrifice of drug profits on the physician's part.[37]

The importance of pharmacy in times of emergency, which had been indicated during the Revolutionary War, was re-emphasized during this constructive era. In 1793 the first plague, believed to have come to the city with the refugees from Haiti, broke out in Philadelphia, which at that time and until 1800, was the seat of the national government. It is said that 5,000 died and 17,000 left Philadelphia. "The national government removed its offices; papers stopped publication; business, *except dealing in drugs,* almost ceased to exist."[38]

Among the remedies used by the people against the plague the mysterious "vinegar of the four thieves" was one of the most advertised and employed. "It was reported that at Marseilles, during the prevalence of the fever there four men had found a drug which made them immune, and they plundered the sick as they pleased. Their recipe was said to have been sent to Philadelphia, and every druggist had his own idea about it."[38]

It may be assumed that the active part taken by the Philadelphia apothecaries in fighting the plague increased the general respect in which they were held, also their own professional self-esteem; in other words

the two bases upon which later the first American professional association was founded. It may here be recalled that a similar event occurred in the history of English pharmacy (see p. 92).

The period of reconstruction after the Revolutionary War was a time of fermentation. Some problems were touched upon, ways of clarification were attempted, many a beginning was made. All of this was necessary and not in vain, although nothing assumed definite shape. The first attempts at regulation of medical and pharmaceutical practice failed. America was not yet ripe for rigid regulation and limitation of professional activity, so necessary in more densely populated countries but impracticable in a continent with vast undeveloped areas.

The rapid conquest of these areas for civilization and their adaptation to the progress which had been made in the older parts of the United States would not have been possible without releasing and utilizing all activities of the pioneers, i.e., without giving them all possible "liberty" to do what the actual circumstances and their personal incentives demanded of them. Thus the necessary restrictions and regulations were left for a long time to the initiative of the professional groups.

The Westward Movement of the Frontier

The so-called westward movement before the Revolutionary War had been, in large part at least, a movement to the South down the fertile valley of the Shenandoah, etc. After the Revolution the mountain barriers were overcome and the movement west of the Alleghenies became one of the dominant factors of American national life.

As a result of the Revolutionary War all the western areas, which had been partly ceded by England shortly before the war to the province of Quebec, were transferred to the United States. Furthermore the war necessitated a rapid westward development for both political and financial reasons.

If the soldiers who had fought for American independence could not be paid in full during the time of their service, after the war the government was even less financially able to give them back pay. For this reason Congress very early sought a way out of the difficulty. "As early as September, 1776 Congress tried to encourage enlistments by offering bounties of land—five hundred acres to a colonel, 100 acres to a private, and other ranks in proportion."[39]

In the law of September 30, 1780 concerning reorganization of the medical department of the army (see p. 152) it is stated that the several officers of the medical staff also "shall at the end of the war be entitled to a certain provision of land, in the proportion following: the Apothecary the same as a Lieutenant-Colonel, assistant apothecary the same as Major."[40]

Saying farewell to his officers after the war, George Washington gave them this admonition: "The extensive and fertile regions of the West will yield a most happy asylum to those fond of domestic enjoyment, and seeking for personal independence."[41]

That many of the people pouring into the lands now given to them sought this personal independence mentioned by Washington, is an indication of how history repeats itself.

With every wave of this "westward ho!" movement to extend the boundaries of the United States, pioneer scenes of the Atlantic coast were reenacted.

"The original 13 states (New Hampshire, New York, New Jersey, Virginia, North Carolina, South Carolina, Georgia, Maryland, Pennsylvania, Delaware, Massachusetts, Rhode Island, Connecticut) and also Vermont, which joined the Union in 1791, had already a history, a tradition, and an active cultural life. But the West had to begin at the beginning all over again."[42] In 1800 it was estimated that there were a million inhabitants, west of the Alleghenies. Ten years later the number had risen to two and a half million; and in 1830 to three and a half million.[43] In 1937 in only five states of the old Northwest (Ohio, Indiana, Illinois, Michigan, and Wisconsin) dwelt 26 millions of people.

Territory was added after territory, state after state, in the order indicated:

1792	Kentucky	1858	Minnesota
1796	Tennessee	1859	Oregon
1802	Ohio	1861	Kansas
1812	Louisiana	1863	West Virginia
1816	Indiana	1864	Nevada
1817	Mississippi	1867	Nebraska
1818	Illinois	1876	Colorado
1819	Alabama	1889	North Dakota
1820	Maine	1889	South Dakota
1821	Missouri	1889	Washington
1826	Arkansas	1889	Montana
1837	Michigan	1890	Wyoming
1845	Texas	1890	Idaho
1845	Florida	1896	Oklahoma
1846	Iowa	1912	Arizona
1848	Wisconsin	1912	New Mexico
1850	California		

The medico-pharmaceutical scenes described by Cooper in "The Pioneers" are redescribed, though in modified form, in Gerstäcker's "Die Regulatoren von Arkansas."[44] A picturesque scene of a charlatan

among planters and frontiersmen on board a Mississippi and Red River steamer during the early decades of the nineteenth century is vividly pictured by George Sealsfield[45] or, rather, Karl Postl, the "poet of two continents." Further information along these lines is offered by Cumings in "A Tour to the West."[46]

In a Milwaukee journal when Wisconsin was still a territory, advertisements were published similar to those common toward the end of the 18th century in the old thirteen states. "Higby and Wardner, dealers in drugs, medicines, paints, oils, dye-woods & stuffs" recommend in 1841 an extensive assortment of the goods listed "just arrived" together with "brushes, perfumery, patent medicines and a general assortment of physician's and chemist's preparations, among them Corrosive Sub, Red Precip, Opium, etc." In another advertisement Fred Wardner announces a most varied line of goods (steel, stoves, glassware, etc.) as well as drugs and medicines.[47]

It would be a mistake to conclude from some turbulent scenes and periods of the early development of these new states, that the pioneers had only material and no cultural objectives and ideals. The Ordinance of 1787, the charter of the settlements in the old Northwest Territory, contains the statement that "religion, morality, and knowledge, being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged."[48] In the contract of the Ohio Company with Congress the Company provided, on its own not on Congress' initiative, two entire townships for a university. "Under this provision Ohio university was established at Athens in 1808 as the first state university in the world under democratic government."[49]

After the period of infancy, it was in these new states that the idea of state university departments of pharmacy and state organizations became important for pharmacy.

PART THREE

SECTION TWO

THE PERIOD OF ORGANIZED DEVELOPMENT

12

THE GROWTH OF ASSOCIATIONS

1. Local Organizations

IN THE preceding chapter it has been pointed out how the restrictions and regulations, necessary to raise American pharmacy to the status of a profession, were for a long time left to the initiative of individual druggists. This initiative, however, was by no means voluntary, for, on the one hand, the few people with professional pharmaceutical education, skill, and vision prospered and did not need regulations for the proper conduct of their business. On the other hand, the uneducated merchants, calling themselves druggists, did not want them. This latter class may be divided into two groups, viz., one which was anxious as to its ability to meet regulations requiring a modicum of knowledge, and another the unscrupulous business of which was possible only because there was no regulation and control.

It was pressure from outside which forced the druggists in the United States to form their first associations. This pressure came from the medical profession.

During the first half of the eighteenth century the situation within the medical profession was not much better than that within pharmacy (see p. 138). There was one city, however, at that time the American center of cultural and scientific life in general and of medicine in particular, which had the oldest American school of medicine and the greatest number of well-educated physicians. This city was Philadelphia which had seen the first attempt at a proper separation of pharmacy and medicine undertaken by the founder of its medical school (see p. 144). Hence, it is not surprising that the next step in the direction of professional pharmacy was again taken in Philadelphia. Taken in consequence of a plan proposed by a Philadelphia professor of medicine, this consisted in the organization of the first pharmaceutical association striving for the attainment of professional aims based on adequate education.

It was by no means the first attempt on the part of the physicians to secure a better regulation of the drug trade. Shortly after the Revolutionary War, November 8, 1786, the Massachusetts Medical Society petitioned the legislature to prohibit the sale of bad or adulterated drugs.[1] South Carolina issued an edict in 1817 establishing an examination and a license as prerequisites for the practice of pharmacy (see p. 166).

The difference between these movements and the Philadelphia action is noteworthy. In their earlier attempts the medical societies in Massachusetts and in South Carolina made legislation affecting future druggists. In the Philadelphia attempt Dr. Redman Coxe, with the consent and the support of the University of Pennsylvania acted directly and with immediate effect on all the storeowners in Philadelphia calling themselves apothecaries or chemists or druggists. His suggestion, made in March 1820 and undersigned by 16 prominent Philadelphia druggists, provided for an honorary degree to such apothecaries "as have taken every measure to become perfect masters of their profession . . ." and for the following regulation in the future:

> It is suggested that by a close attention for at least three years in an apothecary's shop to the practical part of their duties and after two courses of lectures on the subject of chemistry, materia medica, and pharmacy, such persons may be subjected to an examination by the professors of those branches in the University, and if found qualified, may receive a degree under some appropriate denomination which, being publicly known, may ensure them a greater chance of popular favor than will probably be granted to those who are neglectful or indifferent to the high responsibility they are invested with.[2]

This statement explains the indignation of those druggists not included in the group of sixteen, and their vehement opposition to the entire plan. All those not distinguished by the proffered degree of a "master of pharmacy" and not able or willing to obtain it by passing the examination required by the university were branded as being "neglectful or indifferent." The same statement, however, which caused the Philadelphia druggists to resent the action of the medical faculty, also suggested the proper way of counteraction. In his final sentence, having referred to the English Society of Apothecaries, Dr. Redman Coxe remarked that the progress which he had in mind could not be achieved in any "other way than by the measure proposed" because "such an incorporated association does not exist here."

On February 19, 1821 the board of trustees of the University of Pennsylvania published its resolution concerning the examination of druggists and 4 days later, on February 23, the Philadelphia apothecaries and druggists held their first meeting, this being the first united action of members of the calling known in the history of American pharmacy. A committee was appointed to determine whether it might not be "preferable to adopt a plan as a substitute, distinct from the one proposed."[3] This committee consisted of nine men among them being the most prominent Philadelphia wholesale druggists. One of them,

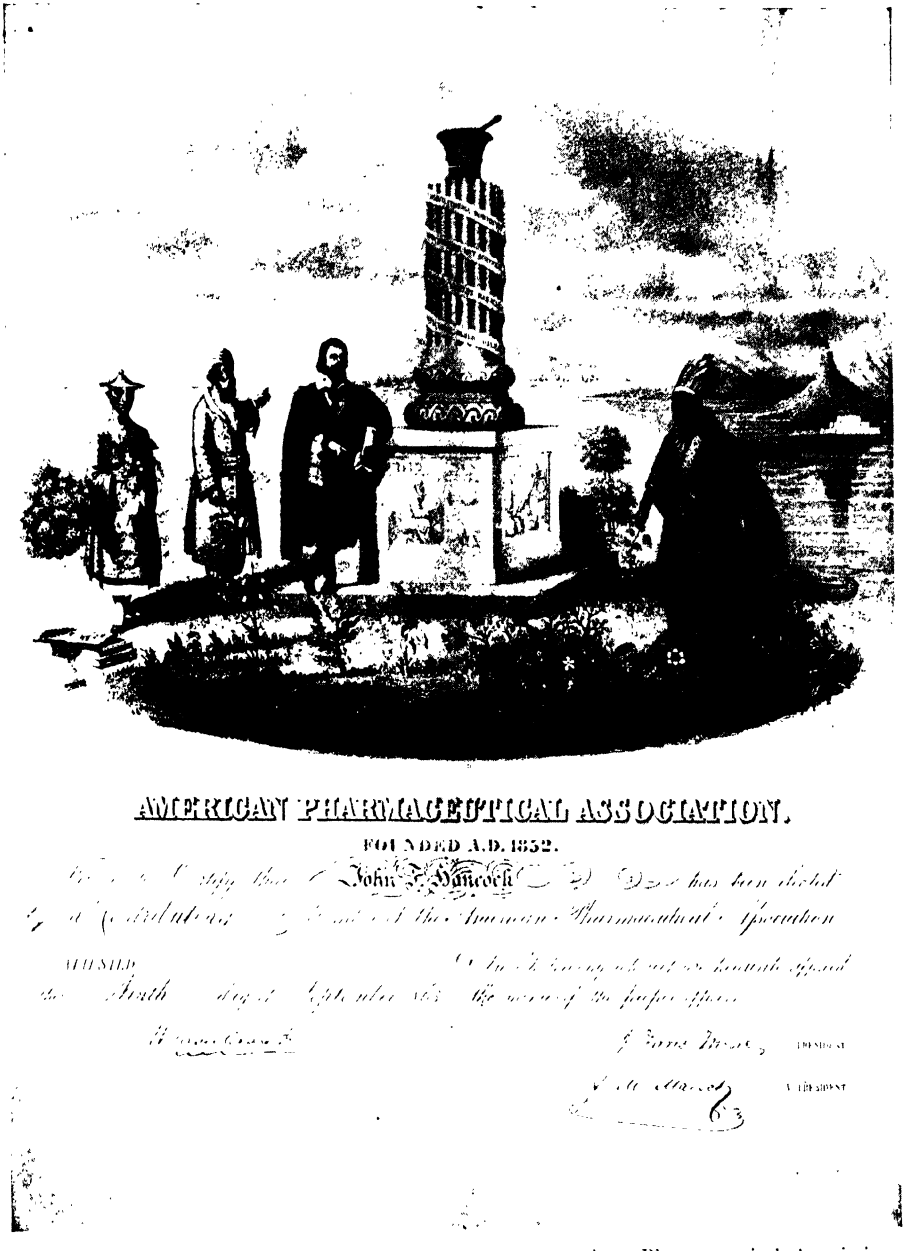

FIGURE 14. Original Membership Certificate of the American Pharmaceutical Association. In the picture the European represents all modern scientific pharmacy, the Arabian Mohammedan pharmacy; the Chinese represents the pharmacy of the Far East while the Indian refers to the indigenous drugs of the New World. (*By courtesy of the American Pharmaceutical Association.*)

Henry Troth,[4] was the leader of the movement. Another was Samuel Jackson, M.D., who for some years had been an active druggist and who now functioned "as a link between the professions of pharmacy and medicine."[5]

> "It was an enterprise of youth, for the average age of the five whose ages we know was but 28 years at the time of the founding, the oldest being Samuel Jackson, who was 34, and the youngest, Peter Williamson, who was but 24."[6] The report of the committee delivered at a second meeting is noteworthy. It admits that "medicines of inferior or sophisticated qualities 'were' too often introduced into the shops," due to "the want of proper pharmacological information on the part of some druggists and apothecaries who vend" and also "of physicians who buy." Finally there is a passage frankly stating that it was the "happy effect" of the action of the University to rouse the druggists "to a sense of the propriety of placing their business on the respectable footing it ought to possess as a branch of the science of medicine." As the best method "to effectuate the reformation generally desired in the business" the committee recommended "the establishment of a College of Apothecaries, the attention of which will be constantly directed to the qualities of articles brought into the drug market," and furthermore of "a school of pharmacy."

It may be mentioned that the University of Pennsylvania carried through its arrangements. It conferred the honorary degree of a Master of Pharmacy on 16 Philadelphia pharmacists and opened a course in pharmacy. However, "not a single student ever attended the lectures in the Medical Department with the view of securing the degree of Master of Pharmacy."[7]

This "College of Apothecaries,"[8] established after the hearing of the report by those present at the meeting of March 13, 1821, changed its name about one year later. In the charter which it received March 30, 1822 it is called by the name which was at first applied to the early American pharmaceutical associations and later on became restricted to pharmaceutical schools: College of Pharmacy.

The designation college was obviously chosen with the intent of placing the new corporation on the same footing with its well-known medical sister, the Philadelphia College of Physicians. This in turn had followed the old English custom, the English Royal College of Physicians, having been founded in 1518 (see p. 90). However, the change of the word apothecaries to pharmacy shows a deep understanding of the situation in the world of pharmacy at this time. It was due to William Lehman, who was one of the representatives of that intellectual

group of Philadelphians which had made the "city of brotherly love" the intellectual center of the United States. He was the first vice-president and executive of this first pharmaceutical association on American soil. William Lehman spoke French and German. He was known as a very diligent reader of foreign literature and he had visited Europe several times. Hence, he understood the European pharmaceutical situation.[9]

The English "apothecaries" had become more and more medical practitioners and could no longer be considered as typical representatives of the pharmaceutical profession. The designation apothecary was misleading. What designation should therefore be used which would characterize the calling and at the same time describe its professional aims? The English terms "chemist" and "druggist" did not solve the dilemma because neither the one nor the other had as yet achieved the recognition and the status of a profession (see p. 93). France and to a certain extent Germany offered the solution to this problem.

Almost half a century earlier the French *apoticaire* had been replaced by *pharmacien*, and from 1777 until 1796 a *Collège de Pharmacie*, an association of the Parisian pharmacists based not on private initiative but on law and including members of highest scientific attainment, had existed (see p. 63) and had made the word *Pharmacie* the recognized European designation for the entirety of professional pharmaceutical activity. Even in Germany where the pharmaceutical practitioners retained the old term *Apotheker*, the word *Pharmacie* had replaced the expression *Apothekerkunst* as the designation for the profession as a whole. The two pharmaceutical journals which at that time enjoyed international fame and which were well known to Lehman, were the French "Bulletin (later Journal) de Pharmacie" and the German Trommsdorff's "Journal der Pharmacie." Hence, "pharmacy" was the more than suitable designation since it implied professional aims at the same time. It was Lehman who, on his own initiative and without questioning the other members of the board of trustees, baptized this firstborn child of American pharmaceutical solidarity "Philadelphia College of Pharmacy."

There was still another action of the young college which revealed the broad spirit of its members: the appointment of honorary members shortly after the college had begun to function. With this adoption of a custom characteristic of and used exclusively by associations with scientific or professional backgrounds and standards, the Philadelphia College of Pharmacy from its very beginning put itself on a par with them. Moreover, the names of its honorary members justified this claim.

During this period of glorious rivalry between French and German scientific and professional pharmacy both countries possessed a considerable number of pharmacists whose achievements had received world-

wide recognition. France led only in so far as the so-called *pharmacia elegans*, the more elegant preparation and equipment of a number of products were concerned. It was probably due to the Franklin francophile tradition that the French honorary members Derosne, Pelletier, Robiquet, Vauquelin and Virey—were more numerous than the German, namely, Brandes, Doebereiner, and Trommsdorff. It is equally significant for the English situation of that period that there was no one in the ranks of English pharmacy prominent enough to be added to this list of illustrious French and German pharmacists. In order that the roll of honorary members might also include an Englishman, the college conferred honorary membership upon the physicist Faraday.

It was a French pharmacist who in Philadelphia and in connection with the Philadelphia College of Pharmacy exerted an immediate and strong foreign influence on American pharmacy. This was the former *pharmacien* of the Grand Army of Napoleon I, Elias Durand, who established a drugstore in Philadelphia in 1825. William Procter, Jr. describes the activity and the importance of this man as follows: "His (Durand's) store became an important center of pharmaceutical information, which directly and indirectly, had much to do with the introduction of scientific pharmacy into Philadelphia, and through this college, his journal, and graduates, into the United States. Many of the finer medicinal chemicals were made in this country first by Durand."[10]

Augustine J. L. Duhamel, a pupil of Durand and like his master of French origin although born in Philadelphia, strengthened the French influence on American scientific pharmacy. Although he had reached the age of only 33 years he had published in the American Journal of Pharmacy 34 papers all of them "eminently practical in their character . . . Two of his communications relate to Boullay's filter and method of displacement (percolation), and we believe that he was the first on this side of the Atlantic to comment on this valuable improvement in pharmaceutical manipulation . . . His familiarity with the French language gave him access to the writers of that country, of which he extensively availed himself."[11]

In accordance with the fact that the Philadelphia College of Pharmacy was founded as an association (like the early colleges of physicians and the French *Collège de Pharmacie*), its professional activity was by no means restricted to the establishment and the administration of its school. Its constitution provided "a committee of inspection" for the examination of drugs "brought into the market and submitted to them," a "committee of equity, to settle any disputes that may arise in the transactions of the members of the college" and finally stated that members, "guilty of adulterating or sophisticating any articles of medicine or drugs

or of knowingly vending articles of that character, or of deteriorated qualities may be expelled."[12]

The leaders of the college very wisely balanced the scientific and the commercial interests of the calling which they represented and tried to promote. Their first step was the publication of formulas for the imitation of English patent medicines. As early as May 1822 they named a committee for this purpose and in 1824 the publication made its appearance. Such imitations were a general American custom (see p. 163) and it was doubtless true that frequently, prepared on the basis of senselessly composed formulas, they constituted a danger for the people using them. But it was nevertheless a somewhat peculiar fact that the first action of general importance undertaken by the first professional pharmaceutical association in America, if not in plain words, yet in effect, sanctioned the imitation of patent medicines.[13]

In 1825 the leaders of the college founded the first American pharmaceutical journal, the Journal of the Philadelphia College of Pharmacy, the purpose of which was to disseminate current scientific and professional information.[14] In 1826 the college issued "The Druggist's Manual, a price current of drugs, medicines, paints, dyestuffs, glass, patent medicines, etc., with Latin and English synonyms, a German, French, and Spanish catalogue of drugs, tables of specific gravities, etc., etc., and a variety of useful matter." The prices in this first American guide for the retail business in pharmacy were not supplied by the editor but had to be filled in by the druggists.[15]

Having laid down in its constitution the fundamentals of professional pharmacy and having tried partly to realize them it is not surprising that the Philadelphia College of Pharmacy became the model and sometimes the advisor of other local American pharmaceutical associations founded between 1821 and the Civil War—that political event which so greatly changed the political, economical, and spiritual life of the United States. The following list shows the spread of the early local pharmaceutical associations:

1821 Philadelphia College of (Apothecaries) Pharmacy
1823 Massachusetts College of Pharmacy
1829 College of Pharmacy of the City (and County) of New York
1841 Maryland College of Pharmacy
1850 Cincinnati College of Pharmacy
1859 Chicago College of Pharmacy
1864 St. Louis College of Pharmacy

As was to be expected, Boston and New York were the first American cities to follow the example of Philadelphia in the organizations of pharmaceutical associations. These three cities were at that time not only leaders in general cultural standards; they were also the most important

ports for the entrance of drugs. Moreover, they were the homes of the three oldest medical schools of the country: The Medical School of the College of Philadelphia (since 1791, Medical Department of the University of Pennsylvania) founded in 1765; King's College (now Columbia University) founded in 1768; the Harvard Medical School (commonly called the Massachusetts Medical School), founded in 1783. It may be pointed out that the medical associations of these three cities took the first steps toward the establishment of uniform standards. These efforts finally brought about the first U. S. Pharmacopoeia published in 1820 and compiled exclusively by physicians.

In repeating an earlier attempt to bring about a legal regulation of pharmacy (see p. 173) the Massachusetts Medical Society on June 6, 1823 petitioned the legislature to give the counsellors of the society "together with an association of apothecaries for all parts of the Commonwealth, if such an association should hereafter be incorporated" the power to appoint "Boards of Examiners," to examine all people "who may hereafter wish to compound or retail medicines in small quantities or to put up the prescriptions of physicians," and to grant licenses. In justifying the interest of the physicians in this regulation the petition states—in 1823!—that "physicians are daily discontinuing the practice of compounding or preparing the medicines which they use, and have therefore become in a great measure dependent upon the druggists and other retailers of medicine."[16]

The attempt of the Boston physicians to play a decisive role in pharmaceutical affairs suffered the same fate as that of their Philadelphia colleagues. Due to the opposition led by several wholesale druggists it was defeated.[17] However, the association recommended in the medical petition was founded December 26, 1823 in accordance with the advice asked of and given by trustees of the Philadelphia College of Pharmacy.[18] The constitution of the Massachusetts College of Pharmacy stressed the same points emphasized in its Philadelphia model. In the activity of the first American pharmaceutical colleges the main difference was that in Philadelphia lectures were provided in the year of foundation and were continued without interruption and continually improved, whereas in Boston no serious attempt at regular instruction was made until 1867.

"Almost all the business transacted was in reference to prices."[19] In 1825 a committee was appointed to prepare a price list for the trade, followed by like committees in 1827, 1829, and later. In contrast with the Philadelphia manual these lists contained definite prices and may be considered the first American attempt to fix the prices for drugs and medicines on the basis of associative agreement. The preface of the "catalogue of the materia medica and of the pharmaceutical preparations with the uniform prices of the Massachusetts College of Pharmacy" gives in

classical brevity the motives for the "uniform prices." It states; "that a judicious arrangement as to prices is no small means of adding support and dignity to the business . . . One evil where there is a difference in price is, that the purchaser either thinks that the one who charged high wronged him as to price, or that the one who charged low wronged him as to quality . . . A competition as to prices must be eventually ruinous to all; but a competition as to the quality of the medicines and attention to business will add to the respectability and standing of the profession." It is significant that this preface still appears with exactly the same wording in the price list published in 1854.

To the Massachusetts College of Pharmacy American pharmacy is furthermore indebted for the first American pharmaceutical library catalogue which has come down to us. In December 1825, i.e., two years after the foundation of the college a report of the trustees mentions about 125 books collected "by donation and purchase." The catalogue of 1829, preserved in the Sheppard Library of the Massachusetts College and made generally available by an annotated reprint in the Bulletin of the college[20] shows an increase to 190 volumes. For that period this implied a very respectable library since the list of members, appended to the catalogue, contains only 24 names of individuals and firms. The large number of French books on chemistry is remarkable. There are English translations of books by Lémery, Lavoisier, Macquer, Fourcroy, Berthollet, and Chaptal.

The list of the founders of the College of Pharmacy of the City of New York shows that here also wholesale druggists were very instrumental in promoting American professional pharmacy. "When our College was organized in 1829 a majority of the first 30 members were jobbers of goods for the arts as well as dispensing druggists."[21] It is evident that these proud and self-conscious men like their colleagues in Boston and Philadelphia wished to regulate their business affairs according to their own opinion and not under the supervision of the medical profession. It may be mentioned that the constitution of the college was signed by 70 New York druggists. The college was founded as "an association of pharmacists, druggists, and others interested in the progress of the profession, for purposes of mutual instruction, protection and assistance in all matters pertaining to their professional welfare; the school for undergraduates forming merely the teaching department of the institution." On the occasion of its centennial anniversary the college found its historian in C. P. Wimmer.[22]

The foundation of the Maryland College was affected not in counteracting some action or demand on part of the physicians but as a fruit of the most friendly understanding. The Maryland medical and chirurgical faculty initiated a meeting with representatives of the Baltimore pharma-

cists in the home of one of the physicians "with the idea of elevating pharmacy." At this meeting, attended by three members of the medical faculty and eight pharmacists, a committee of five pharmacists was appointed which undertook all further steps and finally, on July 20, 1840, founded the Maryland College of Pharmacy. This association was more or less active until 1847, "but thereafter languished until 1856, when . . . it was thoroughly reorganized."[23]

The foundation of the Cincinnati College of Pharmacy was more indirectly influenced by the sister profession of medicine. "The meeting of the American Medical Association in Cincinnati in the year of 1850 . . . was so fraught with the high ideals in medicine that the founders of the Cincinnati College of Pharmacy were stimulated to greater effort in the accomplishment of their plans."[24]

There were special reasons for the strength of this incentive. The leading personality among the quartet of talented men who founded the college, William B. Chapman, was a graduate of the Philadelphia College of Pharmacy as well as a graduate of the Ohio Medical College. In the Civil War he served as a surgeon.

The history of the local St. Louis pharmaceutical association goes back to 1854. On April 8, 1854, the St. Louis Medical Society protested against the "habit of prescribing for and administering medicines" by druggists and the refilling of prescriptions without authorization by the physician, resolving "to withdraw the medical influence from any druggist, who may thus act." This resolution found an interesting comment in the Journal of the Philadelphia College of Pharmacy. It is, says the comment, "too threatening for a Western city, where men of all classes are less controlled by custom and chartered privilege than in the older cities."[25] On May 25, 1854 the St. Louis pharmacists founded, in self-defense and encouraged by the attitude of the Philadelphia Journal, the St. Louis Pharmaceutical Association "for the purpose of exciting a more generous and brotherly feeling among the members of the profession of pharmacy . . . and the improvement of the educational status of the apothecaries and druggists."[26]

The association was not very active. It was reorganized in 1857,[27] but died during the Civil War. It "did not survive the shock of the upturning influences which marked the breaking out of the rebellion."[28] Finally on November 11, 1864 the St. Louis College of Pharmacy was founded, not in defense against but in close harmony with the medical profession. The meeting at which organization was effected was held in the hall of the St. Louis Medical College and "largely attended by the physicians of the city." Of the 23 members made known as officers or trustees of the new college not less than 9 had the letters "M. D." attached to their names.[29] Like the older associations, this new St. Louis pharmaceutical

organization was influenced by Philadelphia. As James O'Gallagher, M. D. and corresponding secretary of the St. Louis College of Pharmacy, wrote on January 31, 1865, to William Procter, Jr., dean of the Philadelphia College of Pharmacy and editor of its journal, "we have adopted the constitution and by-laws of the Philadelphia College."[30]

The foundation of the Chicago College of Pharmacy was to a large extent due to the influence of the American Pharmaceutical Association which gradually became inseparable from each progressive step in American pharmacy. "At the sixth annual convention of the American Pharmaceutical Association, four Chicago pharmacists were elected to membership. Two of these members, E. O. Gale and James D. Paine, were among those who led the movement to form a College of Pharmacy in Chicago."[31] On September 5, 1859 the College was founded. On September 14 the American Pharmaceutical Association elected E. O. Gale as Third Vice-President, William Procter, Jr. of the Philadelphia College of Pharmacy being First Vice-President.[32] Soon thereafter the constitution, by-laws, and code of ethics of the Chicago College, unmistakable offspring of those of the Philadelphia College and the American Pharmaceutical Association respectively, were adopted.

In addition to these organizations which gradually developed into institutions in which the educational instrumentality, the school, became dominant, there were other early local pharmaceutical associations, such as the Richmond Pharmaceutical Society founded in 1852[33] which later on adopted the name Richmond College of Pharmacy[34] and was revived in 1873 as the Richmond Pharmaceutical Association;[35] "a social-scientific union in Boston"[36] which was re-organized under the name Boston Druggist's Association in 1875;[37] the Pharmaceutical Association of Washington City;[38] and the San Francisco Pharmaceutical Association founded in 1858[39] and deceased in 1860.[40] Such city organizations were founded, disappeared, and were revived again and again all over the country. In large cities there were and are pharmaceutical associations organized because of very different motivations. In New York City a multiplicity of such associations strives for co-operation in an organization founded in 1910 under the name of New York Pharmaceutical Conference and reorganized in 1935 as the New York Pharmaceutical Council. There are not less than 14 local pharmaceutical groups affiliated within the Council, among them the New York German Apothecaries Society and the New York Italian Pharmaceutical Association.[41] The New York organization of Chinese druggists does not consist of licensed pharmacists.

As stated in the beginning and clearly demonstrated in the course of this chapter, the rise of the early local pharmaceutical associations was due to outer circumstances more than to the professional enthusiasm of member druggists. Even the Philadelphia College of Pharmacy, the

early and consistent herald and standard-bearer of American professional pharmacy, experienced times in which the general indifference became threateningly obvious in the decrease of its members.

It was the general American appetite for independence which expressed itself both in the formation of the early American pharmaceutical associations and in their decline when the independence of the trade no longer seemed endangered. The average American of this period did not want any restrictions whether by a special group thinking itself superior to him (in this special case the medical profession), by associations, or even by laws which tried to regulate his conduct. Naturally legislators respected this sentiment. It was this specific American spirit which defeated the early medical endeavor to regulate legislatively the practice of medicine in all its branches, including pharmacy, by forcing it under the control of legally authorized and chartered medical associations (see p. 162).

There were, however, in America, pharmacists imbued by origin and education with an appreciation of authoritarianism who gained a steadily growing influence over the development of American pharmacy. These were the apothecaries of German descent who came to the United States in the turbulent years before the German civil war of 1848 or in consequence thereof.

Even in early colonial times (see p. 141) there were in North America German apothecaries who enjoyed a high reputation. However, these men were neither numerous nor ambitious enough to exert any lasting influence. Thus the early development of American professional pharmacy found its model more in the French pharmacist, whose native country was America's ally in the struggle for independence, than in the German apothecary. Had the period between 1830 and 1860 brought as many French pharmacists to the United States as it did of German apothecaries, the development of American pharmacy might have taken other directions. The French July revolution of 1830 as well as that of 1848 was successful and hence caused no emigration. The German revolution of 1848 failed and the stern measures of the German princes against the revolutionaries forced thousands of the best educated Germans to seek refuge in the United States. This was doubtless of great importance for American cultural life since this date. The fact that German physicians and apothecaries had played an important part in the German political movement of 1848 brought a great number of them to America. In the small German principality of Baden alone 30 physicians and 20 apothecaries left their native country after the defeat of the uprising.[42]

These German apothecaries spread over the entire country. All of them possessed practical and scientific training and a professional standard, which at that time could not be equalled either by the English

chemists and druggists or by the few graduates of the early American colleges of pharmacy, not to mention the druggists without college education. Thus their pharmaceutical practice was recognized as exemplary and was imitated. In some cities, such as St. Louis, Belleville, Cincinnati, and Milwaukee, the majority or at least a great number of all real pharmacies were for a long time in the hands of such "*Acht und vierziger*" ("48er") or of German pharmaceutical immigrants following them, or finally of American-born citizens of German or sometimes non-German descent trained by the older German immigrants, who occasionally completed their pharmaceutical education in Germany. The decisive influence exerted by German immigrants on the practice of pharmacy in Texas has been described by E. G. Eberle.[43]

The reputation which these German pharmacists enjoyed and their importance as preceptors is reflected in a biographical sketch of John Uri Lloyd[44] written by C. A. Mayo. Having described the two-year apprenticeship of the young boy with an Anglo-American pharmacist the author writes:

> The large number of Germans living in Cincinnati gave a pronounced Teutonic flavor to the drug business, no clerk being proficient unless drilled in German. In order to learn that phase of the business, it was deemed expedient for John Uri to become apprenticed to a German pharmacist. He found an opening with Mr. George Eger . . . Mr. Eger, who had been educated as a pharmacist at a German university, gave careful attention to the young apprentice . . . The lad who finished his apprenticeship under George Eger . . . was everywhere accepted as a competent pharmacist.

It was a group of such German pharmacists, a total of 24, who on September 30, 1851 founded an association which first received the name *New Yorker Pharmaceutischer Leseverein* (New York Pharmaceutical Literary Society). Six months later it was changed to *Deutscher Pharmazeutischer Verein* (German Pharmaceutical Society), in 1864 to *Deutscher Apotheker-Verein* (German Apothecaries Society), in 1875 to *Deutscher Apotheker-Verein von New York* (The German Apothecaries Society of New York). This association was the first American pharmaceutical group formed with the purpose of improving the scientific and professional standards of its members which had not been forced into organization by the pressure of outside influences. It was furthermore the first to obligate its members to notify the board of the society when taking an apprentice, to fix the period of apprenticeship and to make the examination of the apprentices obligatory. "These apprentices, after the time of their apprenticeship, have to pass a stringent examination

before a commission, and on passing the examination receive a certificate." (Article XI, par. 2 of the statute of October 1, 1851)[45]

In the first years of its existence the members of the New York German Pharmaceutical Society sent their apprentices to the New York College of Pharmacy.

> In 1857 the society instituted the system of examinations for the apprentices that many members had trained in their establishments, and certificates of proficiency were issued to those who wished them. The College of Pharmacy at that time was in a somnolent condition, no students had graduated in 1857 and only two in 1858 and 1859. The examining board of the German Apothecaries Society filled the gap for a number of years, until the college revived its work, whereupon the apprentices were again sent to that institution.[46]

It should be mentioned that the two men of German descent who exerted the greatest influence on the development of American pharmacy, John M. Maisch, the first general secretary of the American Pharmaceutical Association, and Charles Rice, the creator of the modern American pharmacopoeia, did not come to America as German apothecaries but became pharmacists after their immigration. It was perhaps due to that fact that they were able to give more to American pharmacy at large. The danger of isolation because of special professional education and traditions acquired abroad did not exist for them. American pharmacy was for them a given reality which they tried to improve in accordance with their general background. The third man to be named together with these two great American pharmacists of German descent, Frederick Hoffman, having passed all German pharmaceutical examinations and being, therefore, a German apothecary, was protected from onesidedness by his special geniality which made him one of the greatest journalists and most stimulating spirits American pharmacy has had.

Some of the later local pharmaceutical associations were and are branches of national organizations, such as the branches of the American Pharmaceutical Associations, coming into existence after 1905,[47] devoted primarily to the dissemination of scientific knowledge; the branches of the National Association of Retail Druggists, advancing the commercial interests of the calling; and the Greek letter academic fraternities and sororities. Of a different type are the alumni associations of the colleges, the first to be organized being that of Philadelphia in 1864. Lastly come the veteran druggist associations, pursuing primarily social ideals. Some local associations have covered not only one city but a county. One of the first of these was the Kings County Pharmaceutical Society, reorganized in 1877 under this name but having been founded in 1876 as the Long Island Pharmaceutical Society.[48] According to J. W. Colcord,

"Essex County Massachusetts, is entitled to the credit of making the first organized effort (to withstand the operation of the cutter!) in the way of a county association and a pricelist."[49] Pricelists seem to have been a Massachusetts pharmaceutical specialty (see p. 179). Likewise in 1879 the Rock County (Wisconsin) Pharmaceutical Society was founded, the forerunner of the Wisconsin Pharmaceutical Association, which came into existence in 1880.[50]

It required a central, nationwide organization, which on its part fostered the foundation and existence of state organizations, gradually to achieve a general professional pharmaceutical sentiment in America and with this greater willingness on the part of the individual pharmacists to give up part of their independence for the benefit of all. It should, however, be stated that this central organization, the American Pharmaceutical Association, was caused not so much by a growing understanding of the necessity of professional pharmaceutical solidarity and intercourse as by the same pressure from outside which had brought into existence the early local associations, this pressure arising from the bad conditions in the drug trade.

2. *State Organizations*

It was on July 23, 1867, fifteen years after the foundation of the American Pharmaceutical Association, that the first state association, that of Maine, was founded. It is significant that the establishment of this association, most of its officers being members of the American Pharmaceutical Association, coincided with the appointment of a "committee on legislation regulating the practice of pharmacy" by the American Pharmaceutical Association and that it was very heartily welcomed by the American Journal of Pharmacy, the members of the editorial staff of which were among the most active leaders of the American Pharmaceutical Association.[51]

The fate of this association is somewhat shrouded in mystery. In 1877 it was still represented by delegates at the 25th annual meeting of the American Pharmaceutical Association. In 1878 the American Journal of Pharmacy published a report of a meeting held in Portland.[52] The Proceedings of the American Pharmaceutical Association of 1880 mention the "Maine Pharmaceutical Association" in the list of societies, etc., to which "complimentary copies of the proceedings are forwarded."[53] The Proceedings of the next year show a peculiar change. Instead of the Maine Pharmaceutical Association the list mentions the Maine Insane Asylum.[54] This institution received the proceedings at least until 1894 (from this time on the list ceased to be published) in spite of the fact that in 1890 the association "having been dormant for a number of years" was reorganized[55] and delegates of this revived pharmaceutical

body took part in the 40th meeting of the American Pharmaceutical Association in 1892.[56] Thus there must have been an interested pharmacist in charge of the Maine Insane Asylum, who was a member of the old organization and participated in the foundation of the new one.

This story is of general interest because it shows how state organization was frequently brought about. There were a few persons, sometimes only one, who held the organization together. With their decease or withdrawal from public life interest waned and the association died, to be revived later. Such was the fate of several state pharmaceutical associations. Their necessity had become so obvious that none of them disappeared permanently as so many local associations had done. John M. Maisch described the main tasks of the state associations as follows: "A few subjects that ought to claim their attention are the enactments of laws for the regulation of pharmacy where none such exist, and the amendment of those now in force where they are inadequate to the public or oppressive to those engaged in the practice of pharmacy. The co-operation of these various societies ought to be secured in an endeavor to modify the laws and rulings of the general government where they oppress the true liberty of those engaged in business."[57]

Not aware of the necessity of persistent vigilance many pharmacists considered the work of the state associations definitely completed by the passing of a pharmacy law.

C. Lewis Diehl, in his report on the progress of pharmacy[58] in 1884 calls these state pharmaceutical associations "the children of the American Pharmaceutical Association." Indeed the American Pharmaceutical Association inspired the foundation of these organizations wherever and whenever it could. "Thus we often find, that the early officers of the state organizations are also active members of the American association, and that the organization of a state body followed a meeting of the American association near the birth place of the new society."[59]

It must, however, be stated that the medical influence, so decisive in the formation of the early local pharmaceutical colleges or societies, was sometimes the impelling force also in the establishment of state associations. The State Medical Association of Mississippi resolved in April 1871 "that the druggists, pharmacists, and chemists of the State of Mississippi be requested to call a convention at an early day, and organize a State Pharmaceutical Association, to meet annually at the same time and place that the Medical Association does, and cooperate with it in any and all measures of mutual interest and importance."[60] It was only one month later that the Mississippi Pharmaceutical Association was founded, and it is very significant that this new organization tried to stabilize the good relations with its older medical sister on the one hand and at the same time to gain recognition and secure its place within its

own profession. One of the first resolutions of the new association was to the effect that the president be an ex officio delegate to the State Medical Association, and that the two organizations should co-operate. At the same time it adopted the constitution of the American Pharmaceutical Association and urged "all pharmacists in the State to join" the national representative of American professional pharmacy.[61] When in 1881 the West Virginia state association was reorganized there were among the druggists thus engaged "a number of physicians who maintained stores in various localities."[62]

The following list, based on a publication in the Druggist's Circular[63] has been checked, corrected, and completed with the aid of all available sources. It shows the gradual diffusion of the state pharmaceutical associations all over the country. The one striking point that is readily observable is that the greatest activity in the matter of state organization lasted for little more than a decade, from shortly before 1880 to shortly after 1890. It was also during this period that most of the state pharmacy acts came into existence. Both lines of activity, as has already been indicated, were stimulated by the American Pharmaceutical Association, and more particularly by its general secretary, John M. Maisch.

TABLE OF STATE PHARMACEUTICAL ASSOCIATIONS

1867....Maine
1869....California
1870....New Jersey
1870....West Virginia
1870....Vermont
1871....Mississippi
1873....Tennessee
1874....New Hampshire
1874....Michigan
1874....Rhode Island
1875....Georgia
1876....South Carolina[64]
1876....Connecticut
1877....Kentucky
1878....Pennsylvania
1879....Texas
1879....New York
1879....Ohio
1879....Missouri
1880....Iowa
1880....Kansas
1880....Wisconsin
1880....North Carolina
1880....Illinois
1881....West Virginia (reorganized)
1881....Alabama
1882....Virginia
1882....Louisiana
1882....Indiana
1882....Massachusetts
1882....Nebraska
1883....Maryland
1883....Mississippi (reorganized)
1883....Minnesota
1883....Michigan (reorganized)
1883....Arkansas
1885....North Dakota
1886....Tennessee (reorganized)
1886....South Dakota
1887....Delaware
1887....Florida
1887....Idaho
1890....Washington
1890....Oregon
1890....Maine (reorganized)
1890....Oklahoma Territory
1890....Colorado
1891....Montana
1891....Mississippi (2nd reorganization)
1892....Utah
1893....New Mexico
1895....Indian Territory
1902....Mississippi (3rd reorganization)
1904....Florida (reorganized)
1905....Idaho (reorganized)
1906....West Virginia (2nd reorganization)
1907....Oklahoma State
1915....Wyoming
1932....Nevada

While the District of Columbia is not considered as a state, it functions nevertheless as a political unit in many ways comparable to the state. A "Pharmaceutical Association of the District of Columbia" is first mentioned as having sent delegates to the meeting of the American Pharmaceutical Association in 1867[65] and in the years following until 1872.[66] In 1873 the association gave birth to a college, the National College of Pharmacy at Washington, and then disappeared.[67] During the following meetings of the American Pharmaceutical Association the new college only was represented by delegates. Finally in 1898 the list of colleges and associations having accredited delegates to the 46th annual meeting of the American Pharmaceutical Association reveals the names of the National College as well as the Association of the District of Columbia.[68]

This close connection between association and college, typical of the early colleges, has another representative among the state pharmaceutical associations. The California Pharmaceutical Society, founded in 1869, decided, in 1872, "to take measures for the establishment of a college of pharmacy"[69] and founded this college in the same year. The affiliation between Society and College was very close, the meetings of the Society, being held at the rooms of the College and the proceedings being published together.[70] However, that did not change the fact that both institutions had their distinct life with separate officers, meetings, etc.

After the Civil War a new period in the development of American pharmacy began. The privilege of the individual of deciding what to do and what not to do was more and more restricted by law. It was the great good fortune of American pharmacy to possess at this time a national organization with years of experience combining all the talent, knowledge, energy, and diplomacy available within the calling. As so often in history the apparently paradoxical comes to pass. The American Pharmaceutical Association was not erected on the foundation of an established professional pharmacy but it created American professional pharmacy.

3. National Organizations

The American Pharmaceutical Association was the first and for a long time the only national pharmaceutical organization. It represented, defended, and promoted during the decades in which the calling gained its distinctive shape, all fields of pharmaceutical enterprise and interest, the scientific and educational as well as the commercial, the ethical, and the legal. It was and is the guardian of all movements concerning American pharmacy.

Until 1852 the concept of professional pharmacy was only a dream of the few colleges of pharmacy previously mentioned. Even if their in-

fluence extended beyond their local boundaries, as doubtless was the case with the Philadelphia College of Pharmacy, there were no means of promoting this concept on a larger scale, of making it visible to all, to the general public, and especially to the legislators as well as to the presumptive members of the should-be-profession. The American Pharmaceutical Association was founded by the early colleges of pharmacy to provide this means. As previously stated the immediate incentive for the foundation of the American Pharmaceutical Association was the bad conditions of the drug market, the danger of which was again accidentally made evident.

In 1845 Ewen McIntyre, at that time drug clerk for George D. Coggeshall in New York, discovered that a portion of supposed calcium carbonate, imported from England, was in fact calcium sulfate. Coggeshall and his friend John Milhau brought the matter before the New York College of Pharmacy. Other preparations were examined and likewise proven to be substituted, adulterated, or deficient in strength. The result of the protests to the British manufacturers and exporters, found its most significant expression in the reply of one of the Englishmen that the products were "as good as the Americans would pay for."[71] A petition to Congress, undersigned by pharmacists as well as by physicians all over the country, resulted in the subsequent passage of a law which required certain standards and went into force in 1848. The effect was unsatisfactory. In 1849 the Medical Association of South Carolina requested the secretary of the treasury to appoint a more efficient inspector for the port of Charleston and "in its meeting of 1850 the society was pleased to note that the unsatisfactory inspector had been removed."[72] However, the occasional change of inspectors did not mean a change of the whole system and therefore brought little or no improvement in the situation.

> This failure to secure the desired results was attributed to the lack of fitness on the part of the inspectors installed at the several ports of entry, who were appointed for their political affiliation rather than for their ability, although they were to some extent handicapped by the lack of clearness in the wording of the law in regard to standard books.[73]

In August 1851 the College of Pharmacy of the City of New York invited the colleges of Philadelphia and Boston to send delegates to a convention to be held in New York. This convention met in the New York College on October 15 and 16, 1851. It recommended the adoption of standards for a few drugs and called for a new conference in Philadelphia. It was almost a year later, October 6, 1852, when delegates from the colleges of New York, Boston, Philadelphia, Baltimore and

Cincinnati, that is, from all American pharmaceutical colleges existing at that time, representatives of the Richmond Pharmaceutical Association and of the pharmacists of Connecticut and San Francisco, in all 21 men, met at Philadelphia. At this conference, during its second session on October 7, 1852, a report of a committee of three, among them William Procter, Jr., was adopted and a "permanent organization under the title 'American Pharmaceutical Association' was effected by the adoption of a constitution, containing 5 sections, and of a code of ethics, consisting of 6 articles, for government and guidance."[74]

The Preamble and Article I of the Constitution give a picture of the situation which the new organization had to deal with and of the objectives of the founders:

> Preamble: Whereas, the advancement of pharmaceutical knowledge and the elevation of the professional character of apothecaries and druggists throughout the United States are dear to us in common with all well disposed pharmaceutists; and whereas, a large portion of those in whose hands the practice of pharmacy now exists are not properly qualified for the responsible offices it involves, chiefly by reason of the many difficulties that impede the acquirement of a correct knowledge of their business:
>
> Therefore, We the members of a convention now met at Philadelphia, composed of apothecaries and druggists from different sections of the Union and from all the colleges and societies therein existing, with the object of deliberating on the condition of our profession, do hereby resolve and constitute ourselves into a permanent association, to meet annually, at such times and places as may hereafter be determined, for more effectually accomplishing the objects for which we are now assembled and do now adopt the following
>
> Constitution:
>
> Article I. This association shall be called the American Pharmaceutical Association. Its aim shall be to unite the educated and reputable pharmaceutists and druggists of the United States in the following objects:
>
> 1st. To improve and regulate the drug market, by preventing the importation of inferior, adulterated or deteriorated drugs, and by detecting and exposing home adulteration.
>
> 2nd. To establish the relations between druggists, pharmaceutists, physicians and the people at large, upon just principles, which shall promote the public welfare and tend to mutual strength and advantage.
>
> 3d. To improve the science and the art of pharmacy by diffusing

scientific knowledge among apothecaries and druggists, fostering pharmaceutical literature, developing talent, stimulating discovery and invention, and encouraging home production and manufacture in the several departments of the drug business.

4th. To regulate the system of apprenticeship and employment so as to prevent as far as practicable, the evils flowing from deficient training in the responsible duties of preparing, dispensing and selling medicines.

5th. To suppress empiricism, and as much as possible to restrict the dispensing and sale of medicines to regularly educated druggists and apothecaries.

By an amendment, adopted during the 18th annual meeting of the American Pharmaceutical Association in 1870 several changes were made. The preamble was eliminated. It no longer seemed opportune to admit that "a large portion" of the pharmaceutical practitioners were "not properly qualified." In Section 5 of Article I a very clever shift of the words "and as much as possible" gave this sentence quite another meaning better fitting the actual situation. It was now the task of the American Pharmaceutical Association "to suppress empiricism as much as possible and to restrict the dispensing and sale of medicines to regularly educated druggists and apothecaries," this restriction being intended unconditionally. Finally the following two new paragraphs were added to Article I, the first being of substantial, the second of more programmatic value: "6th. To uphold standards of authority in the education, theory and practice of pharmacy. 7th. To create and maintain a standard of professional honesty equal to the amount of our professional knowledge, with a view to the highest good and greatest protection to the public." Since that time, that is for about 70 years, Article I of the constitution of the American Pharmaceutical Association has not been changed, this fact being the best possible confirmation of the wisdom of its authors.

The Code of Ethics, adopted by the constituting convention of the American Pharmaceutical Association in 1852 was not without a predecessor. The early colleges of pharmacy had rules of ethics within their constitution[75] and in 1848 The Philadelphia College of Pharmacy published the first distinct "code of ethics." This code was doubtless the model for the American Pharmaceutical Association Code, which had not been changed previous to 1922.[76] In that year the American Pharmaceutical Association adopted a new and comprehensive code, stating in three chapters the duties of the pharmacist, (1) in connection with his services to the public, (2) in his relations to the physician, (3) in his relations to other pharmacists and the profession at large.[77]

The fact that the early colleges of pharmacy were associations of

practicing pharmacists which maintained educational institutions (schools) was of highest importance for the development of the new organization. Their leaders, who shaped the work of the American Pharmaceutical Association, had experienced in their local districts all the problems which pharmacy had to face in this period and were therefore able to deal with them efficiently and realistically within the national organization.

The great American pharmaceutical associations, devoted to special tasks within pharmacy proper, are outgrowths of the American Pharmaceutical Association. They have not lost their connection with the mother organization since the latter, delegating certain functions to the younger societies, has always maintained its position as the highest court within the profession for all matters pertaining to pharmacy proper.[78]

It was the sections of the American Pharmaceutical Association which became the forums in which all special questions of pharmaceutical interest could be discussed with recognized authority and where the work of the later special associations found proper place within American pharmacy in its entirety. In 1887 the 35th convention of the American Pharmaceutical Association adopted as Article II of Chapter VIII of the By-laws the following: "To expedite and render more efficient the work of the association, four sections shall be formed as follows: (1) Scientific papers. (2) Commercial Interests. (3) Pharmaceutical education. (4) Legislation."[79] In 1889 the sections on pharmaceutical education and on legislation were merged. In 1900 the section on Practical Pharmacy and Dispensing was added, in 1904 a section on Historical Pharmacy, in 1912 a Women's Section and a section on Pharmacopoeias and Formularies. Finally in 1936 the hospital pharmacists found a possibility of developing their special interests with the aid and to the benefit of the entire profession within the American Pharmaceutical Association as a subsection of the section on Practical Pharmacy and Dispensing.[80]

The special national pharmaceutical organizations growing out of activities of the American Pharmaceutical Association are:

1870 . . . Conference of Colleges of Pharmacy[81]
1883 . . . National Retail Druggists' Association[82]
1890 . . . Association of Boards of Pharmacy and Secretaries of State Pharmaceutical Associations[83]
1898 . . . National Association of Retail Druggists[82]
1900 . . . Conference of Pharmaceutical Faculties,[81] since 1925 called American Association of Colleges of Pharmacy[84]
1904 . . . National Association of Boards of Pharmacy[80]
1927 . . . Conference of Pharmaceutical Association Secretaries[85]
1929 . . . Conference of Pharmaceutical Law Enforcement Officials[86]
1939 . . . Conference of Professional Pharmacists[87]

It will be observed that three of these organizations died and were revived later: the Conference of Colleges of Pharmacy which became inactive after 1882 until 1900, the National Retail Druggists' Association which disbanded in 1887 to be reorganized in 1898, and the Association of Boards of Pharmacy and Secretaries of State Pharmaceutical Associations which "died of inanition" to be reborn as two separate organizations in 1904 and in 1927 respectively.

Of national organizations which are not connected with the American Pharmaceutical Association, although all of them have been affected by and have affected American pharmacy and therefore the work of the American Pharmaceutical Association, the following should be mentioned:

1876...National Wholesale Druggists' Association, founded as Western Wholesale Drug Association, taking on the new name in 1882.[88]
1881...The Proprietary Association of America.[89]
1897...Association of American Dairy, Food and Drug Officials.
1908...American Association of Pharmaceutical Chemists, since 1921 called American Pharmaceutical Manufacturers Association.
1909...Flavoring Extract Manufacturers Association of the U. S.[90]
1910...National Drug Clerks' Association.[91]
1912...National Association of Manufacturers of Medicinal Products (American Drug Manufacturers' Association).
1915...Federal Wholesale Druggists' Association.[92]
1921...United Medicine Manufacturers of America.

A veritable flood of national pharmaceutical organizations, or at least of organizations founded with the intention of becoming nation wide, rose and faded after the Civil War. They were devoted to widely different purposes. Among them were an American Medico-Pharmaceutical League, founded in 1897, and even an American Drug Trade Bowling Association, founded in 1898.

The national pharmaceutical associations, however, have not been the last word in American pharmaceutical association activity. Through the initiative of the American Pharmaceutical Association co-operative organizations were founded, combining delegates of different national associations for joint work on common tasks. Thus arose:

1910...Pharmaceutical Syllabus Committee[93]
1912...National Drug Trade Conference[94]
1922...National Conference on Pharmaceutical Research[95]
1923...Plant Science Seminary[96]
1932...American Council on Pharmaceutical Education[97]

Now and again plans have been proposed to bring about a federation of all pharmaceutical forces in the United States. Reviewing in a brief and illuminating way the work done by and within the American Pharmaceutical Association during the first 75 years of its existence, James H. Beal makes the following statement:

> While waiting for the political genius who will show us how the obstacles in the way of a universal organization can be removed or reconciled, let us not forget that in the American Pharmaceutical Association we have a wonderful instrumentality for good, that in fact, it comes very near to being the universal society we have been looking for . . . There is no question of concern to any part of the drug world which cannot be given as full and as fair consideration in this Society as in any other that could be created.[98]

REPORT ON LEGISLATION

REGULATING THE PRACTICE OF PHARMACY

IN THE UNITED STATES.

Read at the Sixth Session of the Sixteenth Annual Meeting of the American Pharmaceutical Association, held in Philadelphia Sept. 10, 1868, by

JOHN M. MAISCH,

Permanent Secretary.

PHILADELPHIA:
MERRIHEW & SON, PRINTERS.
243 Arch Street.
1868.

FIGURE 15. Cover page of Maisch's "Report on Legislation," 1868.

13

THE RISE OF LEGISLATIVE REGULATION

ANY MOVEMENT carries within itself the seeds of its own destruction. Reluctantly it nourishes them, tolerates them, helps them to survive. Gradually they grow until the movement itself is overshadowed, until its originators find themselves in the peculiarly uncomfortable position of condoning what they had condemned, following what they had organized to oppose. Thus it was in pharmacy. Organizations which were first established to avoid legal restrictions in the practice of pharmacy, became the initiators and subsequently the guardians of American pharmaceutical legislation. There naturally were and are a number of laws affecting the practice of pharmacy in one way or another. The following explanations are devoted exclusively to a survey of legislation creating the structure of American pharmacy, or at least decisively influencing it.

1. Local Laws

Characteristic of American pharmaceutical legislation is the fact that the state laws concerning the practice of pharmacy did not grow gradually out of local regulations. With few exceptions, neither local nor state laws came into existence before 1870. Before the Civil War there was only one local pharmacy act, enacted in 1839 for the city of New York. This was followed in 1866 by another for Lycoming County in Pennsylvania.[1] Of both it has been said that they "have been a dead letter." But although the local pharmaceutical laws were not the precursors of the state laws, they were often their substitutes for great cities or densely settled parts of the state at a time and under circumstances in which a state law could not be achieved. John M. Maisch in 1872 describes as follows the situation which brought about local laws instead of state laws:

> We must remember that in thinly settled districts, where frequently for many miles no drugstore can be found, physicians are compelled to dispense medicines and carry them in suitable forms in their saddle bags, while the sale of popular remedies is usually in the hands of country storekeepers who make no pretensions as to any acquaintance with drugs and their preparations. Hence the necessity which exists in the larger cities to confine the practice of pharmacy to pharmacists alone is not felt there, and the opposition to general laws came, in most cases, only from the representatives

> of such districts. In most of the states the idea of a general law was soon abandoned, and the efforts confined to the securing of local laws, with the expectation that their provisions would gradually extend to other localities. In 1871 the proposed laws were defeated in the States of New Hampshire, Massachusetts, New Jersey, Ohio, Michigan and Illinois; even the only attempt at a general law for Pennsylvania, introduced into the Senate, January 21st, 1868, . . . did not pass.[2]

In 1870 a law concerning the practice of pharmacy was enacted for the city of Baltimore, being replaced in 1872 by another. In 1871 a law was promulgated for the city of New York which became the starting point of a remarkably successful protest movement on the part of the New York pharmacists. It was initiated and led by one farseeing man, Dr. Frederick Hoffmann, who recognized the danger of a law which placed the power of examining and licensing pharmacists in the hands of a political commission preponderantly medical in character and supported by a large examination and registration fee. This danger was not restricted to the city of New York, for during these fumbling beginnings of pharmaceutical legislation it could, by precedent, become a general danger for the entire country.

Dr. Hoffmann refused to take the examination and organized a front of resistance. A New York Apothecaries' Union was founded and a draft of a suitable pharmacy act, sponsored by this organization, by the New York College of Pharmacy and the German Apothecaries Society of New York, was presented to the legislature. Public opinion supported the pharmaceutical movement all the more when it became evident that pharmacy was in danger of becoming a source of income for partisans of the corrupt political machine of Tammany Hall. The originator of the ominous law of 1871, a Mr. James Irving, was in the meantime defeated for re-election and charged with a crime.[3] Thus the pharmacists' draft with some modifications successfully passed the legislative bodies and was signed by the governor, May 22, 1872.[4] According to the new law[5] (1) the members of the Board of Pharmacy were to be elected by the College of Pharmacy of the City of New York; (2) the examination fee was reduced to $5; (3) the remuneration of the secretary was to be fixed by the Board, and (4) any surplus accruing from the fees for examination and registration was to be used "for the benefit of the College of Pharmacy." In one point the draft was very significantly changed by the new law. While accepting the proposed "five competent pharmacists" as members of the Board of Pharmacy, it ordered that three of them should be "graduates of some legally constituted medical college." There were at that period many "competent pharmacists" who

were graduates of medical colleges; therefore this requirement did not offer any difficulties.

It was no doubt due to the victory of the New York pharmacists that a bill "which was merely the famous Irving law" did not find the approval of the Pennsylvania legislature in 1872. In its place a bill prepared by a committee of the pharmacists of Philadelphia became, with some modifications, the law for the city of Philadelphia on April 4, 1872.[6] An "act to regulate the practice of pharmacy in the city and county of San Francisco," issued on March 28, 1872,[7] "is based upon the law as drafted by the pharmacists of New York."[8] In 1873 a pharmacy act for the city of St. Louis was promulgated,[9] to be replaced by a Missouri state law in 1881. In 1876 a pharmacy law for the city of Milwaukee was enacted,[10] succeeded by a Wisconsin state law in 1882. The credit, if such it can be considered, for operation over the longest time by a local pharmaceutical law must be given to the pharmacists in Baltimore. As previously stated the Baltimore pharmacy act was issued in 1870 and remodeled in 1872. It required 30 years before the Maryland Pharmacy Act of 1902 replaced the local Baltimore regulations.

An example of the difficulties which can sometimes lie in the way of state pharmacy laws is offered in the development of legislation in the state of New York. The pharmacy act for the city of New York previously mentioned was followed in 1879 by a similar one for King's County, New York; in 1884 by a law for Erie County, and in the same year for "all the counties of this state except New York, Erie and Kings." It was not until 1900 that a uniform pharmacy law for the entire state of New York was enacted.

2. *State Laws*

State pharmaceutical laws and state pharmaceutical associations are very closely related. The legal functions of these associations aid in the enforcement of the laws. This followed as a consequence of the fact that most of them were organized primarily to bring about state pharmaceutical legislation. With success in this endeavor, it naturally fell to them to enforce the laws.

As previously shown, it was the American Pharmaceutical Association which fostered the organization of state pharmaceutical associations. Naturally, the mother organization did not send her children into the battle without providing them with a weapon. This weapon was the so-called model law or "draft of a proposed law to regulate the practice of pharmacy and the sale of poisons and to prevent the adulteration of drugs and medicines."[11] This was prepared by a special committee and more particularly by John M. Maisch and presented at the Chicago meeting of the American Pharmaceutical Association in 1869. The his-

tory of this model law shows the transitional character of this period. "The draft was liberally discussed and finally ordered to be printed in the proceedings but without the formal endorsement of the association, as many of the members doubted the advisability of encouraging pharmaceutical legislation."[12]

This inner resistance against legislative restriction by some of the best men in American pharmacy at that time had its origin partly in the circumstances described by John M. Maisch three years later (see p. 197). An additional reason, however, lay in the deep mistrust of the state administrations. "If we propose a law," said Dr. Squibb during the discussion of the draft, "that makes a whole train of offices and office holders, we are simply establishing another political engine in each state that will soon become corrupted to political ends." Only two years later the first pharmacy law for the city of New York, previously mentioned, proved that the point of view taken by Dr. Squibb was by no means unfounded. At any rate, the knowledge that some states were about to adopt pharmacy laws without guidance and thus bring out quite undesirable regulations, made the draft the lesser evil. Thus a pamphlet was printed, containing the model law and the somewhat lukewarm resolutions and conditional recommendations of the American Pharmaceutical Association. Ten copies of this pamphlet were sent to the governors and the speakers of the legislatures of each state in the Union.

This resulted in securing the best confirmation of the necessity of the draft. It became the model of a majority of the early laws. How some of the bills were rushed through legislative committees of the state associations and through the legislatures becomes apparent from a comparison of some of the laws with their drafts, which, in one instance at least, consisted of nothing more or less than a printed copy of the law of a neighboring state with the name of the enacting state substituted in red ink.[13]

In 1900 another model law, of which James H. Beal was the spiritual father, was adopted by the American Pharmaceutical Association, this time unanimously, without long debate and without any reservations.[14] Like its older brother this model law was printed in pamphlet form and sent to the different state governments.

The following table shows the chronological order in which the states adopted their first pharmacy laws:

PASSAGE OF STATE PHARMACY LAWS

1861....Alabama[15]	1876....South Carolina
1867....Georgia[16]	1877....New Jersey
1870....Rhode Island[17]	1877....Maine
1872....Florida	1878....District of Columbia
1874....Kentucky[18]	1880....Iowa
1875....New Hampshire	1881....Connecticut

1881....Illinois
1881....Missouri
1881....North Carolina
1881....West Virginia
1882....Wisconsin
1883....Delaware
1884....Ohio[19]
1884....New York[20]
1885....Michigan
1885....Minnesota
1885....Massachusetts
1885....Kansas
1886....Virginia
1886....Wyoming Territory
1887....Idaho
1887....Pennsylvania
1887....Dakota Territory
1887....Nebraska
1887....Colorado
1888....Kentucky (all state)
1888....Louisiana
1889....New Mexico
1889....Texas
1890....South Dakota
1891....North Dakota
1891....California
1891....Oregon
1891....Oklahoma Territory
1891....Washington
1892....Utah
1892....Mississippi
1893....Tennessee
1894....Vermont
1895....Montana
1899....Indiana
1900....New York (all state)
1901....Nevada
1903....Arizona
1904....Indian Territory
1909....Oklahoma State

These laws legally defined the difference between pharmacists and mere merchants and established professional pharmacy as a distinct entity existing for the public good.[21] Without a legally recognized and effective pharmaceutical profession, the national laws, which while not dealing exclusively with American pharmacy still very substantially affected it, would have lacked the substratum on which some of the most significant Federal agencies were to rest. These laws are the Federal Food, Drug and Cosmetic Act and the Harrison Anti-Narcotic Act.

3. National Laws

The number of national or federal laws is restricted by the fact that the regulation and protection of the conduct of life of the American citizen is principally the task of state legislation. The Constitution and Court decisions have left the police power largely with the states. There are, however, activities whose uniform national regulation is necessary or at least highly desirable. One of these activities is that of supplying the people with good, genuine, and unadulterated foods and drugs.

Congress had acted within this field during the 19th century by appointing inspectors in the principal ports of entry. These men had to examine the imported drugs and to decide whether they were to be admitted or not (see p. 190). Confined only to imported drugs, this control could at best only effect certain improvements. In 1880 the National Board of Trade sought state legislation to fill the gap and in 1881 New York and New Jersey promulgated the first state food and drug adulteration laws. It was on June 30, 1906, that the Federal Food and Drugs Act was passed. Amended several times, it was completely changed and replaced by the Federal Food, Drug and Cosmetic Act of June 25,

1938.[22] The change of title indicates that cosmetics are now also within the jurisdiction of the Act.

The validity of this law is based on and effectively defended by the statement, that "Congress has power not only to regulate inter-state commerce, but also power to keep the channels of such commerce free from the transportation of harmful or illicit articles."[23]

The purpose of the Federal Food, Drug, and Cosmetic Act is the protection of the public from bad, adulterated, or misbranded substances or preparations and to guarantee the truth of the advertisements thereof, whereas the purpose of the Harrison Anti-Narcotic Act is the restriction of the distribution of narcotics to medicinal use in order to minimize the spread of drug addiction. "In its form and classification a revenue measure, the Harrison law affects in its operation the moral and social welfare of the people."[24]

The constitutionality of this act has been attacked by groups commercially interested in the unrestricted production and sale of narcotics quite in the same manner as the constitutionality of the Pure Food and Drug Act had previously been questioned. "The right of the federal government to regulate and control this problem is found: (a) in the power of Congress to carry out treaty provisions; (b) power of Congress to regulate foreign and interstate commerce, and (c) power of Congress to tax."[24] The act was promulgated December 17, 1914 and has been amended several times. The principal statements of the law as to the restriction of the distribution of narcotics to medical purposes are promulgated in accordance with international agreements (see p. 119). "It is of interest to note . . . that the number of druggists prosecuted under this act is small in comparison with the number of physicians, drug peddlers, and others having possession of the drug who have been brought to trial."[25]

While state statutes may supplement the federal laws, they must not conflict with them. Here again the American Pharmaceutical Association has been true to its traditional role in urging uniform legislation. It has drafted model state laws for food, drug, and cosmetic legislation as well as for state narcotic regulations.

Thus pharmacy as a profession has been gradually recognized by law and has been made the bearer of special duties for the benefit of the public. The basis, however, for this recognition as well as for the fulfillment of the duties imposed upon the calling is to be found in professional education.

14

THE DEVELOPMENT OF EDUCATION

1. Private Schools

THE establishment of European civilization in the New World was not to be achieved by simply transferring the European cultural achievements of the late 18th and early 19th century to the virgin soil of America. The conditions were too different. The exigencies of conquest and settlement, for centuries past merely a matter of history in Europe, in the United States determined the actual life of the people until the Civil War. Thus the young republic had to experience a repetition of the processes of evolution which had characterized the earlier European development—arriving finally at a specifically American culture pattern. Professional education was not a matter of tradition and still less a general rule aiming at general and comprehensive knowledge. It centered around the kind of people wanting an education and the kind of actual, practical work for which they should be educated.

> The first school in America to include pharmacy in the title of one of its professors was the Medical School of the College of Philadelphia, when Dr. Samuel Powell Griffits was elected professor of materia medica and pharmacy in 1789. On the fusion of the College of Philadelphia with the University of Pennsylvania in 1791, Dr. Griffits was continued as professor of materia medica and pharmacy until he resigned in 1796.[1]

Pharmacy at the Medical School of the College of Philadelphia and later at the University of Pennsylvania was taught by physicians and for physicians. Chemistry too was taught in connection with medicine. In a memorial presented to the trustees of the University of Pennsylvania about 1810 the respective professors stated that the professorship of chemistry is "almost exclusively" supported by students of medicine, who "are induced to do so in consequence of its application to pharmacy and the different branches of medicine," and they added, that "no man can teach pharmacy unless he has some knowledge of the practice of medicine."[2]

Previous to the foundation of the Philadelphia College of Pharmacy in 1821 only a few attempts to provide instruction in pharmacy for pharmacists are known to have been made. James Cutbush, "an early

Philadelphia chemist and apothecary who published many articles of interest and value upon chemical subjects beginning with 1808"[2] advertised in 1812 a course of "evening lectures on chemistry" and also "lectures on theoretical and practical pharmacy." He must be considered the first known pharmaceutical scientific author of some importance and as the first and, for decades, the only pharmaceutical teacher in pharmacy in America. The other early attempt to instruct pharmacists theoretically in the sciences of their profession was made in 1816 by the Philadelphia physician Dr. James Mease. Both attempts were evidently unsuccessful and did not receive much attention, "for no further mention was ever made of them."[3]

At that time pharmacy in America was considered by most of those active in the drug and apothecary business, and by the majority of physicians, as an art which did not require theoretical knowledge but could best be learned by practice "by daily handling and preparing . . . the remedies in common use" (see p. 167). Had it not been for the necessity of counteracting imminent measures on the part of the physicians who wanted to bring the drug business under medical control, educational pharmaceutical institutions in this country would have remained for a long time only the dream of a few farseeing pharmacists. Even after their foundation, the schools of the early colleges by no means enjoyed a continuous prosperity. Thus the Massachusetts College of Pharmacy, founded in 1823, arranged occasional lectures, but as previously mentioned, regular instruction was not provided for until 1867.

> Some of the institutions, while anxious to better educate the rising generation of pharmacists, found that they were in advance of the time. Even the large cities in which these colleges were situated did not provide a sufficient number of students to pay the professors a moderate lecture fee. Thus after several attempts in New York, Dr. Squibb offered his services free and even dragged his lecture equipment from his Brooklyn factory to the lecture room in New York City. In St. Louis the preceptors appear to have been interested more than were their apprentices. Students were few and in order to have any graduates whatever, the St. Louis College offered honorary degrees to its own members.[4]

The New York College of Pharmacy, founded in 1829, was between 1857 and 1869 "in a somnolent condition" (see p. 185). The Maryland College, founded in 1841, "languished from 1847-1856" (see p. 185). The course given by the Chicago College of Pharmacy, organized in 1859, was suspended upon the outbreak of the Civil War and the school was not re-opened until September 1870, to be destroyed by the great Chicago fire only one year later and re-established with the aid of

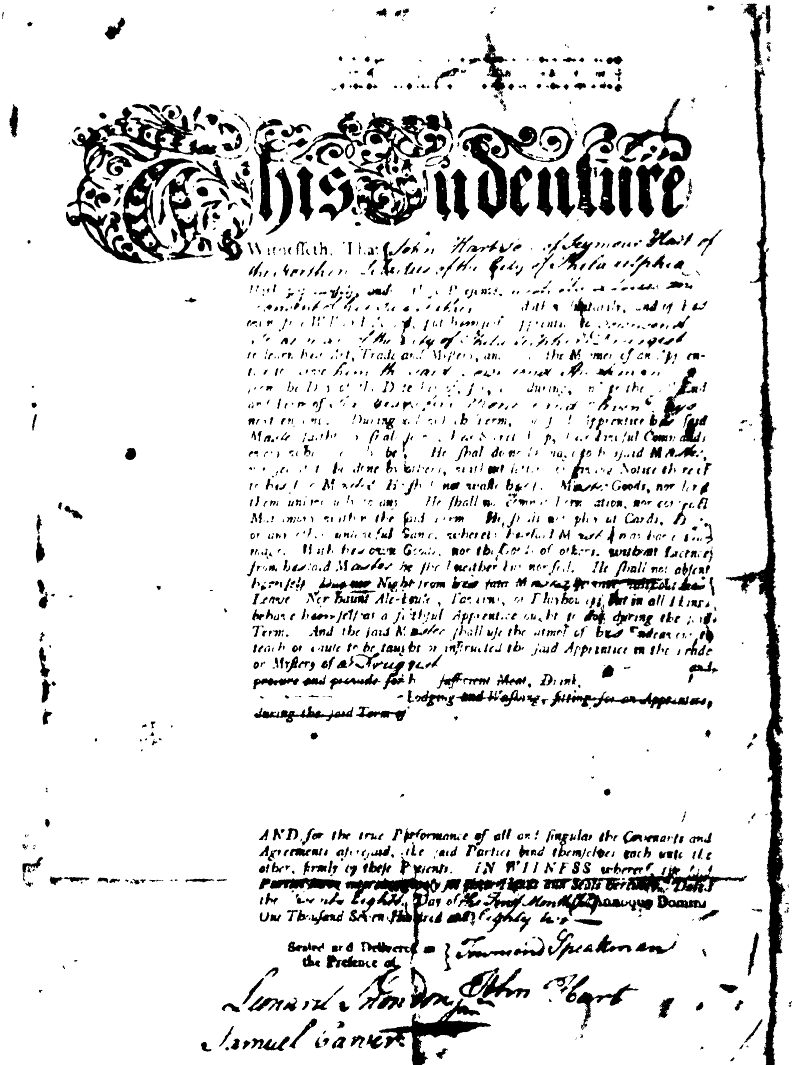

FIGURE 16. Late 18TH Century Pharmacy Apprentice's Indenture. The original is in the possession of the Philadelphia College of Pharmacy and Science.

organized support by the pharmacists of all parts of the civilized world. Even the list of graduates of the Philadelphia College of Pharmacy displayed in some years a very small number of graduates, 3 in 1839, 4 in 1840 and 2 in 1841.[5]

Thus the number of pharmacists attending lectures in the few American colleges of pharmacy before the Civil War was small and the number of those who passed the examinations and became graduates was naturally still smaller. The whole situation cannot be characterized better than it has been done in the "address to the pharmacists of the United States," composed by a commission under the leadership of W. Procter, Jr., and E. Parrish, accepted at the Cincinnati meeting of the American Pharmaceutical Association in 1854 and printed "for general distribution."[6] The address complained that there was at that time—as a rule—neither a legally indentured apprenticeship nor an honor bound obligation and that, therefore,

> Our country has been deluged with incompetent drug clerks, whose claim to the important position they hold or apply for is based on a year or two's service in the shop, perhaps under circumstances illy calculated to increase their knowledge. These clerks in turn become principals, and have the direction of others—alas! for the progeny that some of them bring forth, as ignorance multiplied by ignorance will produce neither knowledge nor skill . . . It has been found that there are three classes of individuals engaged in pharmaceutical pursuits . . . to whom particularly this address is directed: First, those who are imperfectly acquainted with pharmacy and are in business for themselves; secondly, those who have been but half educated as apprentices and who are now assistants receiving salaries, having the responsibility of business entrusted to them; and thirdly, those who are now apprentices or beginners under circumstances and with ideas unfavorable to the acquirement of the thorough knowledge of the drug and apothecary business.

It is very significant that the association did not expect these people to whom it appealed, not even the beginners, to study at one of the pharmacy schools. It merely admonished all of these groups "to read regularly and understandingly" pharmaceutical literature and "assist the reading when necessary by experiment and observation." The graduates of the schools of pharmacy were given the admonition to "act as examples to their less favored brethren." The address states that the American Pharmaceutical Association, recognizing the "vast importance of good schools of pharmacy, where the sciences are regularly taught," will "freely extend its countenance and encouragement to those already existing and to all new efforts."

This address was distributed to those most concerned, i.e., to the great majority of all people working in the fifties of the 19th century in American drugstores as proprietors, clerks or apprentices. A few years before its distribution another very important step had been taken; the establishment of the first American professorship of pharmacy, a professorship not connected with materia medica and not held by a physician but by a pharmacist. In 1846, just 25 years after the foundation of the Philadelphia College of Pharmacy, the trustees of the college divided the chair of materia medica and pharmacy. William Procter, Jr., the senior author of the address just quoted, who later was designated "the Father of American Pharmacy" was unanimously elected to the chair of pharmacy being the first American pharmacist appointed to an American professorship of pharmacy. In the "report of the committee of nine, appointed to consider the propriety of creating a Professorship of Pharmacy," unanimously adopted at a special meeting of the college on May 4, 1846, the following statements were made:

> In organizing the school of pharmacy, it was found necessary to seek professors in the ranks of the medical profession—few, if any, of the apothecaries had so accustomed themselves to the systematic study of the several branches connected with the practice of our profession, as to be prepared to assume the office of teachers. Hence it is not surprising that the theory and practice of pharmacy, although held to be of the highest importance to the student, was not allotted to a professor as a separate branch of instruction, but was appended secondarily to the branches of materia medica and chemistry. The question now arises whether, by the lectures in our school, and by other means tending to create a greater taste for scientific attainment among those who practice our profession, so much advancement has been made, as to warrant the appointment of a practical apothecary to teach in a scientific manner, *what has hitherto, in America and England, been the confused and unsystematized art of Pharmacy* . . . The professor of Pharmacy, if one should be elected, must enter a field of labor scarcely less extensive than that of either of his colleagues in the school, and one which he will have to traverse in the double capacity of teacher and learner. *We look in vain amongst the medical literature of the English language for a single work devoted exclusively and systematically to this branch of knowledge.* To French and German Pharmaciens and books we are indebted for most that is interesting, instructive and original in regard to Pharmacy. The latter are only available to a limited extent in this country, and are not well adapted to our different circumstances . . . We would suggest, that as

> Philadelphia was the first city in the Union to organize a College of Pharmacy, and has continued to be regarded as the metropolis of Pharmaceutical as well as Medical Science in America, it is peculiarly appropriate that this measure, *so imperatively demanded by our present circumstances, and so necessary to an advancement of our profession,* corresponding with the progress of science and general intelligence in our country, should be consummated here.[7]

These two documents, the "address" of 1854 and the "report" of 1846, supplement each other. The one pictures the general situation among the members of the calling who needed to become educated, the other shows the difficulties which the educators had to face in the fulfillment of their task. The conditions within the drug trade around 1850 and for decades afterwards made a scientific basis for the whole of American pharmacy a remote objective, and the situation within the sciences of pharmacy made each American teacher in pharmacy a pioneer in his field. The ostensible motherland of the American people, England, had neglected pharmacy and could offer neither a pattern to be followed nor the means to be used in building up American professional pharmacy. The French and German models and achievements were of too high a standard and too different in spirit to be simply taken over. The step taken by the Trustees of the Philadelphia College of Pharmacy was the more courageous as the report shows that its initiators were painfully aware of the difficulties involved. How large a need they filled and how highly esteemed this instruction in pharmacy proper was, is best illustrated by the following: "The number of graduates (of the Philadelphia College of Pharmacy) in 1868 was 51. There had been an average number annually for the nineteen years preceding the election of Procter to the new chair of pharmacy in 1846 of only 5½, while in the 19 years which followed the average number receiving the diploma annually was 21."[8]

The establishment of the first professorship of pharmacy at the Philadelphia College of Pharmacy had a remarkable prelude. The first man to occupy this chair, William Procter, Jr., as well as the secretary of the college who signed the announcement of this election, Edward Parrish, were graduates of the college. Thus both had experienced the inadequacy of pharmacy "for physicians taught by physicians" as the basis for the professional work of pharmacists. But Parrish had gone a step further. If pharmacy was indeed a special branch of medicine, it had to receive acknowledgment of its independence. As a separate art, it had the right to declare its own standards and to insist on its own curriculum. Only those who mastered its scientific foundations and could demonstrate a complete knowledge of all departments, including its practical applica-

tions, could qualify as teachers. All pharmacists, doctors or any other persons who wanted to practice pharmacy were to be taught by these learned pharmacists. Doctors had not only lost their foothold in the teaching of pharmacy, but were also being told that pharmacists had to teach them, if the physicians had to practice pharmacy. Thus Parrish turned the tables on the medical profession.

> In 1843 he (E. Parrish) purchased the drugstore . . . , adjoining the building of the University of Pennsylvania, which brought him in contact with medical students and their wants. He believed that those who should return to their homes, often in isolated communities, would be without the information that would enable them to compound and dispense medicines for their patients, and that pharmaceutical knowledge was necessary to them, since they would be far removed from prescription drugstores, *still to be found only in the largest towns and cities*. He therefore started a School of Practical Pharmacy in the rear of his building . . . and gave courses of instruction to those who wished to avail themselves of them. Later (1850) . . . the school was removed to a place, where better accommodations were had and instruction was given to both pharmaceutical and medical students.[9]

In 1859 John M. Maisch announced that he had assumed "the position of superintendent of the practical department of Parrish's School of Pharmacy."[10] He promised to teach "twice a week—one and a half hour each . . . all manipulations required in a pharmaceutical establishment" and made known the opening of "a laboratory for practical & analytical chemistry, designed in particular for the wants of pharmaceutists." "For students, sufficiently advanced" Maisch even held out the prospect of "a practical course of toxicological analysis."

This School of Practical Pharmacy, which existed side by side with the new chair of pharmacy of the college, can be considered a parallel to the pioneer instruction in pharmaceutical and chemical laboratory work, given by German apothecaries around 1800 in their capacity of university professors of pharmacy and materia medica or of pharmaceutical chemistry "in the rear" of their pharmacies to students of medicine and pharmacy (see p. 84).

There was a peculiar exchange of duties between Procter, Parrish, and Maisch, all of them equally qualified but with different inclinations, each one complementing the others. Procter was especially interested in theoretical pharmacy, Parrish in practical or experimental pharmacy and Maisch in materia medica, botany, and analytical chemistry. When in 1866 Procter resigned the chair of pharmacy it was filled by Maisch. However, only one year later he and Parrish, who since 1864 had been

professor of materia medica, exchanged chairs. After the demise of Parrish in 1872, Procter returned to his former position which he held until his death on February 10, 1874. In 1870, the professorship of chemistry was the only one at the Philadelphia College of Pharmacy held by a physician.

The separate professorship of theory and practice of pharmacy at the Philadelphia College of Pharmacy was not without an American predecessor. In 1844 the Maryland College of Pharmacy had established such a chair besides another one for chemistry and a third one for materia medica. But, and this was the significant point, the man holding the chair of pharmacy was no pharmacist but like the other two professors, a physician.[11] At the school of the Chicago College of Pharmacy in 1859 and 1860, the lectures on chemistry and material medica were given by two physicians, those on pharmacy by "Dr. Franklin Scammon, a pioneer druggist and botanist."[12] In New York the dual professorship of materia medica and pharmacy was held by physicians until 1861, when John M. Maisch was elected. During its early period (1865-1866) the St. Louis college likewise depended on medical men for the instruction in chemistry and materia medica. The lectures in pharmacy were delivered by "old fashioned, thoroughly qualified pharmacists."

The courses and the students during the first period of the Chicago School of Pharmacy (1850/60) have been described by W. B. Day as follows: "The course continued for twenty weeks. Lectures were given upon three evenings each week, two hours each evening . . . The students were earnest young fellows, employed in drugstores during the day, and though the course was necessarily presented in the briefest manner, they were encouraged to read, study, and experiment, utilizing the opportunities afforded in the shops . . . The teachers possessed the equipment necessary for demonstration of the lectures but there were no laboratories."[13]

Of the courses offered after the erection of the new college building at Philadelphia in 1868 the following account has been given: "The courses of instruction were still given only in the evening—on Monday, Wednesday and Friday evenings, from about October, until the end of February. The school, as from the first day, was set to answer the needs of apothecaries' apprentices . . . Diplomas were given only to persons of good moral character of the age of at least 21 years. They must have attended two courses of each of the lectures delivered in the college, or one course in the college and one course in some other reputable college of pharmacy *or medical school* in which the same branches might be taught. They also must have served out at least four years with a person or persons qualified to conduct the drug or apothecary business." A thesis

had to be presented and after having passed an examination the student received his diploma.

These quotations give a true picture of the scope and quality of professional education enjoyed by that small minority of American pharmacists who before 1870 availed themselves of the opportunity to attend one of the pharmacy schools. Materia medica was one of the most prominent subjects taught in this period. Physics was, if treated at all, treated as an introduction to chemistry. Very likely botany was occasionally treated in like manner as an introduction to materia medica. When Maisch became professor of materia medica in 1867 "the chair was enlarged to comprehend the subject of botany."[14] The instruction was almost exclusively through lectures. The unsatisfactory financial conditions were largely responsible for the lack of laboratory instruction. The fees did not even afford a competence for the teachers, whose main activities, therefore, lay outside of the college. Without endowment the colleges were not prepared to equip laboratories and to maintain them. It is noteworthy that even when the Philadelphia College of Pharmacy in 1868 erected a new building which was remarkable for that period, it did not equip a laboratory immediately. By means of funds collected from the alumni of the college "a pharmaceutical and chemical laboratory for individual instruction" was opened in the new building in October 1870. It was put under the direction of John M. Maisch, the same man who about ten years before had conducted the first individual laboratory instruction for pharmacists and physicians in Parrish's School of Practical Pharmacy.

The era of pioneer pharmacy schools, established by the early pharmaceutical associations called colleges of pharmacy (see p. 178), ended with the Civil War. Until 1864, the year of the foundation of the St. Louis College of Pharmacy, there existed in addition to seven such association schools only one other pharmaceutical educational institution, the Course in Pharmacy of the Medical Department of Tulane University, New Orleans, founded in 1838. From that time on private pharmacy schools were founded either by groups of pharmacists organized only for the purpose of conducting and maintaining such a school, or as part of private or denominational universities and colleges, and finally as divisions of medical colleges.

At that time there existed numerous medical colleges, many of them founded not so much to promote medical knowledge as to further the business interests of the people creating them. "A group of physicians who wished to start a medical school approached a college and asked permission to grant degrees under its charter. Since the medical faculty would not be an expense and might even be financially useful and since the charters of most colleges allowed them unlimited powers, it was

usually easy to obtain this permission. The faculty in these cases considered the school a business."[15]

Whenever these colleges offered courses in pharmacy, as a rapidly increasing number of them did, it was at least questionable whether their departments of pharmacy were created for bona fide pharmaceutical instruction or whether they were really "feeders" for the medical courses. However, the opposition of the men representing professional pharmacy was not directed primarily against inadequacies within these schools; it was based on principle. These men had created and fostered the old colleges of pharmacy in order to make American pharmacy an independent profession and to secure a special education for the pharmacist in the United States. While they were ready to recognize a period of study at a medical college as an equivalent of study at a college of pharmacy (see p. 209), they could not sanction any step which might surrender pharmaceutical education to medical domination, and thus lead the profession back to the situation from which it had scarcely escaped. It was on the occasion of the conferring of pharmaceutical degrees (Doctor of Pharmacy) by the Medical Department of Georgetown College in Washington in 1872, that John M. Maisch wrote:

> We recognize the correlation of medicine and pharmacy, and that the latter, as a separate art and science, is the offspring of the former; but we do not acknowledge their identity, and look upon the conferring of pharmaceutical degrees by strictly medical educational institutions, which by such a precedent, might be inaugurated, with the same favor with which we should regard the attempt of a college of pharmacy to confer the degree of Doctor of Medicine, honoris causa or otherwise.[16] . . . We are earnestly advocating the proper education of the pharmacist, and are in favor of the multiplication of colleges of pharmacy, but not to an indefinite number, which would be fraught with results similar to those which the medical profession throughout the country is endeavoring to correct.[17]

It is understood that the private schools, depending partly on the approval of the practicing druggists who functioned as their trustees and financial supporters, and always on the fees of their students, developed pharmaceutical education along the same lines as did the old line colleges. Any noteworthy change, gradually influencing the entire educational system in American pharmacy, could, therefore, not be expected from private institutions.

Before the laboratory of the Philadelphia College of Pharmacy was opened, another school of pharmacy started its career, placing the pharmaceutico-chemical laboratory in the foreground of its instructional

program. This school was the University of Michigan School of Pharmacy, organized in 1868 within the chemical laboratory and given the status of an independent department of the University on December 29, 1876. Thus was introduced pharmaceutical education by the state, which was highly unpopular within the pharmaceutical circles of that period.

2. *State Institutions*

As early as 1847, William Procter, Jr., in his introductory lecture as professor of pharmacy, stressed the necessity of state-controlled practice of medicine and pharmacy as follows: "It is a characteristic of our national and state governments to interfere as little as possible with the working of private interests, and competition is left unimpeded to control the business affairs of society. This liberty of action, so advantageous in the common intercourse of men, is unfortunate in reference to medicine, which, as no guarantee of qualification is required by law of its practitioners, is thrown open to any individual who chooses to adopt the title of doctor or apothecary, be he ever so ignorant."[18]

The first model law, copies of which were sent by the American Pharmaceutical Association to the state governments as a pattern for their pharmaceutical legislation, owed its origin primarily to John M. Maisch (see p. 199), and it was he who fostered the establishment of state pharmaceutical associations in order to induce and enforce pharmaceutical state legislation. Hence, at first sight it seems incredible that Procter and Maisch should have opposed the elevation of educational standards by the state. But they did and were ardent in their opposition. The explanation is to be sought in the fact that the educational ideology of the older colleges was based on the apprenticeship system. The evening schools of these colleges resembled the German "Fortbildungs anstalten" (continuation schools). The course offered by the University of Michigan, however, ignored the apprenticeship as a preliminary to college education. In other words, it represented a totally different educational ideology. The colleges, having insisted on educational independence from the medical profession, and having opposed the resumption of pharmaceutical education by colleges of medicine, did not wish to accord the state university the privilege of intrusion in the field which pharmacy claimed for its own.

The paper on pharmaceutical education, which A. B. Prescott, "Professor of Organic Chemistry and Pharmacy in the University of Michigan," read before an unwilling audience at the St. Louis meeting of the American Pharmaceutical Association in 1871[19] was proof of unusual personal courage as well as a remarkable piece of pharmaceutical literature. With brevity and admirable clarity Prescott explains the advan-

tages of a real scientific education including ample laboratory work for the adept of pharmacy, and he gives his reasons for his conclusions concerning the insufficiency and the lack of necessity of preliminary apprenticeship. These reasons are met with again and again—in the frequent discussions of the same question in almost all European countries within the past century—a fact which confirms their basic logic and value. The different nations found different solutions. Italy demands store practice (1 year) after study (see p. 53). France requires one year of apprenticeship before study, but only with a pharmacist authorized to take apprentices (see p. 65). Germany requires two years apprenticeship with an authorized apothecary before study and a year of probation after (see p. 76). In England the aspirant has to serve an indentured apprenticeship of 4,000 hours if preparing for the Chemist & Druggist examination, and of 2,000 hours if preparing for the Pharmaceutical Chemist examination, either before or after the required preliminary scientific courses, but before the professional instruction (see p. 102). Finally Switzerland compromised between the argument that the apprenticeship cannot be utilized intelligently without scientific knowledge and the contention as to the necessity of practical store experience before the professional courses by dividing the 3½ years of university study into 1½ years of general science (general chemistry, physics, biology, etc.) and 2 years of professional scientific instruction. Between these two phases of academic study the obligatory apprenticeship of 1½ years is required.

However, all of these regulations, no matter how much they vary, have one important point in common. None of them provides a pharmaceutical certificate serving as evidence of a completed pharmaceutical education without some practical store experience. The remarks made by Maisch about the paper of Prescott might, therefore, have just as well been written in essentially the same phraseology in each country of the civilized world on a similar occasion:

> We grant that as much knowledge in physical and chemical science, and natural history generally, as a young man may possibly acquire before he enters a drugstore, is extremely desirable; but we believe that with all his knowledge of chemistry, natural history, and natural sciences generally, he will not be a pharmacist until he has gone through a regular system of training, and that is exactly where the colleges of pharmacy throughout the country differ from the University of Michigan. . . . *The colleges are not discouraging preliminary education before the apprentice enters the apothecary business; but what we insist upon is that it is wrong to give a pharmaceutical degree before the graduate has had pharmaceutical experience.*[20]

Under these circumstances the American Pharmaceutical Association merely did its duty in not recognizing the School of Pharmacy of the University of Michigan as a "college of pharmacy within the proper meaning" of the constitution and by-laws of the American Pharmaceutical Association; "it being neither an organization controlled by pharmacists nor an institution of learning which, by its rules and requirements, insures to its graduates the proper practical training, to place them on a par with the graduates of the several colleges of pharmacy represented in this association."[21]

The report on the first graduates of the University of Michigan School of Pharmacy shows indeed that non-pharmacists availed themselves of the opportunity to enter the course without practical pharmaceutical experience: "Of the 23 who graduated in the literary department as Pharmaceutical Chemists 13 were medical students, of which 12 graduated as M.D.'s. The pharmacy work was not taken preliminary to the medical work *but along with it.* . . . Of the 23 graduates of 1869 seven were in the practice of medicine and the majority of the remainder in the practice of pharmacy after graduation."[22]

It is very interesting that the second State University School of Pharmacy, founded 15 years later, i.e., in 1883, although following and even competing with Michigan in its scientific emphasis, remained within the old lines in its relationships to the practice of pharmacy. The reason for this different attitude is to be found in a comparison of the circumstances under which the first two American state university schools of pharmacy were founded. The design of the older one was a bold revolutionary attempt at the beginning of the reconstruction after the Civil War, while the younger one was a product of evolution within this period.

The Michigan school was the outgrowth of a course of pharmacy, which "when first established was by no means mainly designed for students looking forward to the practice of pharmacy. . . . In 1860 the design was more for students of medicine, to give them help in handling medicines when they should come into practice, but it was quite as much intended as general practical training in applied science."[23] This school was started without the co-operation of the pharmaceutical practitioners, who in fact were definitely opposed to the idea. This took place 6 years before the foundation of a state pharmaceutical association in Michigan and 17 years before a Michigan pharmacy act was enacted. The Department of Pharmacy at the University of Wisconsin was established by legislative act upon special request of the druggists of the state assembled in an annual meeting of their state association three years after the foundation of this association and one year after the enactment of a Wisconsin pharmacy law. Thus Dr. Frederick B. Power, the first leader

of the University of Wisconsin School of Pharmacy had to take into consideration the established pharmaceutical forces and follow the evolution to which his institute owed its existence. Unlike Dr. Prescott of Michigan, Dr. Power came himself from the ranks of practical pharmacy, and was a graduate of and later on a teacher at the Philadelphia College of Pharmacy. He recognized the desire of the pharmacists not to lose the identity between the concept "pharmacy" and the "store" by allowing the awarding of a pharmaceutical degree to persons without store experience. He made this experience a requirement for a diploma, although not necessarily a pre-requisite for admission to the course.

The problem of dealing equably with the sciences and the practice of pharmacy was solved through the development of the state board examinations. By this method the pharmaceutical practitioners took upon themselves the responsibility for appraising the practical experience and knowledge of the candidate. The requirement that a candidate for a license have store experience before taking the state board examinations made it unnecessary for the schools to require this experience for graduation. With the raising of the academic instruction in pharmacy to a systematic approach to the sciences concerned, corresponding to the needs of practical pharmacy but not dependent upon them, the University of Michigan took the first step in the direction of a new educational policy. Soon after the School of Pharmacy of the University of Wisconsin took an even more significant step by substituting full-time day instruction for the old time evening courses besides making intensive laboratory work obligatory. Gradually other schools followed suit. Yet the state university continued to lead in reforms. It was the first, for example, to establish even modest entrance requirements. In Dr. Prescott's announcement of the first course to be given at Michigan, the course is said to comprise "lectures in inorganic and organic chemistry, materia medica and principles of pharmacy; with laboratory courses in qualitative analysis, toxicology, analysis of urine, volumetric analysis, and a somewhat extended course in pharmaceutical operations. Also class exercise in botany."[24] Quantitative analysis and organic analysis were optional until 1872 when they were added to the list of required subjects. Botany was optional until 1873, when it also was made obligatory. Microscopic botany, first offered as an optional course in 1875, has been required since 1876. This was a comprehensive and for that time an exemplary program. Like the study of medicine at Michigan the course was covered in two years each consisting of two terms of three months each.

Wisconsin started with a similar program, offering a course of two years each consisting of two terms of three months each, which was extended in 1892 to two full academic years of three terms each. In the

same year the University of Wisconsin School of Pharmacy made another innovation. In addition to the 2 years minimum course, under its new head, Dr. Edward Kremers, it offered the first four-year course in pharmacy in America, thus placing pharmaceutical instruction on a par with the other academic courses. This innovation was not achieved without opposition. Like all ideas which are ahead of the times, its worth was not immediately apparent. And so it had to run the gauntlet before recognition could come. At first it was ridiculed. Then reluctantly, here and there, it was imitated. Finally, it was generally adopted. The first school to respond enthusiastically was Ohio State University where the freshman class, entering in 1925, faced four years study before they could receive their pharmacy degree. The University of Minnesota followed with the same requirement in 1927.[25] So far as the National Association of Boards of Pharmacy and the American Association of Colleges of Pharmacy are concerned, the two-years' course common at the turn of the centuries was first demanded. After 1925 the three-years' course was demanded as prerequisite and since 1932 the four-years' course.

Finally it was the School of Pharmacy of the University of Wisconsin which in 1913 founded the first "Pharmaceutical Experimental Station" in the United States thus demonstrating the possibilities and usefulness of academic pharmaceutical research. The experiences gained by this Station are not to be the property of some individual concern but it is the Station's statutory duty to serve the public at large. The work of this first American institution of this kind found endorsement and promotion by the legislature.

Another progressive step taken by the state universities, particularly Wisconsin, was the introduction of studies designed to prepare students for the degree of Doctor of Philosophy. This was an objective considerably higher than the degree of Doctor of Pharmacy, which had been cheapened by a few schools. Students now were to receive their doctorate after having completed the regular university requirements with a major in pharmaceutical subjects.

The state universities did not spring up haphazardly in the states cut out of the old Northwest Territory; but were founded in accordance with the Ordinance of 1787 (see p. 170). It was only natural that the Michigan example of a pharmacy school as a department of the state university, should be first followed by the other states of the old Northwest Territory. Furthermore these new pharmaceutical state institutions became the models for similar ones which have sprung up in the enormous area west of the Mississippi and elsewhere. The following table shows the order in which the schools of pharmacy were founded:

LIST OF COLLEGES AND UNIVERSITIES OF THE UNITED STATES GIVING A PHARMACY COURSE. ARRANGED ACCORDING TO DATE OF ORGANIZATION OF PHARMACY COURSE.[26]

1821—Philadelphia College of Pharmacy and Science
1823—Massachusetts College of Pharmacy (No course given until 1867.)
1829—Columbia University
1838—Tulane University of Louisiana
1840—University of Maryland
1850—Cincinnati College of Pharmacy
1859—University of Illinois
1865—St. Louis College of Pharmacy
1866—Medical College of Alabama†
1867—University of Michigan*
1868—Howard University
1870—Louisville College of Pharmacy
1872—University of California
1872—George Washington University
1874—Medical College of the State of South Carolina
1878—University of Pittsburgh
1879—Vanderbilt University†
1881—Albany College of Pharmacy
1882—Western Reserve University
1883—University of Wisconsin*
1884—Purdue University*
1884—Ohio Northern University
1885—University of Iowa*
1885—Ohio State University*
1885—University of Kansas*
1885—Kansas City College of Pharmacy*
1886—University of Buffalo
1888—South Dakota State College*
1890—Meharry Medical College
1890—Highland Park College†
1890—Detroit Institute of Technology
1891—Brooklyn College of Pharmacy
1892—Valparaiso University
1892—Rutgers University
1892—University of Minnesota*
1892—State College of Washington*
1893—Medical College of Virginia
1893—State University of Oklahoma*
1893—University of Texas*
1894—University of Washington*
1895—Alabama Polytechnic Institute*
1897—University of North Carolina*
1898—University of Tennessee*
1898—Oregon State Agricultural College*
1898—University of Notre Dame
1900—Creighton University
1900—Loyola University
1901—Baylor University†
1901—Temple University
1902—North Dakota Agricultural College
1902—Rhode Island College of Pharmacy
1903—Southern College of Pharmacy
1903—University of Georgia
1904—Indianapolis College of Pharmacy
1905—University of Southern California
1907—University of Montana
1908—University of Mississippi
1908—University of Nebraska
1908—North Pacific College of Oregon
1911—University of Colorado
1911—Fordham University
1914—West Virginia University
1918—University of Idaho, So. Branch
1923—University of Florida
1924—University of South Carolina
1925—Duquesne University
1925—Connecticut College of Pharmacy
1925—College of the City of Detroit
1927—Des Moines College of Pharmacy
1929—St. John's University

* State University Schools established before 1900.
† Discontinued.

The state university pharmacy schools doubtless set a standard which has gradually found general acknowledgement and finally became obligatory for all pharmaceutical educational institutions desiring to be recognized by the American Association of Colleges of Pharmacy and later by the American Council on Pharmaceutical Education. This council consists of representatives of the American Council on Education, the American Association of Colleges of Pharmacy, the American Pharmaceutical Association and the National Association of Boards of Pharmacy. Last but by no means least, the very fact that the state university pharmacy schools gave the students of pharmacy an opportunity to participate in academic life on the campus placed not only them but pharmacy as a

calling in the cultural sphere to which it belongs. More and more private colleges of pharmacy sought and secured affiliation with universities and in this way offered to students and teachers an open door to broader intellectual opportunities. Even those colleges which were so proud of their traditional independence, that they did not want any affiliation, followed the general trend, although in another way. The Philadelphia College of Pharmacy, for example, responded to the challenge by remodelling the structure of the school, adding courses of purely scientific character and developing into "a great specialized scientific school. In token of the extension of its activities, a new charter was secured in 1920, and the name of the corporation was changed to the Philadelphia College of Pharmacy and Science."[27] Thus the old guardian of pharmaceutical independence, the representatives of which had so ardently protested against the first attempt to expand the concept of pharmacy, capitulated honorably before the spirit of a new time.

It has been the task of the Pharmaceutical Syllabus Committee, founded in 1910 and consisting of representatives of the American Association of Colleges of Pharmacy, the National Association of Boards of Pharmacy, and the American Pharmaceutical Association, to achieve, maintain, and watch over the unification of the curricula of the schools and to adapt these to the actual requirements of time and circumstances. The first Pharmaceutical Syllabus was published in 1910. In 1939 the curriculum of the colleges of pharmacy comprised: theoretic and applied pharmacy, biological sciences (including bacteriology, botany, pharmacognosy, pharmacology, physiology, zoology, public health and first aid), basic and applied chemistry, physics, commercial subjects, English, modern foreign language, mathematics, and other cultural subjects, more particularly the history of civilization and the history of pharmacy.

3. Special Educational Instrumentalities

Before the passage of pharmacy laws (see p. 200) requiring an examination as a prerequisite for a pharmacy license, the desire for knowledge and the student's belief in the value of systematic instruction under the guidance of qualified teachers was, no doubt, the decisive factor inducing college attendance. The new laws asked of all pharmacists some knowledge although without stating how and where this knowledge was to be obtained. If the passing of the state board examination was all that the applicant wanted, was there not another and easier way than the toilsome one offered by the colleges of pharmacy?

The new pharmacy laws were not retroactive. They recognized and registered the druggists in business at that time, without an examination, just as the boards of medical examiners had recognized the old medical practitioners as physicians. The consequences which arose from

this practice may be illustrated by the following report concerning such a recognized physician and druggist as late as 1896: "In Bay City, Michigan flourished for some years a practicing physician by the name of O. Barber, who is also a retail druggist. Recently, Dr. Barber had a case of diphtheria which he failed to report. For this oversight he was overhauled by the Health Board and the matter brought into court. To the amazement of that body and probably to the horror of his patients he gave testimony that he could neither read nor write."[28]

That was, naturally, an extreme case. But pharmacists with professional education were rare and it was at times difficult to find competent examiners within the ranks of the pharmaceutical practitioners. The example of West Virginia is characteristic. When this state first required some pharmaceutical qualifications before allowing a person "to run a drugstore"[29]—law of 1877—, the applicant had to present "a certificate from two practicing physicians of good standing." Even when in 1881 the first West Virginia Pharmacy Act was issued, the legislators did not dare to require a college education even of the examiners. They only had to have "five years experience in a drugstore." Of the 326 pharmacists registered during the next two years after the passage of the act mentioned, only two were college graduates. "In 1882 the West Virginia Board of Pharmacy consisted of three members and the list of questions was sent by mail to a local notary public. The applicant had to appear before this man and was given a limited time to answer the questions, after which the papers were sent back to the secretary of the Board."[30]

To meet the requirements under such conditions did not require a lengthy period of study. As a matter of fact, another kind of preparation, restricted to a knowledge of questions commonly asked in the state board examinations, promised better success. It is not surprising therefore that very soon different ways of preparation were offered to all who wanted them, viz., instruction: (1) by correspondence, (2) by home study of books especially written for this purpose, (3) by so-called cramming schools.

Correspondence Schools. Possibly the most serious instruction by correspondence was given by the well-known National Institute of Pharmacy in Chicago, the commercial management of which was administered by the publisher of the "Western Druggist," G. P. Engelhard of Chicago. In a series of 24 lectures, covering a period of one year, a complete course in pharmacy, chemistry, and materia medica was given. The main purpose of the institute, as explained in the announcement inviting subscribers for the course in 1886 and 1887, was to enable clerks, assistants, and druggists engaged in business and contemplating a removal "to another state having a pharmacy law . . . to cover the most ground in the least possible time (an important advantage when

preparing for a Board of Pharmacy examination)." An examination consisting of answers to a series of questions sent to the applicant, brought the student "a certificate of graduation in the institute." The announcement however denied, any intention, to give this certificate "any legal force whatever under pharmacy laws, the great advantage in this respect to be derived from the lectures being to qualify members for passing Board of Pharmacy examinations."

This institute in fact was closely affiliated with the faculty of the Chicago College of Pharmacy. At the time of its foundation, in 1885, the instructor in materia medica, Edson S. Bastin, was at the same time a teacher at the Chicago College of Pharmacy, while the director of the course, Carl S. Hallberg, in 1885 was editor of the "Western Druggist," and was in 1890 elected to a professorship in the college. Charles B. Gibson, the instructor in chemistry and physics, was a member of the faculty of the University of Illinois College of Medicine. In 1890 Frederick B. Power, at that time director of the Pharmacy Department of the University of Wisconsin wrote the lectures on chemistry and physics. It is understood that an undertaking, directed and supported by such men, did good work and achieved the best results which were possible within fixed limits. It is remarkable that the business managers of the Institute who were identical with the authors of the lectures, explicitly refused "to fall short of enough" because that would "lead the student by false hopes, such as those born of delusive 'quiz compends' and other 'short cuts' to a 'failed board examination' " (announcement 1906-7). There were naturally other and less ambitious correspondence schools. In 1906 J. H. Beal expressed the opinion of most of the official representatives of scientific and professional American pharmacy as follows: "In so far as these agencies have honestly striven to raise the standard of education among drug-clerks and to promote habits of study and self-help, they should have our commendation; but any proposition or suggestion to the effect that any course of instruction by mail, is or can be made to be the equivalent of a residence course of instruction at a respectable college of pharmacy is false absolutely, and stamps those who make such claims as guilty of misrepresentation and attempted fraud."[31]

Mention must also be made of a very peculiar "Post-Graduate Correspondence Course in Pharmacy," offered by an institute likewise located in Chicago, the Lincoln-Jefferson University. This establishment, naming itself after two of the greatest Americans, offered all men or women who were registered pharmacists or graduates of a college of pharmacy, the diploma of "Doctor of Pharmacy." Ambitious people who were not registered or who had not graduated were offered a preliminary course. The candidate had to pass an examination on "ten large lessons for-

warded by mail." The original fee of $100 was later reduced to $65, "cash in advance." According to the announcements of this correspondence university, "the diplomas are large and beautiful, bearing no statement that the work was done by correspondence." This course was discontinued in 1926.

Home study books, especially written for this purpose. The best known representative of this type of literature is that of Oscar Oldberg. Its very title reveals its purpose: "A course of home study for pharmacists." The first edition was published in 1891. It is very significant that this method of preparation to meet the state board of pharmacy requirements had its origin at the same place as the National Institute of Pharmacy in Chicago. Like Hallberg, the founder of the National Institute, Oldberg was of Swedish origin. Oldberg had preceded Hallberg as a teacher at the Chicago College of Pharmacy. He had left in 1886 with a group of dissenting members, to organize the Illinois College of Pharmacy, of which he became the Dean. This school was affiliated with Northwestern University. Oldberg worded his preface very carefully. He emphasized the fact that "no course of study at home takes the place of a good college with its experienced teachers and its invaluable laboratory practice." At the same time he pointed out that of 75,000 persons employed in the drugstores of the United States "only a few thousand have enjoyed the advantages of a college of pharmacy education." He therefore recommended "home study" as being "of the highest importance to those who are prevented by circumstances from entering college . . . The pharmacy laws, too, oblige many thousands to study at least enough to pass the State Board examinations." In the same year in which the first edition of this "Home Study" was published, the Department of Pharmacy of Northwestern University took up "the work of applying the principles of University Extension by conducting an elementary or preparatory course of home reading in physics, chemistry, materia medica, and pharmacy"[32] or, in other words, instruction by correspondence. Whereas in Hallberg's course the lectures were sent to the students one at a time, in Oldberg's course the entire subject matter was placed in the hands of the student at the beginning. He was guided from time to time by receiving a set of questions from the instructor. The Home Study had been preceded in 1885 by the same author's "Outline of a Course of Study in Practical Pharmacy," in which a special order was recommended for "students who are reading pharmacy without the aid of a teacher."

Another remarkable collection of lectures for home study, or, to quote the words of the editor, "the most liberal opportunity yet offered to those who have not had the advantages of a college course, . . . to those who are preparing for examinations" etc., is that published as a

series of articles, under the title "The Study of Pharmacy" in the Pharmaceutical Era, volumes 13 and 14 (1895-96). In addition the same journal published series of questions and awarded prizes to those who sent in the best answers.

Cramming Schools. If the prime intention of the correspondence schools, and of the home study books and similar attempts was to prepare for the state board examination, some of them also endeavored to impart a better understanding of the subject matter to their students. But this can scarcely be claimed for any of the so-called cramming schools. Possibly without exception their objective was the preparation of their students for the state board examinations by cramming their brains with answers to commonly asked questions in the least possible time. These schools naturally used the "quiz compends" which had been prepared for college courses. In addition they made extensive use of the questions of state boards published in pharmaceutical journals. These cramming schools survived even the prerequisite laws, which made college graduation in pharmacy a prerequisite to examination by state boards of pharmacy. They were given a new lease on life because of the continuation of the examination of a kind of second-class licentiates recognized legally as assistants, "licensed druggists" (New York) or some other designation. These, like the former "minor" are hold-overs of early legislation. There is a movement on foot to abolish these second-class certificates entirely. If in a state in which such a cramming school existed, the "assistant" was disposed of by legislative act, the school moved to a more favorable location where this advanced legislation had not yet been enacted.[83]

In his capacity as Secretary of the National Association of Boards of Pharmacy, H. C. Christensen estimated the number of registered assistants in the United States in 1936 as being between 10,000 and 15,000. He also published the following summary of statistical statements, compiled by Secretary Baker of the Colorado State Board of Pharmacy:

> Six states have never provided for assistant: Arkansas, Florida, Georgia, Nebraska, New Mexico, and Washington, D. C.—Twenty states that do provide for assistant and which have not eliminated that grade: California, Colorado, Connecticut, Delaware, Idaho, Illinois, Massachusetts, Mississippi, North Carolina, North Dakota, Pennsylvania, Washington, West Virginia, Wisconsin, Wyoming, Louisiana, New Hampshire, Nevada, Oklahoma, Maine. Twenty-two states that did provide for assistants and which have eliminated assistant pharmacists: two states that automatically made the assistant a registered pharmacist without examination: Tennessee, Iowa (Iowa automatically at 21 years of age); four states that

allowed existing assistants to take registered pharmacist examinations with no restrictions: Kansas, South Carolina, South Dakota, Virginia; three states that allowed no examinations for full registered pharmacist by virtue of being an assistant pharmacist: Minnesota, Montana, Vermont; eleven states that allowed assistant pharmacists to take full registered pharmacist examinations with time requirement: Alabama, Arizona, Indiana, Kentucky, Maryland, Michigan, New Jersey, New York, Ohio, Oregon, Texas; two states that allowed assistant pharmacists to take full registered pharmacist examinations with graduation requirement: Missouri, Rhode Island.[34]

Professional continuation study. In recent years several attempts have been made toward more or less regular professional instruction of pharmacists engaged in business. Some colleges are giving evening lectures occasionally or at definite intervals, which are accessible to all pharmacists residing within the respective districts, usually on the payment of a fee covering the expenses. Another more comprehensive plan is pursued by the Philadelphia College of Pharmacy with an annual course called "Seminar on modern pharmaceutical practice," lasting three days and consisting of a series of lectures and classroom demonstrations. The seminars can be attended by graduates of any recognized college of pharmacy.

An entirely new and progressive kind of regular pharmaceutical continuation study was initiated in 1937 upon the initiative of Sylvester H. Dretzka, Secretary of the Wisconsin State Board of Pharmacy and is being conducted under the auspices of the Board. By utilizing a state educational institution, the Wisconsin State Board of Vocational Education, Dretzka has secured for his enterprise the support and cooperation of the state. An itinerant instructor has been appointed whose salary and traveling expenses are paid by the Wisconsin State Board of Vocational Education out of the federal allotment for distributive education, pharmacy being recognized as a distributive occupation in the meaning of the George-Deen Act, the legal basis of these allotments. It is possible to cover the entire state and thus to reach and instruct the largest number of Wisconsin pharmacists. A direct contact between practical pharmacy and state authorities being thus established, in Wisconsin the State Board of Pharmacy acts in an advisory capacity to the State Supervisor of Distributive Education and the State Trade and Industrial Education Coordinator in helping to set up the program.

The instruction is in charge of a pharmaceutical circuit teacher who at the present time serves eight cities regularly. He visits each city group every two weeks for one day and is occasionally aided by guest lec-

turers. The pharmacists are being informed on all kinds of new developments in the science and practice of their profession.

4. Prerequisites and Degrees

In 1870 when the Conference of Colleges of Pharmacy was organized, it did not venture to establish any fixed standards for candidates entering the practice of pharmacy. It was pointed out only that the pharmacists should insist on a better educational background in selecting assistants for their shops. Although some institutions, more especially university schools of pharmacy, demanded high school graduation as a requirement for admission during the eighties and nineties of the past century, a person with only a grammar school education or even less could enter most of the colleges of pharmacy in the United States until the beginning of the 20th century.

It was not until the session of 1908-09 that, according to a resolution of the American Conference of Pharmaceutical Faculties, "a satisfactory completion of at least one year of work in an accredited high school or its equivalent" was made an obligatory prerequisite for entrance to one of the colleges belonging to the conference, "providing, however, that said requirements shall not apply to matriculants who are bona fide residents of the states of Alabama, Arkansas, Louisiana, Mississippi, Texas, Arizona, Colorado, Idaho, Nevada, New Mexico, Utah, Wyoming, and Missouri."[35] In 1920 the one-year requirement was changed to two years, and finally in 1923 graduation from a recognized high school became the obligatory entrance requirement of the colleges belonging to the Association. Somewhat later many states made it a legal prerequisite.

In a little more than one decade, between 1920 and 1932, American pharmacy finally caught up with European standards attained about a century before. Within this short time the united endeavor of the American Pharmaceutical Association, the American Association of Colleges of Pharmacy and the National Association of Boards of Pharmacy placed American pharmacy, so far as education is concerned, on a recognized academic basis and has made it equal to the best European patterns. However, before this progress could become effective for the whole of American pharmacy this college standard had to be made a prerequisite of state board examinations and licensing. It is only through this legal requirement that better and more uniformly educated pharmacists can be guaranteed.

"The enactment by New York State in 1904 of a law requiring that all applicants for registration as licensed pharmacists appearing before the State Board of Pharmacy after January 1, 1905, shall be graduates in pharmacy gives to New York the credit of being the first state in the

Union in which such a requirement has been put into force."[36] Pennsylvania followed in 1906. The other states remained inactive until 1915, when North Dakota and Washington enacted prerequisite laws. Illinois and Ohio followed in 1917. Up to January 1, 1921 there were prerequisite laws in 17 states.[37] Progress was necessarily slow. At present, however, similar laws have been enacted in the majority of states.

The question of what degree, if any, should be awarded to graduates of schools of pharmacy has revealed many divergences of opinion. The Philadelphia College of Pharmacy, having started its career by protesting against the Master of Pharmacy, offered by the University of Pennsylvania, was at first somewhat shy of titles. At that time the self-styled "doctors" swarmed beyond the doors of the educational institutions of the country and the English "apothecary" had become a misleading designation (see p. 93). "Our diploma," said the president of the College, Daniel B. Smith, in 1829, "bestows no title, for it was the design of the college to avoid any name, which may hereafter acquire a peculiar meaning and become the designation of a new class analogous to the English apothecary. In attempting to avoid this danger, it has committed what may be considered a blunder by establishing a distinction without giving it a specific name."[38] Thus the diplomas of the college, the first of which were issued in 1826, declared the successful student "to be a Graduate in the Philadelphia College of Pharmacy." This simple confirmation of graduation did not prove to be a blunder, as had been apprehended. For more than a century the "Graduate in Pharmacy" became the modest but significant title of most of the graduates of American colleges of pharmacy. True, several other degrees were bestowed upon the graduates from time to time, but none of them was generally accepted.

Not infrequently colleges offered higher degrees to their regular graduates because of competition. Thus the doctor's degree was offered as a "drawing card" by some colleges. The general wavering in this matter may be exemplified by the practice of the Philadelphia College of Pharmacy. This dignified institution introduced the once disdained Master of Pharmacy as a postgraduate degree in 1875,[39] revived this title as a "course" degree in the beginning of the 20th century and has since 1886 used it as an honorary degree. "In 1895 the 3-year course leading to the degree of Doctor in Pharmacy (P.D.) was instituted and was continued to 1915, when it was replaced by a 2-year course leading to the degree of Graduate in Pharmacy (Ph.G.) . . . In the fall of 1916, the college provided a post-graduate course of approximately 1400 hours leading to the degree of Pharmaceutical Chemist (Ph.C.) . . . ; it was based upon the 2-year course and a general education of

four years of high school study. The degree of Phar.D. was conferred in 1917-18, but not thereafter . . . In 1917 the college planned a post-graduate year of approximately seven hundred hours, leading to the Bachelor in Pharmacy."

In 1915 the School of Pharmacy of Northwestern University offered a one-year course leading to the degree of Graduate in Pharmacy. The degree of Pharmaceutical Chemist was awarded after a second year of study. Before the 19th annual meeting of the American Conference of Pharmaceutical Faculties in Chicago in 1918, A. Koch delivered the following report: "The Ph.G. degree is conferred by 39 institutions for a two-years' course; the Ph.C. degree by 32 schools for a three-years' course, and by one school after 4 years; the degree of Bachelor of Science in Pharmacy by 20 schools for a four-years' course, by one for three years and by one for two years; the Doctor of Pharmacy degree by three schools for three years, by one for four years, by three schools for six years and by one for a seven-years' course. The Master of Pharmacy degree is conferred by one school for three years, and the Master of Science in Pharmacy by three schools for a 5-years' course."[40]

The first official statement of the American Conference of Pharmaceutical Faculties as to degrees was adopted in 1913 and required "for the degree of Graduate in Pharmacy a minimum course of 1200 hours." In 1924 the by-laws refer for the first time to the Doctor in Pharmacy, asking as "the minimum requirement" for "at least a four-year college of pharmacy course." In 1937 the Graduate in Pharmacy degree disappeared from the by-laws of the American Association of Colleges of Pharmacy and thus became a matter of history. The degree of Doctor of Pharmacy, for work in course, disappeared after July 1, 1938. Now the American colleges of pharmacy uniformly award the following degrees: Bachelor of Science (B.S.) or Bachelor of Science in Pharmacy (B.S. in Pharm.) for the completion of the four-year course, and the degrees of Master of Science (M.S.), Master of Science in Pharmacy (M.S. in Pharm.), Doctor of Philosophy (Ph.D.) or Doctor of Science (D.Sc.) in accordance with the general requirements of standard graduate schools.

At the end of 1939 there were in the United States 67 regular colleges of pharmacy, of which 61 had made application for accrediting by the American Council of Pharmaceutical Education. The other six were expected to follow in the near future.[41] The growth of uniformity in prerequisite requirements and professional education has enabled the National Association of Boards of Pharmacy to pursue and to achieve in large measure another aim: the mutual recognition of state board examinations all over the country, thus removing, at least pharmaceutically, the boundaries between the individual states. In 1939 reciprocity

in pharmaceutical registration was practiced by all states with the exception of California and New York.

American pharmaceutical education has now reached the uniformity of conditions and the adequacy of standards which guarantee satisfactory educational activity and an easy adaptation to changes required by further progress in the science and the practice of pharmacy.

PRACTICAL PHARMACY:

THE ARRANGEMENTS,

APPARATUS, AND MANIPULATIONS,

OF THE

PHARMACEUTICAL SHOP AND LABORATORY.

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EDITED, WITH EXTENSIVE ADDITIONS,

BY

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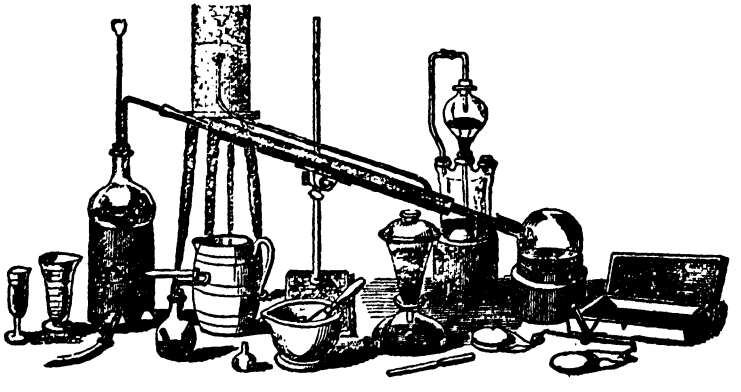
ILLUSTRATED BY FIVE HUNDRED ENGRAVINGS ON WOOD.



PHILADELPHIA:

LEA AND BLANCHARD.

1849.

FIGURE 17. Title-page of the first edition of "Practical Pharmacy," the first pharmaceutical text-book adapted to the needs of American students.
(Mohr's first name here erroneously given as "Francis" was "Carl Friedrich.")

15

THE ESTABLISHMENT OF A LITERATURE

PHARMACOPOEIAS, DISPENSATORIES AND FORMULARIES

1. European Books Used in the United States

THE books on materia medica used by early American physicians and the formularies which served as guides to the pharmacists previous to the publication of the first United States Pharmacopoeia might readily be surmised even if there were no substantial evidence. Most of the early American-born physicians who were educated at all, received their education at the medical schools of Edinburgh or London. After returning to their native country, they became the founders and instructors of the American medical schools and it was, naturally, the medicine taught in the British Isles and the literature used there which they conveyed to their pupils.

Reports of the libraries of medical societies, of physicians, and druggists previous to 1820 mention especially the pharmacopoeias of London and Edinburgh. The pharmacopoeia of Dublin (Ireland), first published in 1807, seems to have been used more by the compilers of the later American pharmacopoeias and dispensatories than by the practitioners. The New York Academy of Medicine owns a copy of the 1790 London Pharmacopoeia with the inscription "Ephraim Eliot 1798." The original owner was a Boston druggist. The catalogue of the old New York Hospital Library for 1818 lists one London and two Edinburgh pharmacopoeias.[1] The original Boston Medical Library had the Edinburgh pharmacopoeia of 1804 listed in a printed catalogue of 1806, and a London pharmacopoeia of 1809 listed in a manuscript catalogue of about 1810.[2] In the Catalogue of the Library of the Massachusetts College of Pharmacy of 1829 the following European pharmacopoeias and dispensatories are listed: Edinburgh Pharmacopoeia of 1803, Edinburgh Dispensatory (in the catalogue erroneously called pharmacopoeia), edited by Lewis in 1748, Edinburgh Dispensatory, edited by Rothnam in 1794, London Pharmacopoeia of 1809, London Dispensatory, edited by Pemberton in 1794, New Dispensatory, edited by W. Lewis in 1781, Fuller's Pharmacopoeia of 1719, James' Dispensatory, Salmon's Dispensatory. In the preamble to the resolutions on the subject of an American Pharmacopoeia, adopted by the New York State

Medical Society on February 4, 1818[3] the statement is made that various pharmacopoeias were in use "in the different sections and States of the Union such as: the Edinburgh Dispensatory, the London Dispensatory, the London Pharmacopoeia, the Dublin Pharmacopoeia, the Parisian Pharmacopoeia." This list which also mentions the few formularies issued in America between 1806 and 1818, makes no pretense at completeness and the omission of the Edinburgh Pharmacopoeia was surely not a deliberate one. However, the fact that the Edinburgh Dispensatory was mentioned and not the pharmacopoeia on which the dispensatory was based reveals clearly the fact that in America the dispensatories which combined the pharmacopoeial text, explanatory comments, and additional material, were much more in practical use than the pharmacopoeias themselves. This was true not only in early American medicine and pharmacy but until about the last third of the 19th century.

That the Paris Pharmacopoeia should be mentioned by the New York State Medical Society as one of the European books used in certain sections of the United States, illustrates the influence which French pharmacy exerted in America at that time. In addition pharmacopoeias and dispensatories of German origin as well as Italian, Dutch, and Swedish pharmaceutical standards were used by practitioners who had immigrated from their native countries to the United States. This fact added to the already confusing number of formulas. However, it did not detract from the dominance of English pharmacopoeial literature.

2. Early Attempts at the Establishment of an American Pharmacopoeia

Philadelphia. It was John Morgan who took the first known step toward an American pharmacopoeia. He had already distinguished himself in the medical field by establishing the first medical school and American pharmacy was also indebted to him for his efforts in instigating the movement to separate pharmacy and medicine in this country (see p. 145). "Early in 1787 Dr. John Morgan proposed to the College of Physicians of Philadelphia the compilation and publication of a pharmacopoeia for Pennsylvania."[4] Since the Federal Constitution had not yet been ratified by all of the thirteen States a general standard was apparently not considered. When only one year later the United States of America had become a reality the plan of the College of Physicians of Philadelphia was expanded.

> At a stated meeting of the college, June 3, 1788, John Redman, John Jones, Adam Kuhn, William Shippen, Jr., Benjamin Rush, Samuel P. Griffitts, Caspar Wistar and James Hutchinson were appointed a committee to form a pharmacopoeia for the use of the college. As a result of their discussion of the subject the idea of

> preparing a work for local use seems to have been abandoned. Nine months after the appointment of this committee, the college ordered, April 7, 1789, a copy of the following circular to be sent to the most respectable characters in the United States.[5]

This circular of which 100 copies were printed and forwarded "to the proper persons" contained among other communications the following statements: "one of the objects of the college has been that of forming a pharmacopoeia adapted to the present state of medicine in America; for which purpose a committee of their members has been some time since appointed, who have made some progress in their work." Furthermore the circular pointed out "the absolute necessity of some standard amongst ourselves to prevent that uncertainty and irregularity which in our present situation must infallibly attend on the compositions of the apothecary and the prescription of the physician." It asked the addressees to "particularly inform us what native American remedies have been discovered amongst you."[5]

The response to this call was obviously not very encouraging. The Transactions of the Philadelphia College of Physicians report two replies, one from Dr. James Tilton, president of the Medical Society of the State of Delaware, and the other one from the Medical Society of New Haven, both expressing appreciation of the idea conveyed by the circular. However, the subject was not abandoned. "May 3, 1791, Dr. Benjamin S. Barton was appointed a member of the committee on the pharmacopoeia . . . Dr. Thomas Parke was added to the committee January 1794. Drs. Griffitts, Barton, and James were appointed June 6, 1797, to prepare and submit to the college a statement of all medical substances and pharmaceutical processes which seem proper to be included in the intended pharmacopoeia."[5]

Apparently this statement was never made. By way of explanation a statement made by Barton may be quoted with reference to the desirability of giving American drugs "a place in the Pharmacopoeia of this country," viz., "when such a desideratum shall be supplied."[6]

South Carolina. The idea of "the establishment of an independent American Materia Medica" was mentioned in a letter published by the Medical Society of South Carolina in April, 1798. The movement was in all probability started by the physician and wholesale druggist Dr. Johnson (see p. 166), a graduate of the Philadelphia Medical School. It can be considered, therefore, a continuation of the Philadelphia endeavor. Later on the society touched the problem again in a letter written by the same Dr. Johnson in 1808 to the Massachusetts Medical Society refusing to adopt the Massachusetts Pharmacopoeia.

Connecticut. At its annual convention at New Haven, October 18,

1815, the Connecticut Medical Society voted "that the professors of the Medical College be requested to communicate to the next convention the best mode of producing a general and uniform pharmacopoeia."[7] At the next year's convention, October 16, 1816, it was voted "to accept the report of the committee . . . , and that Eli Ives, Jonathan Knight, and William Tully be appointed a committee to compile a pharmacopoeia and to submit it to the next convention."[8] Whether these three men did any preparatory work is unknown. In 1818 the Connecticut Medical Society received the invitation of the New York Medical Society to take part in forming a National Pharmacopoeia. It appointed as delegates two of the men who had constituted its own pharmacopoeial committee, Eli Ives and William Tully.[9]

3. *The Massachusetts Pharmacopoeia*

The plans of the physicians in Philadelphia, in South Carolina and in Connecticut, were fully realized by their Massachusetts colleagues. The Massachusetts Medical Society had shown its concern for genuine and adequate medicines as early as 1786 when it petitioned the legislature to prevent the sale of bad or adulterated drugs (see p. 173). The compilation and publication of a standard formulary, a "Pharmacopoeia," was only another step in the same direction.

> At different periods, the Society has expended no small amount of labor to secure a uniform mode of compounding medicines, and to protect the community against the dangers incurred by the use of such as are spurious. At a meeting of the Counsellors, October 3, 1805, a committee was appointed to draw up and lay before them a pharmacopoeia or formulary, for the preparation of compound medicines, with names affixed to the same, to be called the Massachusetts Pharmacopoeia.[10]

At the meetings in February and June, 1806, the committee, the physicians James Jackson and John C. Warren, reported progress. "An advertisement was inserted in the public papers requesting members of the profession to furnish such formulae as they might judge useful to be introduced." This general appeal to whom it may have concerned apparently met with response. Finally, on June 5, 1807, "the committee . . . presented the manuscript of a pharmacopoeia" at a meeting of the Counsellors of the Society and it was voted "that the said pharmacopoeia be printed for the use of the Society."[11] The book, a volume of 272 pages, listing 536 drugs and preparations, appeared early in 1808.

The following quotation from the preface is illuminating: "The Society," the preface reads, "then resolved to adopt the pharmacopoeia

of the Edinburgh College as the basis of their own; but to permit such omissions, alterations, and additions as, upon minute examination, should be found necessary. It was not desirable however, to give to this the appearance of originality; on the contrary, trifling considerations have not induced any variation from that excellent work." These words illustrate the honesty of the compilers as well as their modesty.

The most important of the additions mentioned were indigenous American drugs not to be found in the Edinburgh Pharmacopoeia. "The learned physicians of Massachusetts," says a reviewer in the "Medical Repository," in all probability Dr. S. L. Mitchill, then editor of this first American medical journal, "have neither neglected the native productions of this country, nor hazarded the introduction of them into their catalogue of materia medica."[12]

In another innovation the authors of the Massachusetts Pharmacopoeia were in advance of their time. Their model, the Edinburgh Pharmacopoeia, was like all other official and most of the semi- and even unofficial formularies of that period, written in Latin. With the exception of the titles which are given in Latin as well as in English, the text of the Massachusetts book is in English. It was not until 1840, i.e., 38 years later, that the "United States Pharmacopoeia" followed this example. The preface justified the bold innovation with the statement that a Latin book "is not adapted in this country, where the apothecaries are not necessarily instructed in that language." The same statement naturally held true for most of the American physicians of those days.

The apothecaries are mentioned several times in the preface, e.g., the statement that "it is the business of the physician to prescribe, and of the apothecary to prepare medicines."[13] This unreserved recognition of the separation of medicine and pharmacy as early as 1808, implied an advanced position. It was the first known official declaration of this kind to be made not by an individual physician like John Morgan (see p. 144), but by an organized group of American medical practitioners. The following sentences of the preface, however, imply the recognition that this desirable separation was of necessity restricted to the larger cities. "In them, the professions of physician and apothecary are most distinct; and between those, whose relation to each other is so important, a perfect understanding should exist. As this cannot be established between them as individuals, it is necessary that there should be uniformity, both in the pharmaceutical preparations and language." Finally the authors chose an excellent way to induce the apothecaries to adopt their work. They appealed to self-interest and professional responsibility. "The Medical Society indeed is not empowered to require of apothecaries a compliance with the directions of this pharmacopoeia; nor does such power seem

requisite. It has a sufficient substitute in the apothecary's regard to his own interest, and to his duty to the public." This appeal found the expected response within the state of Massachusetts. "The Pharmacopoeia of the Society has been adopted by the apothecaries in Boston and throughout the State, so far as we are informed; and with most cordiality by the most eminent of them."[14]

Was this local success all the authors of the Massachusetts Pharmacopoeia had hoped for? The sentences with which they closed the preface of their work reveal a higher and more comprehensive aim. The authors "cannot hesitate to solicit the aid of all scientific men in effecting a revolution, so very desirable for the correct practice of medicine; a revolution, which concerns the reputation and success of every medical practitioner, and the health and safety of every individual."

"Revolution" is too strong a word to have been used by men so deliberate as Jackson and Warren with reference only to Massachusetts. They must have had in mind all of the United States. Indeed, attempts were made to secure general recognition for the book. Copies and a circular letter, emphasizing the advantages of "a pharmacopoeia calculated for the practice of the United States"[15] were sent to the medical societies of other states. The New Hampshire Medical Society was the only one to adopt the book.[16] One other response, that of the Medical Society of South Carolina previously mentioned, is known to have been received. This letter expresses the opinion that "a perfect pharmacopoeia" can be obtained only by "the concurrence of different States," by requesting "the different Medical Societies, at a future date . . . to refer such a compilation to some one of the learned Medical Associations."[15]

It was exactly this idea, the recognition of all medical organizations in the compilation of such a standard which Lyman Spalding made the basis of his attempt at a national pharmacopoeia. Early in 1818 the Massachusetts Medical Society appointed a committee to revise its pharmacopoeia. After the receipt of the request of the New York State Medical Society to co-operate in the preparing of a national pharmacopoeia according to the plan of Spalding, the Massachusetts Society concurred on June 2, 1818 in the necessary measures. Through the collaboration of members of the Massachusetts Medical Society in the preparation of the national work "more than ninety per cent of the articles in the Massachusetts book were included in the later publication."[17] It is one of the ironies of history that in this way the book which had been refused general recognition was 12 years later destined to constitute the greatest part of the first generally recognized pharmaceutical standard formulary.

4. The New York Hospital Pharmacopoeia, 1816

The "Pharmacopoeia Nosocomii Neo-Eboracensis" with the subtitle "Pharmacopoeia of the New York Hospital," published in 1816 "under the authority of the physicians of that institution" is usually mentioned as one of the precursors of the U. S. Pharmacopoeia. This is true so far as its earlier appearance is concerned. It is not true either as to contents or even as to the ambitions of its authors.

These ambitions are very plainly described in the remarks introducing the book. The preparation of a special formulary for the hospital had its beginning with "the adoption, by common consent and common usage, of a few formulae of prescriptions, thrown together upon a single sheet of paper . . . and kept in the apothecary's apartment for his special guidance."[18] A more comprehensive formulary had been begun by Dr. Elihu H. Smith "for his own individual accommodation, in his practice."[19] The death of Dr. Smith put an end to this attempt, and the manuscript, not considered important by anyone, was lost. It seems doubtful whether a formulary of the New York Hospital would ever have been printed, had there not been another incentive: the desire for a convenient means of instruction in the art of prescribing.

The New York Hospital had developed into "a most valuable practical school for the improvement of youth to the exercise of healing art."[19] A book containing all necessary information about the Latin terms, the weights, the drug names and synonyms, the doses, the diet employed in the hospital etc. as well as a catalogue of the simple drugs and a list of "preparations and compositions, including the more general prescriptions employed in the practice of the hospital"[19] could facilitate the instruction. Besides there was some hope that such a book could become a good seller. It recommended itself in the preface not only to the students studying medicine in the hospital for present informational and future practical use but also as "a manual of prescription and selection of officinal preparations" to those "apothecaries, who reside in parts of the United States where no regular pharmacopoeia has been established." This sentence refers doubtless to the Massachusetts Pharmacopoeia, the only "regular" pharmacopoeia at that time established in the United States, and it shows furthermore that the authors did not regard their book to be of the same kind. In addition to "private extemporaneous prescriptions as the physicians and surgeons of the establishment have individually suggested"[20] the preface of the New York Hospital Pharmacopoeia mentions as its principal sources the pharmacopoeias of London, Edinburgh, and Dublin.[21] It does not mention the Massachusetts Pharmacopoeia, probably because this book was its only dangerous

competitor. In using English instead of Latin it follows the Massachusetts example.

The New York Hospital book was doubtless a good and useful compilation but it was no state pharmacopoeia; neither was it a precursor to the United States Pharmacopoeia in any proper sense. It was an early American representative of the innumerable printed or unprinted hospital formularies which, designed for local use and instruction, have always been written and still continue to be written.

It is not known who first suggested the issue of the New York Hospital Pharmacopoeia. At a meeting of the physicians and surgeons of the hospital, April 4, 1815, Samuel L. Mitchill and Valentine Seaman "were appointed to prepare a pharmacopoeia for this institution." On the 7th of October of the same year they presented a manuscript, previously "admitted to the examination of the members individually, for criticism and amendment." After further amendments this manuscript was adopted.[22]

Of the two authors, Valentine Seaman, teacher of clinical surgery in the hospital, had already in 1811 "drawn up a small work for the students attending his lectures, which was printed at their request and for their particular convenience."[23] This "Pharmacopoeia Chirurgica in usum Nosocomii Novi Eboracensis" met with very acrimonious criticism.[24] The good reception which the new book found was doubtless due to the fact that Dr. Mitchill was its main author. It was he who played an important part in the movement which only a few years later led to the issuance of the first Pharmacopoeia of the United States.

5. *The United States Pharmacopoeia*

In recent years there has been some discussion whether Lyman Spalding is to be regarded as the "father of the United States Pharmacopoeia" as stated by historians for more than a century, or whether this proud title should be given to another man, Samuel Latham Mitchill.[25]

In comparison with Lyman Spalding, S. L. Mitchill was unquestionably the greater and more brilliant personality. He was older, much more versatile and experienced, and his reputation as a physician was of the best. He was one of the founders and the principal editor of the earliest medical journal in the United States. He had served in the capacity of teacher and chemist. Once he had been senator and twice a representative. All of this, however, could not offer a guarantee of success in a venture which in the previous decades had several times been tried in vain.

The statement that a national pharmacopoeia was a "desideratum" of American medicine and pharmacy, coined by Barton in 1798 (see p. 231), had been quoted in the medical literature again and again and had

become a current phrase. No one in the country knew this better than Mitchill. He was exactly informed as to the different attempts to create such a book. He also knew why they had failed. To have tried under the circumstances would have been hazardous. True, all scientific and practical sources and resources were at his command. But instead of issuing the first United States Pharmacopoeia the cautious Mitchill launched a hospital formulary. To make the dream of an American Pharmacopoeia a reality required a man more easily satisfied in his ambitions than Mitchill, a man who had less to lose and more to gain besides possessing the necessary diplomatic talents. This man was Lyman Spalding. However, although Mitchill did not want the risk, he wanted to manage the undertaking. Spalding had gained his friendship through correspondence which started in 1798 and concerned Mitchill's "Medical Repository." This friendship proved very useful to Spalding. It was Mitchill who helped the young doctor to settle in New York and later encouraged Spalding in the plan of initiating a "United States Pharmacopoeia" to be prepared as a co-operative task by the medical associations of the entire country and to be published as their common product. Although he gave sanction to this plan and assisted in its execution he left both responsibility and glory to Spalding.

The real start of the new and finally successful enterprise was made by Dr. Lyman Spalding on January 6, 1817 when he submitted "to the New York County Medical Society, a project for the formation of a National Pharmacopoeia, by the authority of all the medical societies and medical schools in the United States. The plan proposed was, (1) That a convention should be called in each of the four grand divisions of the United States, to be composed from all the medical societies and schools; (2) That each district convention should form a pharmacopoeia, and elect delegates to meet in general convention in the city of Washington, on the first of January, 1820; (3) That the general convention should, from the district pharmacopoeias, form the national work."[26]

If at this time there was any possibility of bringing to pass such a work in the United States, the plan of Spalding promised success. True, the earlier plans also had provided co-operation by the several medical associations and practitioners interested in the subject. However, this co-operation consisted of additional contributions to a work, undertaken by the medical group which had initiated it and, naturally, claimed the credit. The earlier method had failed in part because it did not satisfy personal ambitions. The suggestions of Spalding solved the psychological and personal difficulties.

The development proceeded rapidly. The New York County Medical Society referred the plan to a committee. Simultaneously Dr. Mitchill brought the matter before a larger forum. On February 6, 1817, only

one month after Spalding had submitted his project to the New York County Medical Society, the New York State Medical Society at the suggestion of Dr. Mitchill approved of "the formation of an American Pharmacopoeia of delegates from the several State Medical Societies."[27] On February 3, 1818 the New York State Medical Society received a report from the committee appointed by the New York County Medical Society and referred it to a committee consisting of the physicians Willoughby, Patrick, and Wendell.[28] It was on the following day that Dr. Willoughby read the elaborate details of the proposed procedure in preparing the projected American Pharmacopoeia, "which were discussed and finally adopted by the Society." A committee with Lyman Spalding as secretary was appointed which first had to function as "a special committee to correspond with all the incorporated state medical societies, etc. in the Union and such influential medical men as they may deem proper." On March 4, 1818 the committee issued the first circular and early in November 1818 the information received had made it clear, "that the design of forming a National Pharmacopoeia had met the approbation of a majority of the medical associations in the U. S."[29] A second circular, dated November 21, 1818, invited "the said associations to designate a time and place for the meeting of each of the district conventions: and in conformity therewith the following places were designated, viz., Boston, Philadelphia, Columbia, South Carolina, and Lexington, Kentucky."[29] The following table shows the states and territories belonging to the districts, the representatives of which were to gather in the cities mentioned.

Table of Districts for the Pharmacopoeia Conventions

Northern (Eastern)	*Middle*
New Hampshire	New York
Vermont	New Jersey
Massachusetts	Maryland
Rhode Island	Delaware
Connecticut	Pennsylvania
Maine	District of Columbia
Convention City: Boston	Convention City: Philadelphia
Southern	***Western***
Virginia	Ohio
North Carolina	Indiana
South Carolina	Illinois
Georgia	Kentucky
Alabama	Northwest Territory
Mississippi	Tennessee (?)
Louisiana	
Convention City: Columbia	Convention City: Lexington

It is not certain whether Tennessee was classed with the western or with the southern district. Since in 1820 there was neither a medical school nor a state medical association in Tennessee, this is of no importance for the subject here under discussion. It is of interest that this division of the country into four districts for the purpose of better intercourse of the parties in question was no invention of Dr. Spalding but an early measure of the Massachusetts Medical Society which in 1785 "divided the Commonwealth into four districts, the Eastern, Western, Southern, and the Middle, to encourage the reporting of medical cases."[30]

Most of the work was accomplished within the Northern (Eastern) and the Middle districts, more particularly by the delegates of Massachusetts, New York, and Pennsylvania. "There were no conventions held in the Southern and Western districts, but measures were taken by those concerned, to secure a representation of the Southern district in the General Convention at Washington."[31] The historical introduction of the "United States Pharmacopoeia" of 1820 merely states that at the general convention "the Northern, Middle, and Southern districts were represented."[32] The explanation is to be found in the fact that, although there were no official delegates of the Southern District present, two members of the Medical Society of Georgia, Dr. Abbott and Dr. Terrell, being in Washington in their capacity as members of Congress "were directed informally to attend the Convention to be held in Washington."[33] There is another and less gentle indication of the diplomacy of the authors of the historical introduction as well as of the preface of the "United States Pharmacopoeia" of 1820: the manner in which they allude to the Massachusetts Pharamocopeia. In the preface they mention the "Pharmacopoeia of the Massachusetts Medical Society" and the "Pharmacopoeia of the New York Hospital" in a footnote as two examples of local measures, taken "in several of the States . . . by the faculty to regulate the preparation of medicines." As no other local measures of this kind resulting in printed books are known previous to 1820, and since the New York Hospital Pharmacopoeia, in contrast with the Massachusetts book, was nothing else than a local formulary with some instructive additions, the intention of minimizing the importance of the Massachusetts Pharmacopoeia seems evident.

Additional proof will be found in the manner in which the results of the convention for the Northern District, held at Boston, June 1, 1819, are reported in the historical introduction. This report says: "A plan for a pharmacopoeia submitted by the delegates from Massachusetts, was taken up, and after being duly revised and amended, was adopted by this convention as their pharmacopoeia." Was indeed only "a plan for a pharmacopoeia . . . taken up" and "adopted" in Boston? The "Trans-

actions" of the College of Physicians of Philadelphia report the following interesting details: "A convention of delegates from societies and institutions of the Eastern (Northern) district of the United States met in Boston, June 1, 1819 . . . The delegates from Massachusetts submitted a plan of pharmacopoeia, which was referred to Drs. Mussey, Goram, Torrey, Ingalls, and Ives for examination and amendment. On their motion *the Pharmacopoeia of the Massachusetts Medical Society*, as now revised, was adopted by the convention to be presented to the General Convention at Washington, D. C., Jan. 1, 1820."[34] It was the contents of this revised Massachusetts Pharmacopoeia and of "the prospectus agreed upon in the convention of the Middle district"[34] which "were duly examined and compared in detail and . . . with such additions as were thought necessary, consolidated into one work, which after full revision, was adopted by the General Convention as the American Pharmacopoeia and ordered to be published by a committee appointed for that purpose."[35] The report of the Philadelphia delegates states that "in the arrangement of the materia medica the plan proposed in the middle district (i.e., virtually New York and Philadelphia) has been departed from," that however "the list of preparations and compounds is pretty nearly what was agreed on in the convention of the middle district."[36] Since "more than 90 p.c. of the articles in the Massachusetts Pharmacopoeia were included" in the United States Pharmacopoeia of 1820 (see p. 234), the draft of the Middle District was either itself based on the Massachusetts book or its authors came independently to similar conclusions.

Eli Ives (New Haven) and Jacob Bigelow (Boston), the two delegates of Massachusetts, were together with Thomas T. Hewson (Philadelphia), Elisha De Butts (Baltimore), and the Chairman Lyman Spalding (New York) members of the committee appointed to prepare "for the press the National Pharmacopoeia."[37] Samuel L. Mitchill acted as President of the first general convention for the formation of the American Pharmacopoeia assembled in the Capitol at Washington on the first of January 1820. Thomas T. Hewson acted as Secretary. The entire editorial work had naturally to be done by the committee of publication, which under the very active chairmanship of Lyman Spalding worked diligently, Spalding bearing the responsibility. How thoroughly the original draft was revised and corrected becomes apparent from a printed copy of items of the *materia medica*, also of the *medicamenta praeparata* submitted by the chairman to his committee members. The copy preserved is the one assigned to Dr. De Butts and apparently returned by him with his suggestions to the chairman. It has been reproduced by Eugene G. Eberle and has thus been made generally available.[38] Finally, the book was printed in Boston and appeared December

15, 1820, bearing the title: "The Pharmacopoeia of the United States of America. 1820. By the Authority of the Medical Societies and Colleges."

The national successor to the Massachusetts Pharmacopoeia differed most strikingly in that it did not confine itself to the use of the English language. The book placed the text on facing pages in Latin and in English. In contrast to the authors of the Massachusetts Pharmacopoeia (see p. 233) the majority of the delegates responsible for the national standard was of the opinion that "no well-educated physician or apothecary is unacquainted" with Latin, and it is very interesting that they believed the Latin text would render the book "more intelligible to foreigners, and more useful in those districts of the United States where the French and German languages continue to be spoken."[39] There is another very significant remark in the preface representing one of the earliest official American statements concerning pharmaceutical manufacturing on a large scale. It reads: "Those compound substances which are prepared in the large way at manufactories, and which are to be kept by the apothecary, *though not necessarily prepared by him*, are inserted on the materia medica list. Those which are to be made by the apothecary alone, are placed among the preparations and compositions."[40]

The uncertainty of the authors as to the definite selection of drugs is best illustrated by the fact that they divided the materia medica list into two parts, one containing "articles of decided reputation or general use" and another containing "those the claims of which are of a more uncertain kind." This dual list was continued until radical changes were effected in 1882 (sixth revision). It is of interest to note that this procedure had its European pattern. There is, however, one difference. In the European countries in which the pharmacopoeias are required by law the discrimination had and has a very practical meaning. It is less a matter of recognition than of the general importance of the drugs in question. The articles of the first list form the so-called *series medicaminum* which must be kept in stock in even the smallest pharmacy thus guaranteeing the presence of these drugs at least to the physician and the public throughout the country.

In general the new book met with a kind reception, although there were disapproving voices. In a review, published in a Philadelphia medical journal, an anonymous author, after a very long and detailed criticism, came to the conclusion that the work "will probably require immediate revision,"[41] and the senior surgeon of the Navy, Dr. Edward Cutbush, stated to the Secretary of the Navy that he was not able to give his "unqualified approbation of the work for the use of our naval surgeons."[42] The members of the medical and pharmaceutical professions, so far as their members were interested at all, accepted the book, and in 1828 a reprint was necessary.

The importance of first publications such as this lies not so much in their perfection and immediate results as in the simple fact that a beginning has been made. At the close of a twelve-page review the "Medical Repository" wrote: "This work forms an era in the history of the profession. It is the first one ever compiled by the authority of the profession throughout a nation. Collections of this sort have been made in other countries, but none, so far, under the impressive sanction which distinguishes this. Many of the authorities of the Past compiled similar works, later still, the Colleges of Great Britain have followed their examples. France by command of her Monarch has furnished her 'Codex,' but it has remained for American Physicians to frame a work which emanates from the profession itself, and is founded on the principles of Representation. It embodies a Codex Medicum of the free and independent United States."[43]

The United States Pharmacopoeia, 2nd editions, New York (1830) and Philadelphia (1831). It was the denial of the "principles of representation" which created a dangerous schism in the second edition (first revision) of the national pharmacopoeia. Previous to the adjournment of the first general convention at Washington in January 1820 resolutions were adopted to secure the continuation of the work. The prescribed method of constituting a convention to meet January 1, 1830 was, that the president, Dr. S. L. Mitchill, should on the first of January 1828 "issue writs of election to the several incorporated State Medical Societies, etc., in the northern district, requiring them to ballot for three delegates to a General Convention to be held at Washington on the first of January, 1830, for the purpose of revising the American Pharmacopoeia; and that these several institutions be requested to forward to the president, on or before the first day of April, 1829, the names of three persons thus designated by ballot; and the president of the Convention is hereby requested, on the said day, to assort and count the said votes, and *to notify the three persons who shall have the greatest number of votes of their election*; and in case there should not be three persons who have a greater number of votes than others, then the said president is desired to put a ballot into the box for each of those persons who have an equal number of votes, and draw therefrom such number of ballots as shall make the number of delegates three, and notify as before."[44] This method to be also in the Middle, Southern, and Western districts.

Doubtlessly the procedure of determining the delegates according to the number of votes cast for them, was a very crude one, depending largely upon the casual attendance at the respective meetings of the individual societies and not so much on the competence of the men to be chosen. Very able men elected by a small constituency were in this way excluded from co-operation, while unfit candidates, elected in a

better attended meeting of another society, outnumbered them. There was, however, only one way to avoid this: a general agreement to change the situation, to be initiated either by the president of the first convention or by the opposing parties. Neither party to the dispute acted. The president stuck to the letter of the resolution and the opposing parties tried a trick. "The societies," they argued, "in the first part of the sentence, are required to send the names of the delegates."[45] However, it was nowhere stated that they likewise were obliged to make a return of the state of the ballot to the president. Surely, according to the last part of the sentence the president had "to assort and count the said votes." That was his business and if he had no votes he would have to find another way or eventually to accept all delegates without regard to the number of votes cast for them or the final number of the delegates constituting the convention. It is significant that the Northern (Eastern) district was loyal, the dissidents residing in the Middle district. From this district "only one return of the state of the ballot was made to him (i.e., President Mitchill), although the Philadelphia College of Physicians notified him of the election of its delegates."[46]

This one return came from New York. It was the old rivalry between New York and Philadelphia which here became evident. As to the further development the official report reads as follows: "On counting the ballots returned to him it was found that for the Northern district, Prof. Eli Ives, M.D. of New Haven, Prof. Jacob Bigelow, M.D. of Boston, and Prof. Daniel Oliver, M.D. of Hanover, were chosen delegates; and that for the Middle district, Prof. James McNaughton, M.D. of Albany, Prof. John B. Beck, M.D. of New York, and A. W. Ives, M.D. of New York were chosen delegates; from the Southern and Western districts, no ballots were received, and of course, no delegates elected."[47]

Until now the president had acted strictly according to the letter of the resolution of 1820, although not diplomatically or in a conciliatory manner. Now he departed from the resolution and lost. The General Convention was "to be held at Washington on the first of January, 1830." Instead "for the sake of convenience, it was, by general concurrence, resolved, to hold the meeting at New York." Another step, not provided for in the resolution of 1820, was taken. The convention did not take up the work of revision at the fixed date but resolved to "hold another session at the College of Physicians and Surgeons in New York, on the first Wednesday of June next" and "in accordance with the original plan for the formation of a National Pharmacopoeia" to send a circular "to each of the medical societies and medical institutions in the United States, not represented in this convention, requesting them to appoint a delegate."[48] Finally, ten men met in New York

on June 2, 1830. A comparison with the duly elected delegates present at the meeting of January 1, 1830 shows that the Western district (Ohio) and the Southern district (South Carolina) were now represented. However, two representatives of the Northern district, Jacob Bigelow and Daniel Oliver, were replaced by only one man, Charles B. Coventry. Even among the New York representatives changes had occurred.

It was doubtless due to the energy of Dr. Mitchill that this group of men fulfilled their task. In November 1830 the new edition, printed in New York, was published "by the authority of 'the General Convention for the Formation of the American Pharmacopoeia,' held in 1830."[49] The preface states that "it was deemed advisable on every account, not to extend the alterations or additions any further than seemed to be actually required . . ."[50] There were, however, some principal changes which prove the thorough consideration devoted to the revision. A technical alteration, namely the arrangement of both Latin and English text in double column on the same page, reduced the volume from 272 to 176 pages. Of greater importance was the fact that short descriptions were given of the quality and the use of the drugs of the materia medica list. This is in contrast to the first edition and to the second edition printed in Philadelphia.

Previous to adjournment of the New York "General Convention" resolutions "for the purpose of providing for future conventions, to revise the Pharmacopoeia" were adopted, resolving "that the convention hold their next meeting on the first Wednesday of June, 1835." Eli Ives was chosen president.[51] This convention was not called and the Pharmacopoeia of New York, 1830 had no successors. The reason why the New York book was supplanted by its Philadelphia rival was not so much any superiority as the difference in activity of the men concerned. Lyman Spalding had died in consequence of an accident on October 21, 1821, shortly after completing his historic task. Mitchill, unwillingly entangled in a dissension which he had not anticipated became weary of the whole thing. There was no one in New York willing not only to do the work but also to fight for it. The ambition and the willingness to fight were on the side of Philadelphia. Moreover, there were two men, George B. Wood and Franklin Bache, whose work and personality became decisive for the future of the "United States Pharmacopoeia."

There can be no doubt that the unfortunate schism in the preparation of the second edition of the Pharmacopoeia, resulting in the publication of two different books, is due to the attitude of the Philadelphia group. From its very beginning this attitude was contradictory to the obligations expressed or implied in the resolutions adopted at the General Convention at Washington in 1820.

The seriousness of this indifference to established resolutions is not mitigated by the fact that Dr. Mitchill and his New York group departed likewise in the long run from their legitimate authorization, as this was only a consequence of the attitude of the Philadelphians.

It cannot be said that the General Convention held by the Philadelphia group at Washington from January 1 to 7, 1830, revealed a general interest on the part of the American medical profession. There were in all eight delegates present: Lewis Condict and Isaac Pierson (New Jersey); George B. Wood and Franklin Bache (Philadelphia); John L. Morris (Delaware); James H. Miller (Maryland); N. W. Worthington and Thomas Henderson (Washington). "The Convention was organized by the appointment of Dr. Condict, President, and Dr. Henderson, Secretary. As many parts of the United States were not represented, it was resolved, in order as far as possible to supply the deficiency, and to give the various medical interests of the country their due weight, that the Surgeon-General of the Army, the Senior-Surgeon of the Navy stationed at Washington and those members of Congress who were practitioners of medicine should be invited to participate in the proceedings. In compliance with this invitation, the following gentlemen took their seats in the Convention—Joseph Lovell, M.D., Surgeon-General; Bailey Washington, M.D., Senior Naval Surgeon; and Nathan Gaither, M.D., of Kentucky, E. G. Mitchell, M.D., of Maryland, and Samuel Swan, M.D., of New Jersey, members of Congress."[52] Delegates of Louisiana arrived after the adjournment of the Convention.

The work of this Convention was easier than that of its predecessor of 1820. There was only one revised draft of a pharmacopoeia to examine, that of Philadelphia. "The committee to which it had been referred, reported that in its opinion, 'the draft of the pharmacopoeia presented by the Philadelphia delegates was decidedly superior to the original work, and should be adopted as the basis of the new edition,' and recommended that it should be referred to a committee composed of members from each of the large cities of the Union . . . The appointment was not restricted to the delegates present. They were selected on account of their supposed interest in the subject, which was inferred from their connection with the Convention of 1820. The committee consisted of Dr. Thomas T. Hewson of Philadelphia, chairman, and two members from each of these cities: Philadelphia, New York, Boston, Baltimore, Washington, D. C., Charleston, S. C., Lexington, Ky., and Cincinnati, Ohio."[53]

The seventeen members of this committee[54] were, no doubt, among the best known American physicians of their time. However, it may be reasonable to assume that the work would not have been started had it not been for the draft presented by the Philadelphia College of Physi-

cians; nor would it have been completed without the ceaseless application and energy of this enthusiastic group. The draft in itself was the product of painstaking labor. "Dr. Thomas T. Hewson, president of the College, Joseph Hartshorne, Dr. George B. Wood, and Dr. Franklin Bache . . . held more than one hundred meetings at Hewson's house . . . Both Wood and Bache gave themselves unsparingly to the service. So many alterations were found to be necessary that the pharmacopoeia was almost entirely rewritten, in some instances two or three times in Wood's own hand."[55] The copies of the draft, to be sent to the cities mentioned above, were made at the expense of the College. It is of interest that, while the New York edition introduced instructive remarks, its Philadelphia rival eliminated even those contained in the edition of 1820. The authors considered such definitions and explanations to be "wholly out of place in a pharmacopoeia which is intended for the guidance of those already instructed in medicine and pharmacy, not as a text book for the student."[56] In April, 1831 the new book, printed in Philadelphia, was published "by authority of the National Medical Convention, held at Washington, A. D. 1830."[57] Among the newly introduced formulas that for potassium iodide is especially noteworthy. Salts of morphine and quinine are listed the first time in both the New York and Philadelphia editions. What is more, directions for their preparation are given.

Soon the Philadelphia revision superseded its New York rival and gained general recognition. The interest of the medical profession in the subject, however, had flagged so much that it was primarily due to the dispensatory, written by Wood and Bache as a commentary on the Philadelphia Pharmacopoeia of 1831, and published in 1833, that pharmacopoeial work was continued. Whereas Spalding brought into existence an American pharmacopoeia, Wood and Bache kept it alive.

For American pharmacy the victory of the Philadelphia group was of special importance. In New York there had been no attempt whatever on the part of the pharmacists to participate in the preparation of the book destined to be their professional bible. In Philadelphia this participation was sought by both parties. As a matter of fact the Pharmacopoeia of 1820 was just one year old when the Philadelphia College of Pharmacy was founded and opened its school (see p. 175). "As soon as it appeared the Philadelphia College of Pharmacy was ready with wholesome criticism. A committee pointed out errors which had crept into the book. They properly held that in the revisions which were contemplated the apothecaries and druggists of the country should be conferred with. Both professions, medicine and pharmacy, should each have a hand in a work in which they were equally interested."[58]

It was the good fortune of the Philadelphia Pharmacopoeia of 1831 as well as of American pharmacy that the chief authors of the new book

were also appointed lecturers in the Philadelphia College of Pharmacy: George B. Wood in 1822, and Franklin Bache in 1831. Thus there was created a contact and collaboration which otherwise might never have come about. On "June 30, 1829 the committee on the pharmacopoeia was authorized to employ Mr. D. B. Smith, at the expense of the College [of Physicians], to make some experiments for the use of the committee."[59] This Mr. Smith was a wholesale and retail druggist in Philadelphia, one of the founders and from 1829 president of the Philadelphia College of Pharmacy, and, in 1852, elected the first president of the American Pharmaceutical Association. In several places the preface of the Philadelphia Pharmacopoeia of 1831 gives evidence of the co-operation of pharmacists and of the appreciation of the work done by them. Thus it states that some "alterations were the necessary consequence of improvements to which the industry and zeal of pharmacists as well in this country as in Europe have given rise,"[60] and that "every accessible pharmaceutic authority has been consulted, and practical investigations have frequently been resorted to." Finally the preface declares, that "*the whole has passed the examination of pharmacists* of acknowledged eminence in their profession."[61] From now on until the fifth revision, which resulted in the sixth edition published in 1873, pharmacopoeial revision followed a definite routine. The decennial revisions were carried out by a "committee of revision"[62] appointed and authorized by each subsequent Washington Convention. Most active were the two men previously mentioned: George B. Wood and Franklin Bache of Philadelphia.

The United States Pharmacopoeia, 2nd revision (3d edition). While the co-operation of pharmacists in the first revision of the "United States Pharmacopoeia," leading to the Philadelphia edition of 1831, was restricted to members of the Philadelphia College of Pharmacy, the next revision took advantage of the advice of the other pharmaceutical colleges existing at that time. It was "by virtue of the authority received from the Convention," that the chairman of the committee of revision asked the presidents of the colleges of pharmacy of Boston, New York, and Philadelphia for their co-operation. All of them responded, the Philadelphia college naturally rendering the most comprehensive and important service. How highly the authors of the book appreciated these pharmaceutical contributions becomes evident from the fact that they preferred to delay the publication—the book did not appear until 1842—rather than to fail to give due consideration to contributions made by or expected from their pharmaceutical collaborators. "As assistance was solicited from associations capable of rendering it, a length of time was unavoidably consumed in awaiting their contributions, and these again required deliberate consideration . . . The sources whence these contributions proceeded are the pharmaceutical bodies of all the cities where

such combinations exist, namely, of New York, Boston and Philadelphia, and particularly . . . the most important aid was afforded by the College of Pharmacy of the latter place, from which an *amendment of the whole Pharmacopoeia*, by a special committee was obtained."[63] Here the first time the name of William Procter, Jr. appears among the eminent collaborators in the pharmacopoeial work. This growing active pharmaceutical interest contrasted obviously with the indolence on the part of the medical profession, due possibly to the schism of 1830. At the National Medical Convention, held at Washington January 1, 1840, no delegates from New York, Massachusetts, and Connecticut were present. A total of twenty persons were in attendance, half of them being from Baltimore or Washington and five from Philadelphia, "so that the rest of the country was but meagerly represented."[64]

The new pharmacopoeia closely followed contemporary progress. It was one of the first official books which, preceded only by the French Codex of 1837 and the Edinburgh Pharmacopoeia of 1839, at the suggestion of William Procter, Jr. introduced the "method of displacement" (percolation), although merely as a matter of choice. Likewise, following the example of the two European pharmacopoeias, it omitted the Latin text, putting forth the new edition in a "complete English garb." Furthermore, in connection with certain articles of the materia medica and certain preparations, the new book brought as "another novel feature, brief notes indicating the readiest means of ascertaining their genuineness and purity," following "the example of the London and Edinburgh Colleges, in the late edition of their respective Pharmacopoeias."[65] Among these "means," i.e., reagents, are litmus and turmeric. For the first time temperature received consideration, the Fahrenheit scale being employed. The standard temperature was placed at 60°. The French Codex often served as a model due doubtless to the influence of Elias Durand, one of the members of the special revision committee of the Philadelphia College of Pharmacy previously mentioned.

Important and appreciated as was the part played by American pharmacy in the preparation of the editions of 1831 and 1842 it was only semi-official. With the third revision, leading to the edition of 1851, pharmacy was accorded official representation in the General Convention at Washington. It was the dawn of a new period.

The United States Pharmacopoeia, 3d revision (4th edition). Until the incorporation of The United States Pharmacopoeial Convention in 1900 the continuation of the decennial conventions depended upon resolutions, adopted at the close of the preceding convention which obligated the president-elect to issue a notice at a definite date before the next convention requesting certain institutions to elect delegates, and to invite certain persons to participate in the proceedings. The History of the

United States Pharmacopoeia, published as an introduction to the "United States Pharmacopoeia,"[66] enumerates the institutions represented and the persons especially invited who were present at these decennial conventions.

It was at the convention of 1840 that a resolution was passed which included "the incorporated Colleges of Pharmacy" in the list of those associations which should be requested to attend the General Convention of 1850. This put an end to the convention as a purely medical organization. Yet, in spite of the official participation by the colleges of pharmacy during the Washington Convention of 1850 the new edition, like its predecessors since 1831, was published "by the authority of the National Medical Convention." It was not until 1864 (4th revision) that, upon the initiative of John Meakim, one of the pharmaceutical members of the convention from New York,[67] the word "medical" was dropped and the note on the title-page changed to read "by Authority of the National Convention for Revising the Pharmacopoeia." Since 1905 (8th revision) it reads "by Authority of the United States Pharmacopoeial Convention."

By including pharmacy in the official body concerned with pharmacopoeial revision, the representatives of American medicine had publicly recognized two factors: 1. The existence of American professional pharmacy and its representation by the colleges of pharmacy; 2. The necessity of having pharmacy share not only in the work of the pharmacopoeial revision, but also in the responsibility.

At the convention, which met in Washington May 6, 1850, the Philadelphia College of Pharmacy was represented by Daniel B. Smith, Charles Ellis, and William Procter, Jr., the College of Pharmacy of the City of New York by John Milhau and George D. Coggeshall. A delegate of the Cincinnati College of Pharmacy, Dr. William Chapman, arrived after the adjournment of the convention and expressed his concurrence in the proceedings.[68] It is of interest to note that it was a pharmaceutical institution, the New York College of Pharmacy, which through its representative, G. D. Coggeshall, suggested the propriety of restoring the Latin version of the Pharmacopoeia and that no representative of the medical profession supported him. Two of the five pharmacists in attendance, William Procter, Jr. of Philadelphia and John Milhau of New York, became members of the Committee of Revision. Again the Philadelphia College of Pharmacy had done comprehensive preparatory work before the official gathering. In March, 1847, a committee consisting of a large number of members[69] had been appointed and completed a draft which was presented in Washington. This time the Philadelphia draft was not the only one as it had been at the two previous conventions, and the committee of revision, headed by President

Wood, had to compare and finally to compile a homogeneous book out of the various drafts.

With one exception, the introduction of fluid extracts, the alterations though numerous, were not of major importance. "This new class of preparations, embraces three distinct kinds, viz.: oleo-resins, concentrated syrups, and concentrated tinctures."[70] As to chloroform "a practical process, based on Soubeiran's, is given for its preparation."[71]

A reprint of the book was issued in 1855. In the "American Journal of Pharmacy," edited at that time by William Procter, Jr., a review of the Pharmacopoeia of 1851 appeared concluding with the following complaint:

> A large majority of physicians and apothecaries in this country know nothing of our Pharmacopoeia except as they learn it through the dispensatories, where it is so mixed up with the British Pharmacopoeias as to frequently confuse both physician and apothecary; and whilst we unhesitatingly express the opinion that the U. S. Dispensatory is the most practical work of the kind in the English language, we would be glad to see our National Pharmacopoeia published with a special commentary, explanatory of hundreds of points of interest, which, owing to the dogmatical form of such works are left unexplained.[72]

Considering the fact that George B. Wood and Franklin Bache not only were former professors of the Philadelphia College of Pharmacy, but also the authors of the "United States Dispensatory," and that Wood had acted as president of the convention and chairman of the Committee of Revision, one would scarcely have expected a complaint from this source.

The United States Pharmacopoeia, 4th revision (5th edition). From a pharmaceutical point of view the General Convention of 1860 was in some respects remarkable. A surprisingly large number of pharmacists was present, in all eleven, representing the colleges of pharmacy of Maryland, Massachusetts, New York, and Philadelphia. The Committee of Revision, appointed at this convention, consisted of an equal number of physicians and pharmacists, four from each group. The pharmacists were William Procter, Jr. and Alfred B. Taylor of Philadelphia, Charles T. Carney of Boston, and William S. Thompson of Baltimore. For the first time the American Pharmaceutical Association, organized eight years previously, came into action at a pharmacopoeial convention. "Mr. Parrish presented a printed copy of the Proceedings of the American Pharmaceutical Association at its eighth annual meeting, held at Boston in September 1859, as a contribution from that body in aid of the revision of the Pharmacopoeia."[73] Finally, there appeared upon the

pharmacopoeial scene a man who, two decades later, was destined to bring about a definite change in the routine of pharmacopoeial revision. Dr. E. R. Squibb read a joint communication from the New York State Medical Association and the New York Academy of Medicine, the first contribution from the New York medical profession to the pharmacopoeial convention since the quarrel of 1830. He was made a member of the Committee of Revision. The president of the convention was again George B. Wood. The chairman of the Committee of Revision was his friend, Franklin Bache, co-author of the "United States Dispensatory."

The fourth decennial revision did not appear until 1864. The preface tells of "one hundred and nineteen meetings, generally once a week" and of 138 written reports delivered by subcommittees. There were many changes and additions in preparations as well as to the materia medica. One of the most important innovations was the adoption of five grades of fineness of powders, "strictly defined by the greater or less closeness of the meshes of a sieve through which they will severally pass."[73] According to Thrush, this innovation "is said to have been suggested by J. B. Moore, a Philadelphia pharmacist."[74] Noteworthy is the introduction of new "classes," i.e., generic terms for liquors and oleoresins. Oleum Theobromae, Phosphorus, Potassae Permanganas, Resina Scammonii, Saccharum Lactis and Santoninum appear for the first time. The formula for the preparation of chloroform by the apothecary was omitted. In its place Chloroformum Venale (Commercial Chloroform) was listed in the materia medica catalogue and a method for its purification was given. The use of weights was simplified. "The only denominations of the former apothecaries weight now retained are the troy ounce and the grain; the troy pound, the drachm, and the scruple having been abandoned."[75] Percolation was made more general than before. "For these improvements the revising committee is largely indebted to Mr. Israel J. Grahame of Baltimore."[76]

In this edition, a reprint of which appeared in 1868, the desire for a very close relation to the English Pharmacopoeia, already perceptible in all its predecessors, became more evident. Thus A. B. Taylor in discussing the modification of the system of weights in the edition of 1864 wrote: "The importance of uniformity between the two national Pharmacopoeias was so acknowledged, that a strong effort was made to have the new scheme at once adopted."[77] The delay in the publication of the new edition was partly due to the desire of the authors to see and to use the announced new edition of the British Pharmacopoeia.

The United States Pharmacopoeia, 5th revision (6th edition). The fifth decennial revision of the Pharmacopoeia, based on the convention of 1870, and published in 1873, was the child of a period of transition. The old meritorious men of before the Civil War were still in the saddle.

However, the task to be done in a rapidly changing world, demanded younger and more versatile men, able and ready to create as well as to adopt new ideas. True, George B. Wood worked diligently as he had done for more than 40 years, but now without his old friend and collaborator, Franklin Bache, who had died in 1864. His energy and authority were sufficiently strong to hold this new edition in the old lines. There were, however, new men in attendance at the convention of 1870 whose presence was a promise of implied change, among them the pharmacists Louis Dohme, C. L. Diehl, A. E. Ebert and John M. Maisch. The new Committee of Revision consisted of fifteen members under the chairmanship of the president of the convention, Dr. Joseph Carson of Philadelphia. It is noteworthy that the old master, Procter, although attending the convention, was not made a member of the Committee of Revision. His place was taken by John M. Maisch and it is very likely that Procter purposefully resigned in favor of his younger colleague. Another significant fact is that the most active representative of the medical profession, Dr. E. R. Squibb, also did not participate in the work of the committee. Probably he was biding his time. This man, who initiated the principal change in the system of pharmacopoeial revision beginning with the subsequent edition, kept himself aloof from any responsibility whatsoever.

That the authors of the Pharmacopoeia of 1873, more particularly George B. Wood, realized that they were on the defensive, becomes evident from the following passage from the preface: . . . "it has been the desire of the committee to adapt it (the new book) to the wants of our extended country without losing sight of the conservative character necessarily pertaining to a National Pharmacopoeia. Such a work must necessarily follow in the wake of advancing knowledge; it is no part of its mission to lead in the paths of discovery."[78] There is some bitterness in the complaint about "the meagreness of details that characterized the majority of the reports to the committee, which in many cases presented criticism or suggestion without furnishing the precise form of alteration or amendment in the processes or, in the case of new medicines, indicating their modes of preparation."[79] At the convention of 1870 twenty-four medical colleges and eight colleges of pharmacy were represented. Of the six contributions submitted to the convention, four came from pharmaceutical and only two from medical colleges.[80] "Forty years ago," wrote William Procter, Jr., "before the edition of 1830 was published, apothecaries, even in Philadelphia, used their private manuscript 'receipt books' for most of the leading preparations. Now the pharmacopoeia or its commentary, the United States Dispensatory is found in every shop."[81] There could be no doubt that the pharmaceutical interest in the national pharmacopoeia had increased gradually, while that of the medical profession had correspondingly decreased.

Among the resolutions, adopted by the convention as mandatory directions for the Committee of Revision, was the demand "that measures of capacity be abandoned in the pharmacopoeia, and that the quantities in all formulas be expressed both in weights and in parts by weight." The Committee refused "to execute such directions" because this "entails the use of a metrical system not employed in this country or in England . . ." This resolution, however, caused the introduction of the first tables, showing the relations of American weights and measures to metrical weights and measures and vice versa. New classes were introduced: Chartae, Glycerita, and Suppositoria. The number of fluid extracts was increased by not less than 22 new ones. Among the substances or preparations added were Acidum Carbolicum, Chloral, and Iodoformum.

According to Dr. E. R. Squibb, the edition of 1873 was "as good as could be justly expected" under a system attempting "to get important labor, which but few have the knowledge and skill to render, without paying for it."[82] For several decades George B. Wood and Franklin Bache had given their labors freely without direct remuneration, being however paid by the income from their "Dispensatory." This combination of unpaid work on the one hand and the use of the product as a basis for profit on the other hand was doubtless the main motivation for the attack of Dr. Squibb against the system under which this combination had grown up. It was understood that the power rested with the unpaid editors on whom the results depended. "At the time of the last revision," said Dr. Squibb, "Dr. Bache was dead, and Dr. Wood so infirm in health that his services were not useful, but were rather obstructive in the committee; and have continued to be so unserviceable to the Pharmacopoeia interests, that now, while his Dispensatory still overshadows the Pharmacopoeia, it does not embrace it, and has not been revised to meet the wants of the present plan of revision."[82]

The plan of Dr. Squibb and the taking over of the United States Pharmacopoeia under the patronage of the American Pharmaceutical Association. The question, put by Dr. Squibb to himself and all those interested in the Pharmacopoeia was, whether it might not be possible to issue, instead of "a mere outline or skeleton, requiring the Dispensatory as a commentary," a book embracing "a Dispensatory or its equivalent in the Pharmacopoeia itself,"[83] edited by a small committee under the leadership of a paid editor doing the continuous work. As to the details Dr. Squibb wanted the pharmacopoeia published at intervals of five years and the annual issue of a semi-official "fasciculus or small inexpensive volume," containing information about new remedies and other important innovations, inventions, or improvements.

The loosely connected conventions, each existing only by a resolution

of its predecessor, could not be the basis for such a plan. When the first convention met in 1820, neither medicine nor pharmacy had nation-wide organizations. Now both professions had their representative national organizations: the American Medical Association and the American Pharmaceutical Association. To Dr. Squibb, who as a physician and leading pharmaceutical manufacturer with early experience as a druggist, was closely related to both professions, the idea of replacing the old pharmacopoeial convention by co-operative action of the American Medical Association and the American Pharmaceutical Association was only natural. It was taken for granted that one of these associations had to be the bearer of the legal rights which were to be acquired and maintained as well as of the responsibilities involved. In the opinion of Dr. Squibb the Pharmacopoeia and its revision had its natural place within the medical profession. Pharmacy was to assist in the work acting as a special branch of medicine. This was the plan he submitted in 1876 to the Philadelphia meeting of the American Medical Association. "The plan was favorably received, and was made the special order of business for . . . the next annual meeting."[84]

A few months later in the same city Dr. Squibb submitted his plan to the meeting of the American Pharmaceutical Association and reported the steps taken by him. The discussion was very animated. His audience was unanimously of the opinion that "the medical profession, certainly have a right to direct what substances shall enter into the Pharmacopoeia, their general character, and the preparations, but the details of the work devolve certainly upon pharmacists and pharmaceutical chemists . . ."[85] The "Proceedings" of the meeting disclose a definite readiness to co-operate with the American Medical Association on a basis of equality. There were two minor but significant incidents, the one proving the close connection between American pharmacy and medicine at that time, the other showing that the concept of constitutional liberty was rooted so deeply in most of the then leading personalities in American pharmacy, that they subordinated to it their professional interests. Two speakers, Judge of Cincinnati and Moore of Maryland, were especially sharp in their expressions against any possibility of assumed medical superiority within the planned co-operation. In the course of the debate it became apparent that both men represented "both sides," i.e., like Dr. Squibb they were medical graduates. When one delegate voiced the desire to have "one legal Pharmacopoeia which everybody was obliged to follow" Dr. Squibb, without meeting any opposition, replied: "I would not take away the right from anybody to make a Pharmacopoeia. This is a free country."[85]

On the whole the plan of Dr. Squibb was treated with reserve in pharmaceutical circles.[86] The medical profession paid little attention to

it. However, there seemed scarcely any doubt that the American Medical Association would accept the plan. However, the American Medical Association not only rejected it but stated that any connection or arrangement with the Pharmacopoeia was "thoroughly inappropriate to the association." The lack of interest in the question of the Pharmacopoeia at the Chicago meeting of the American Medical Association in 1877 was so great that Dr. Squibb was permitted to read his paper in full only after insisting upon the privilege. The President of the Association, Dr. Henry I. Bowditch, apparently did not understand the situation. In recommending the appointment of a committee to report at the next meeting, he said: "The object of these suggestions is obviously to give to physicians the right to say what the remedies shall be, which the pharmacist will prepare. One objection to this plan is this, that most of our modern preparations are made by druggists alone, and subsequently used by physicians. It would not, therefore, as I think, be well to try to limit the druggists in the preparation of their remedies under the direction of any single committee of physicians."[87]

After this rejection on the part of the American Medical Association the opportune hour of American pharmacy had come. Fortunately the men within the American Pharmaceutical Association were able and farseeing enough to recognize the task which confronted them and to grapple with it. The "Proceedings" of the Toronto meeting of the American Pharmaceutical Association in 1877 picture a remarkably high human and professional level of discussion. The result of the debate was in some ways a fundamental decision against the English "laisser faire" and in favor of the concept of official responsibility and authority peculiar to continental Europe. The movement was led by the German-born Dr. Frederick Hoffmann of New York and supported mainly by a group of pharmacists of German birth or descent. The preamble and resolution offered by Dr. Hoffmann and accepted by the assembly pointed out the necessity for a new basis for a more frequent, comprehensive, and generally satisfactory revision and asserted the duty of the American Pharmaceutical Association to take over the task and the responsibility since the American Medical Association "after a full presentation of this subject and of a matured plan for action . . . has failed to take any action in reference to the revision of the Pharmacopoeia by indefinitely postponing the proposed project."[88]

The United States Pharmacopoeia, 6th revision (7th edition). In consequence of the acceptance of the Hoffmann resolution the hitherto existing American Pharmaceutical Association committee on the pharmacopoeia, being only a voluntary auxiliary group without any official influence on the pharmacopoeial convention, retired and a new committee was appointed with a much greater task. It had to prepare the draft not

only of a new edition but of a new type of pharmacopoeia. This committee consisted of the following persons, fifteen in all: Charles Rice, Frederick Hoffmann, and P. W. Bedford, of New York; John M. Maisch, Joseph P. Remington and Charles Bullock, of Philadelphia; G. F. H. Markoe and S. A. D. Sheppard, of Boston; John F. Hancock, of Baltimore; A. E. Ebert, of Chicago; C. L. Diehl, of Louisville; E. S. Wayne, of Cincinnati; W. H. Crawford, of St. Louis; Charles Mohr, of Mobile; E. Painter, of San Francisco.[89] Six of these were of German birth or descent. Charles Rice was elected chairman. A report of this committee,[90] the product mainly of the "energy and wonderful talent of organizing possessed by Mr. Rice,"[91] was accepted at the Atlanta meeting of the American Pharmaceutical Association in 1878.

"The draft . . . was presented by the American Pharmaceutical Association to the pharmacopoeial convention, convoked according to the hitherto usual scheme and held at Washington in May 1880. In the hands of the committee of revision and publication, elected by the convention,[92] . . . this draft besides the contributions of some local associations became the starting point of the Pharmacopoeia of 1882. Compared with its predecessors this Pharmacopoeia was a perfectly new and up-to-date book."[93] In reality it was the first modern "United States Pharmacopoeia," and became the basis for all later editions.

The manner in which the American Pharmaceutical Association had gained the dominant influence in pharmacopoeial revision was diplomatic. The old "convention" remained externally untouched, and the office of president was filled by a physician, Robert Amory, as had been the case since 1820. Internally, however, the workings were definitely changed. The Committee of Revision had always played the part of an executive body. But it did it more by the personal authority and autocracy of one man, George B. Wood, than by any official title and association support. Now this committee was made the official executive resting on and supported by the American Pharmaceutical Association as the representative of the American pharmaceutical profession as a whole. Instead of revising and combining afterwards the drafts and contributions, presented to the convention by various associations or individuals, the Committee of Revision, *and it only*, was commissioned to "report a complete plan for the revision of the Pharmacopoeia at the next Decennial Convention" and it was "authorized and directed to publish a supplement at the end of five years, or oftener, if deemed expedient." This meant full power of attorney.

Of the 25 members of the Committee of Revision 14 were pharmacists. They held all positions of responsibility: Charles Rice was chairman, J. P. Remington and C. L. Diehl were vice-chairmen, P. W. Bedford was secretary, and Th. Doliber treasurer. All of these were members of

the American Pharmaceutical Association. Moreover, the convention had adopted as "general principles to be followed in revising the pharmacopoeia," all the essential contents of the program of Rice and his pharmaceutical friends, thus counteracting all possible later opposition. The "Sixth Decennial Revision" (seventh edition) of the "United States Pharmacopoeia" appeared in 1882. What the pharmacists considered its most fundamental changes may be judged from the following quotation:

> The division of the old Pharmacopoeia into a primary and secondary list of drugs and into preparations has been abolished, and a simple alphabetic arrangement adopted, similar to that of the British Pharmacopoeia, and except in nomenclature to that of nearly all European Pharmacopoeias. The drugs derived of the vegetable and mineral kingdom are now *concisely described* as to their physical, and, wherever it was deemed necessary, also their important structural or chemical characteristics. Processes for preparing chemical compounds have been omitted, except in a few cases; but *each chemical is defined* according to its formula, its physical properties, chemical reactions and possible impurities or adulterations."[94]

It was especially the descriptions and explanations, making the Pharmacopoeia a combination of formulary and textbook instead of formulary and drug catalogue, that most impressed the contemporary pharmaceutical and medical world. There were, however, many other important changes representing new beginnings. In following the example of the first "Pharmacopoeia Germanica" (1872), the new Pharmacopoeia definitely abandoned the outworn concept of the retail pharmacy as the place of manufacture of all pharmaceutical preparations, but tried to establish another kind of pharmaceutical responsibility for the public welfare: the examination of the substances in question by the pharmacist. The casual mention of a few tests was replaced by the introduction of detailed tests for identity and purity. For the first time also detailed processes for the assay of alkaloids appeared in the Pharmacopoeia. Symbolic formulas and molecular weights were introduced. "The use of parts by weight (or, of the metric system)" was adopted. Temperature was expressed in both the centigrade and Fahrenheit scales. As the standard temperature for specific gravity determination 15°C. (59°F.) was adopted.

Two new classes of preparations were introduced: abstracts and elixirs. The former were dilutions of powdered extracts so that each gram of product represented a gram of drug. In other words, they were solid preparations corresponding to the fluid extracts. Elixir of Orange was introduced as the first representative of this class. New individual substances were: Acidum Boricum, Acidum Salicylicum, Aether Aceticus, Amylum Nitris, Benzinum, Caffeina, Chrysarobinum, Codeina, Oleum

Eucalypti, Oleum Santali, Oleum Sinapis Volatile, Sodii Bromidum, Sodii Iodidum, Sodii Salicylas, Thymol.

The United States Pharmacopoeia, 7th revision (8th edition). The authority for preparing the draft for the next edition of the Pharmacopoeia having been assigned to a single executive body, the preparatory work could be done in a more systematic way. "In 1888 it was resolved to make a collection of criticisms on the 'United States Pharmacopoeia' from the literature published since the issue of the work and the chairman was authorized to employ an expert to make the compilation. As a result, the committee has published a Digest of Criticisms on the 'United States Pharmacopoeia,' in 3 parts, which, it is hoped, will lighten the labors of the next committee."[95] These "Digests," compiled first by Hans M. Wilder, then, after 1901, by Florence Yaple and Henry Kraemer, from 1905-1913 by Murray Galt Motter and Martin I. Wilbert, from 1914 by the latter alone, and since 1917-1924 by A. G. DuMez, became generally acknowledged sources of information.[96] The last volume, covering the period until 1922, appeared in 1924. After 1905 the Digests covered the National Formulary as well as the Pharmacopoeia. After 1909 they appeared as Bulletins of the Hygienic Laboratory of the Treasury Department of the United States Public Health Service. Since 1926 the American Pharmaceutical Association has rendered this service by enlarging its "abstracts" and by publishing them as a part of the American Pharmaceutical Association Year Book. Beginning with 1935 the American Pharmaceutical Association has published the abstracts as a supplement to its monthly journal.

At the convention of 1890, again called in the usual way by the president elected at the previous convention, Horatio C. Wood, a nephew of the late George B. Wood, was elected president. A Committee of Revision consisting of 8 physicians and 17 pharmacists, was also elected. Of this Committee the President of the Convention was an ex officio member. Again Charles Rice was elected Chairman and J. P. Remington, First Vice-Chairman. The general principles adopted for guidance of the Committee of Revision implied a further step in the direction of modernization.[97] Wherever possible they provided the introduction of assays for the determination of active principles in drugs and their galenical preparations, the methods not "requiring complicated processes"; also standards of purity "as high as practicable for legal enforcement, but not beyond a point reasonably attainable by the manufacturer without subjecting any particular product to unnecessary costs." Chemical formulas were to be given "only in the new notation." The committee was instructed to direct in general "solids to be weighed and liquids to be measured," using the metric system. Of special interest were two new principles: 1. the prohibition of introducing into the Pharmacopoeia any

substance "which cannot be produced otherwise than under a patented process or which is protected by proprietary rights"; and 2. the announcement of "a definite date, reasonably distant from the actual date of publication, when the new Pharmacopoeia is intended to go into effect and to supersede the preceding one." The first measure was intended to prevent the use of the Pharmacopoeia for advertising of patented or proprietary preparations. The other was the first expression of the expectation that the Pharmacopoeia would become the law of the land. For the same reason the hitherto employed term "officinal" was changed to "official."[98]

Of further innovations attention may be directed to the use of optical rotation for physical characterization. Of remedies and drugs added the following were of special interest: Acetanilidum, Adeps Lanae Hydrosus, Aqua Hydrogenii Dioxidi, Cascara Sagrada, Cocainae Hydrochloras, Eucalyptol, Menthol, Naphthalinum, Pancreatinum, Pepsinum, Petrolatum Liquidum, Resorcinum, Salol, Strophantus, Terpini Hydras. The class of "Abstracts," introduced in the previous edition, was dropped. The book appeared in September 1893, and became official January 1, 1894.

The United States Pharmacopoeia, 8th revision (9th edition). The National Convention of 1900 met at Washington in the usual way and Horatio C. Wood was again elected President. However, it was to be the last convention of its kind. Among the motions adopted was the following: "The suggestion that the business affairs of the Convention ad interim be delegated to a Board of Trustees of five members, together with the two officers mentioned (the president of the Convention and the chairman of the Committee on Revision and Publication) . . . ; The incorporation of this body and the adoption of a Constitution and By Laws . . ."[99] It was in accordance with the purport of this resolution that on June 11, 1900 "The United States Pharmacopoeial Convention" was incorporated, an association "organized for a period of 999 years" with the particular purpose of "establishing one uniform standard and guide for the use of those engaged in the practice of medicine and pharmacy in the United States, whereby the identity, strength and purity of all medicines and drugs may be accurately determined and for other like and similar purposes."[100] The Constitution of the Convention added the American Chemical Association and all those delegates who should be appointed by the Surgeon-Generals of the United States Army and Navy and the United States Hospital Service as well as by any body or branch of the United States Government to the delegates entitled to attend the Convention under the previous rules of admission. The 5 members of the Board of Trustees elected at the Convention were representatives of pharmaceutical colleges or associations, among them the three official

delegates of the American Pharmaceutical Association. With the establishment of this newly chartered organization, the American Pharmaceutical Association had realized its carefully and diplomatically pursued goal of giving the Pharmacopoeia and its revisions a solid and lasting foundation, and so it became the guardian of the Pharmacopoeia.

The Committee of Revision elected at the 1900 convention consisted of 18 pharmacists and 7 physicians, with the President of the Convention, Horatio C. Wood, as an ex officio member. Charles Rice, prevented from attending the meeting on account of illness, was re-elected Chairman. However, after Rice's death on May 13, 1901, the First Vice-Chairman, Joseph P. Remington, became Chairman.

It would be a mistake to infer from this steadily growing pharmaceutical majority within the Committee of Revision that there was any intention on the part of the pharmacists to restrict medical influence. On the contrary, the co-operation of the medical profession was eagerly sought. "The acceptance of the Pharmacopoeia as an authority, and confidence in its preparations," said C. L. Diehl in 1890, "depend in so large a measure upon the co-operation of the two professions, that every encouragement should be offered to physicians to participate in the work of revision." According to the same author the larger number of pharmacists on the Committee of Revision was due to the fact that the entire painstaking and detailed work concerned questions of a pharmaceutical nature, hence devolved upon pharmacists, "while the field of the physician in connection with the revision of the Pharmacopoeia is restricted mainly to deciding upon the admission or exclusion of articles."[101]

The "general principles to be followed in revising," adopted at the Convention of 1900 dealt first and above all with the "scope of the Pharmacopoeia," or more precisely with the proprietary or patented articles, excluded undiscriminatingly by the general principles of 1890 (see p. 259). The new rule authorized the Committee of Revision to admit "any product of nature of known origin; also any synthetized product of definite composition which is in common use by the medical profession, the identity, purity, or strength of which can be determined. No compound or mixture shall be introduced if the composition or mode of manufacture thereof be kept secret, or if it be controlled by unlimited proprietary or patent rights."[102] This implied the recognition of synthetics. The committee was furthermore instructed "to state the average approximate (but neither a minimum nor a maximum) dose for adults and where deemed advisable, also for children," but only for guidance and in no way as an inflexible rule. The general advice to introduce as many assays and as many tests of identity and purity as possible, led to a remarkable increase of assays[103] and to the introduction of a purity rubric for each chemical substance, "to apply," however, only "to sub-

stances which are used solely for medicinal purposes and when professedly bought, sold or dispensed as such." It is of interest that the introduction of physiologic tests was explicitly rejected by the general principles.

The revision, executed under the leadership of Remington, was very careful and went beyond the scope outlined by the "general principles." In the years following the convention of 1900 new developments required and received due consideration. Thus the recommendations of the International Conference on the Unification of Potent Medicaments, held in Brussels in September 1902 (see p. 118) were adopted except in one or two instances. In consequence a strength of about 10 per cent. became mandatory for the potent tinctures. For specific gravities the new standard temperature of 25°C (77°F) was adopted, "the average temperature of laboratories and stores in the United States throughout the year being nearer 77°F than 59°F (the previous standard)." A technical improvement was the collection of all general tests and their publication as a special chapter in the appendix. The first serum, Serum Antidiphthericum, found its place in the Pharmacopoeia, Glandulae Thyreoideae Siccae and Glandulae Suprarenales Siccae were introduced, and among other articles added were Acetphenetidinum, Antipyrina, Codeinae Phosphas and Sulfas, Cresol, Guaiacol and Guaiacolis Carbonas, Liquor Cresolis Compositus, Liquor Formaldehydi, and Sulfonmethanum. It was not until 1905 that the Eighth Decennial Revision of the "United States Pharmacopoeia" appeared and became official on September first. This unusually long time between the date of the Convention (1900) and the date of publication caused Remington to discontinue the hitherto usual dating of the Pharmacopoeia according to the year of the corresponding Convention. Hence, the editions bear only the date when they went into effect and are numbered according to the sequence of the revisions. In 1909 a Spanish translation of the "United States Pharmacopoeia" was prepared for the first time.

This first Pharmacopoeia to be prepared under the responsible patronage of the American pharmaceutical profession was also the first to receive full legal recognition. This was granted it by the Pure Food and Drugs Act of 1906, in force since January 1, 1907. This act made the Pharmacopoeia and the National Formulary the legal standards for the examination of drugs. The immediate consequence was the issue of "some additions and corrections"[104] to the Pharmacopoeia of 1905. As a result the "United States Pharmacopoeia" became indispensable for the entire American trade in drugs both within and outside the pharmacies.

The United States Pharmacopoeia, 9th revision (10th edition). J. W. England has described the development between the eighth and the tenth revisions of the "United States Pharmacopoeia" as follows:

"The burden of the eighth revision then (after the death of Rice) fell upon the shoulders of Prof. Jos. P. Remington, who, as first vice-chairman since 1880, had hitherto borne no inconsiderable part in the direction of the work. . . . Remington was continued in the chairmanship in 1910, and upon his death in 1918, Prof. Charles H. LaWall, his friend and assistant . . . succeeded to the position. When the Convention met in Washington in 1920, and a new committee of revision was appointed . . . Prof. E. Fullerton Cook of the College (Philadelphia College of Pharmacy) who, in association with Prof. Remington, had rendered much useful service in connection with the editions of 1900 and 1910, was unanimously elected chairman . . ."[105]

Meeting at Washington on May 10th, 1910, this Convention, the first to meet after the incorporation of "The United States Pharmacopoeial Convention," elected the physician Harvey W. Wiley as President. Of the officers elected 6 represented the medical and 3 the pharmaceutical profession. The Board of Trustees consisted of 2 physicians and 3 pharmacists, brought to a total of 7 by the ex officio membership of the medical President of the Convention and the pharmaceutical Chairman of the Committee of Revision. The membership of the revision committee was increased to 50 plus the President of the Convention as an ex officio member. An innovation was the appointment of 15 sub-committees, "of which the chairmen, elected by the members of the respective sub-committees, constituted an executive committee. . . ."[106] This executive committee furnishes definite evidence of the necessity of a pharmaceutical majority in the practical work of pharmacopoeial revision.[107] There were only three sub-committees on medical subjects which naturally consisted of physicians namely those concerning: scope; therapeutics, pharmacodynamics and posology; and biological products and diagnostic tests. The other 12 sub-committees were concerned exclusively with pharmaceutical, botanical, pharmacognostical and chemical problems and had to consist, therefore, of pharmacists who were specialists in the respective fields of science and practice as teachers, manufacturers, wholesalers, or retail practitioners.

The general principles, adopted at the 1910 convention, were very similar to those of the preceding revision, the most remarkable innovations being that these principles were now "recommendations" instead of "instructions," and that the General Committee was recommended to "make public, for comment and criticism, an abstract of new descriptions and standards proposed, before final adoption." Of new principles, followed in the revision, the most important were the statement of the alcoholic percentages of the respective preparations; the permission to

admit "serums and other biological products of approved usefulness, if standardized by the Government or one of the departments"; the addition of a chapter on diagnostic reagents; and finally the permission to include "biological tests or assays," the introduction of which was expressly forbidden by the rules of 1900. It is indicative of the general trend of the authors of the "general principles," that a special paragraph recommended the discouragement of the introduction of new compound preparations "as far as possible." Not recommended by the principles but of special importance were the addition of a chapter on sterilization, the insertion of microscopical descriptions of powdered drugs, and the introduction of "official methods for the determination of ash, of crude fiber, volatile and non-volatile extractive, melting points, boiling points and congealing points and also specifications for standard thermometers."[108] Furthermore several electrolytic determinations were included and a chapter on refractive indices was added. The list of admitted articles was rather small, contained however the following remarkable new additions: Acidum Phenylcinchoninicum, Aethylmorphinae Hydrochloridum, Caffeinae Sodio-Benzoas, Cotarninae Hydrochloridum, Diacetylmorphina, Hydrargyri Salicylas, Hypophysis Sicca, Liquor Sodii Chloridi Physiologicus, Oxygenium, Phenolphthaleinum, Serum Antitetanicum, Theobrominae Sodio-Salicylas, Toxitabellae Hydrargyri Chloridi Corrosivi, and Virus Vaccinicum.

The ninth decennial revision of the Pharmacopoeia, published in 1916 and made official on September first of the same year, was translated not only into Spanish like its predecessor, but also into Chinese.

The United States Pharmacopoeia, 10th revision (11th edition). The United States Pharmacopoeial Convention of 1920, meeting at Washington on May 11th, elected as president Dr. Reid Hunt, a physician. E. Fullerton Cook, a pharmacist, was elected Chairman of the Committee of Revision. Again there were 15 sub-committees. However, the work on galenical pharmacy had been consolidated, thus permitting the organization of two new sub-committees, one on biological assays as a fourth medical committee, and one on reagents and test solutions.

> The general policies and methods of procedure for the tenth revision were similar to those of the eighth and ninth revisions . . . The recommendation of the sub-committee upon the admission or deletion of therapeutically active substances were widely published in medical and pharmaceutical journals and all resulting criticisms were printed in the general circulars. A "Referee Committee on Scope," consisting of the twenty-one physicians on the General Committee was given the final responsibility for deciding disputed

questions involving the admission of substances of therapeutic value.[109]

Of the articles added the most important were: Acidum Acetylsalicylicum, Aethylis Chaulmoogras, Amidopyrina, Argento-Proteinum, Arsphenamina, Barbitalum, Carbonei Tetrachloridum, Carbromalum, Chloramina, Dextrosum, Epinephrina, Neoarsphenamina, Oleum Chaulmoograe, Phenobarbitalum, Procainae Hydrochloridum, and Thyroxinum.

The tenth revision of the Pharmacopoeia became official January 1, 1926 and again a Spanish translation was issued. In 1924, "a special conference on vitamins was called and this pioneer group proposed the first official vitamin A assay. That there was an anti-rachitic factor was then known, but it had not yet been named vitamin D."[110] Scientific development made the issue of five supplementary monographs necessary, among them, in 1934, a modified cod liver oil monograph with new assays.

"The Committee of Revision . . . was made up of specialists in the several phases of revision . . . To strengthen these groups many experts, not on the original Committee, were invited to serve as auxiliary members . . . The actual work of revision was participated in by every interested group; the National Bureaus and Departments responsible for enforcing drug standards, the various medical associations, numerous national pharmaceutical bodies and hundreds of individuals, all working with the appropriate organized sub-committee."[111] This expansion of interest in the work of pharmacopoeial revision found its expression in a revision of the Constitution and the By-Laws of the United States Pharmacopoeial Convention. The changes adopted in 1930 widely enlarged the circle of those entitled to membership, and steadily increased the growing number of individual supporters of the revisional work.

The United States Pharmacopoeia, 11th revision (12th edition). The third decennial meeting of the United States Pharmacopoeial Convention (the eleventh decennial for the revision of the Pharmacopoeia) met May 13, 1930 and elected the physician and former pharmacist Dr. Walter A. Bastedo as President. E. Fullerton Cook was again elected chairman of the Committee of Revision. The 15 sub-committees remained unchanged. There were, however, added the following "additional committees and boards for the consideration of special features of the revision": on deterioration and storage, on extending pharmacopoeial information, on physico-chemical tests, a United States Pharmacopoeia Vitamin Advisory Board, a United States Pharmacopoeia Anti-anemia

Products Advisory Board, and finally auxiliary commissions in Cuba and in Puerto Rico.

Again many experts not on the revision committee were invited to participate. "Portions of monographs, prepared by the American Medical Association and published in 'New and Non-official Remedies' have been used to form the basis for a number of new texts. Extensive data published by the American Chemical Society has been utilized in preparing the new reagent standards. The joint 'Contact Committee' of the American Drug Manufacturer's Association and the American Pharmaceutical Manufacturer's Association has assisted in developing biological and vitamin assays and in many other problems of the revision."[112] The expense of the work would have been prohibitive "had it not been for the contributions, *without charge*, of laboratory and office facilities by colleges, universities, industrial organizations, private laboratories and the Government," and "through the voluntary service . . . by outstanding physicians, pharmacists, and other scientists of this country."[113]

Of the articles added the following are especially noteworthy: Aethylhydrocupreinae Hydrochloridum, Antitoxinum Scarlatinae Streptococcicum, Calcii Creosotas, Carbo Activatus, Chlorobutanol, Digitalis Pulverata, Ephedrina, Extractum Hepatis, Histaminae Phosphas, Neocinchophenum, Serum Antimeningococcicum, Toxinum Diphthericum, Detoxicatum and Diagnosticum, Toxinum Scarlatinae Streptococcicum, Tryparsamidum, Tuberculinum Pristinum, Vaccinum Rabies, Vaccinum Typhosum, and Vaccinum Typho-Paratyphosum.

The eleventh revision became official June 1, 1936. Again a Spanish translation was issued. A first supplement appeared in 1937, a second in 1939. "When the original volume became official," says E. Fullerton Cook, "it was not, in appearance, unlike the Pharmacopoeia of the past thirty years, but it was basically different . . . It has taken the initiative in many fields and is alive and ready to accept every challenge of the medical profession for necessary standards . . . The United States Pharmacopoeia has brought order out of chaos for vitamins A and D and now for vitamin B_1 . . . Practically all anti-anemia preparations from liver, now sold in this country are evaluated and assigned their potency in terms of U. S. P. units, by the Pharmacopoeia."[114] Between this proud statement and the declaration of George B. Wood, that it is not the mission of a pharmacopoeia "to lead in the paths of discovery" (see p. 252) lie not only 60 years, but a decisive change of situation and point of view.

Recently further advisory boards have been established, i.e., the Endocrine and Hormone Advisory Board and the Sterile Products Advisory Board, the latter devoted to the problem of sterility of

surgical gut, cotton, gauze, bandages, etc. Special digitalis investigations are under way. Reference standards are furnished and distributed. A special committee on the preservation of medicinal products is devoted to the study of packaging and storage directions.[115] Two remarkable features of the 11th revision, the increasing adoption of international standards on the one hand,[116] and a close co-operation between the United States Committee of Revision and the British Pharmacopoeia Convention on the other hand[117] are to be extended. "It is expected, that the new British Pharmacopoeia and the U. S. P. XII will appear at approximately the same time and will establish even more completely identical nomenclature and standards for most of their official products."[118]

The statement of the Board of Trustees of the United States Convention concerning international standards has worldwide importance. It reads: "Within the last two years the League of Nations has appointed and financed the expenses of an International Commission of Pharmacopoeial Experts. This group, representing Great Britain, Switzerland, France, Denmark, Holland and the United States, . . . already has prepared about 100 texts for possible international adoption. The work of this Commission is progressing energetically and when about 300 of the most important therapeutic agents commonly used throughout the world have been described and standardized, these will be offered to all nations of the world as suggestions for adoption within their own Pharmacopoeias."[118]

Should that become reality, then the old dream of a "universal," pharmacopoeia will have found its most practical realization. The part played by American pharmacists toward the gradual achievement of such a unification will have been by no means small. It was the American Pharmaceutical Association which at the seventh International Pharmaceutical Congress, held at Chicago in 1893, replaced the then unpracticable plan of a "Universal Pharmacopoeia" with the less ambitious idea of an international code of potent medicaments. This led later on to the resolutions of Brussels and the "Protocol International" (see p. 118). On the international commission working on the enlarged task, American pharmacy is represented by the present Chairman of the United States Pharmacopoeia Revision Committee, E. Fullerton Cook.

Conclusion. The development of the "United States Pharmacopoeia" is typically American. A small group of idealists started an undertaking, necessary for public welfare, but still in advance of its time. It was greeted with general indifference and could be maintained only by combining it with another promising undertaking which had been enjoying commercial success, the United States Dispensatory. In the meantime a group of professional people developed and organized to

serve public welfare in this relation. This organized group took over the task and made the general importance of that work so evident, that gradually the Government, indeed all authorities, and the people as a whole, became aware of its significance and acted accordingly.

In the case of the "United States Pharmacopoeia" it was American professional pharmacy which in the critical moment took over the work and brought it to its present state of perfection. Now the Pharmacopoeia is not merely the "Bible" of the American pharmacists; under the leadership and responsibility of American pharmacy it has become the legally recognized standard of a number of sciences and industries, guaranteeing honesty and security in the trade in drugs, supporting as well as supported by research work in the most widely different fields. At the present time the United States Pharmacopoeia is generally recognized to be one of the best and most progressive books of its kind.

6. Commentaries or Dispensatories

In the 16th century, when the word *dispensatorium* came into general use as a book title, its meaning did not differ from that of pharmacopoeia. It was in England that the word dispensatory became the designation for a kind of commentary, which embraced the text of the respective pharmacopoeia or pharmacopoeias. During the 18th and the 19th centuries such dispensatories became an English specialty.

Coxe's American Dispensatory. As previously stated there were some English dispensatories in common use in America before the creation of an American pharmacopoeia (see p. 229). This was but natural, since the pharmacopoeias upon which they were based, were recognized in America almost as much as they were in England. However, it may seem strange that America had a dispensatory of its own before it had its own pharmacopoeia.

It was the physician Dr. John Redman Coxe, the same man who later on indirectly caused the organization of the first American college of pharmacy (see p. 174), who in 1806 edited the first edition of his "American Dispensatory." He used Duncan's "New Edinburgh Dispensatory" to such an extent that it came near being a reprint and was considered as such by Duncan. The book met with immediate and continued success and passed through nine editions (1801, 1810, 1814, 1818, 1822, 1825, 1827, 1830, 1831). Coxe took the good wherever he could find it. When in 1810 the first edition of Thacher's "New Dispensatory" appeared, Coxe did not scruple to profit from the work of his competitor. In the preface to the third edition of his book (1814), he stated, that "he has not failed to introduce a considerable addition to the materia medica, for which he is chiefly indebted to Dr. Thacher's very excellent dispensatory." In the preface to the last edition of his book (1821)

Thacher points out that Coxe had transferred "literally from the two last editions" of Thacher's dispensatory more than 40 pages into the fourth edition of his own. He then adds that these transfers "are not designated by the customary marks of quotation."

After the publication of the "United States Pharmacopoeia" of 1820 the book of Coxe of necessity became, although with some reservations, a commentary on this work. In the quarrel over the two second editions of the Pharmacopoeia (New York 1830 and Philadelphia 1831) Coxe sided with New York and received a sharp rebuke from George B. Wood.[119] In the edition of his dispensatory, which followed the appearance of these rival pharmacopoeias, he nevertheless introduced "all that was essential" from both of them.

Thacher's American New Dispensatory. The fundamental difference between the dispensatory of Redman Coxe and that of James Thacher, physician in Boston, was, that the former based his work for the most part on an English book. Moreover, it was written in the English spirit. Thacher on the other hand associated his treatise with the first attempt at an American pharmacopoeia and tried to imbue it as much as possible with the American spirit. It was the Pharmacopoeia of the Massachusetts Medical Society published in 1808 (see p. 232) which served as the basis for Thacher's Dispensatory. "This Pharmacopoeia is," he wrote in the preface to his book, "not inferior in point of merit to any other and its nomenclature and order of arrangement are strictly followed throughout." Thacher's cooperation with the authors of the Massachusetts Pharmacopoeia went so far that he submitted his manuscript to the Massachusetts Medical Society for criticism. "After having been revised by a committee of the counsellors" the Dispensatory was published in 1810.[120] Its principal merit was that it paid "proper attention to several indigenous substances, not to be found in any other Dispensatory." As his sources Thacher quoted the publications of Barton and Cutler (see p. 159) and "that excellent publication, the Domestic Encyclopedia, edited by Dr. Mease." Thus Thacher's Dispensatory was the first distinctly American publication of its kind. It passed through 4 editions (1810, 1813, 1817, 1821). The last edition, following the publication of the first "United States Pharmacopoeia," was based on the new standards embodied in that work.

The United States Dispensatory. It is significant that neither Coxe's nor Thacher's book survived the appearance of the "United States Dispensatory," edited by George B. Wood and Franklin Bache in 1833. The name given to this commentary on the "United States Pharmacopoeia" by its authors proved to be of symbolic value. The book, for several decades the only one of its kind in America, has been indeed up to date "The United States Dispensatory," and a pharmaceutical

book of reference used all over the world. It has even at times put its mother, the pharmacopoeia, in the shade, always accompanying it, however, with merit and dignity. The secret of its extraordinary success lay in the personalities of its authors, especially in that of George B. Wood. Both men, being principal authors of the Pharmacopoeia of 1831, published in Philadelphia, and participating decisively in the work of revision of all later editions during their lifetimes, had naturally the most intimate knowledge of what required exposition. Besides, these men were especially well qualified for their work. They were not only physicians but for several years Wood had been a professor of materia medica and Bache a professor of chemistry at the Philadelphia College of Pharmacy. The fact that Wood in his preparation of the Pharmacopoeia of 1831 insisted on the avoidance of any explanatory notes "as wholly out of place in a Pharmacopoeia" makes it likely that he already at that time thought of the issue of some kind of commentary. It was doubtless due to the commercial success of the Dispensatory that the Pharmacopoeia could be kept alive. Moreover, the fact that both books were issued by the same publisher made possible the requisite financial balancing. It was not until after the death of Wood in 1879 that the two books were produced and published separately.

In the preface to the first edition of the Dispensatory the authors stated that the Pharmacopoeia "requires an explanatory commentary" and that "such a work should be in good faith an American work, newly prepared in all its parts, and not a mere edition of one of the European Dispensatories, with here and there additions and alterations." This was doubtless an attack upon the book of Coxe. That of Thacher had not been reedited since 1821. Wood made this even more clear by stating that in his opinion the field in America "has not been so fully occupied as to exclude all competition." In the book of Wood and Bache the English pharmacopoeias were considered to at least the same extent as in the earlier American dispensatories, but the "almost untouched . . . pharmacy of continental Europe" was also considered and special attention was paid to the "treatises and dissertations . . . on pharmacy . . . of the French writers, who stand at present at the head of this department of medical science."

All possible literary sources were utilized and the mass of information was well arranged and presented in a clear style. It seems almost incredible that for more than thirty years the two authors alone did most of the comprehensive and responsible work. During this period they directed not less than eleven editions (1833, 1834, 1836, 1839, 1843, 1845, 1847, 1849, 1851, 1854, 1858). In the preface to the first edition the authors thanked "Mr. Daniel B. Smith, president of the Philadelphia College of Pharmacy," for "much important information in relation to

the various branches of the apothecary's business," for some "prefatory remarks on pharmacy" and for "several articles." It was not until the death of Bache (1864) that, in the preface of the 12th edition published in 1865, such assistance from outside was again acknowledged. This time it was his "friends, Mr. William Procter, Jr., Prof. of Pharmacy in the Philadelphia College of Pharmacy, and Dr. Robert Bridges, Prof. of Chemistry in the same institution," to whom George B. Wood acknowledged his indebtedness. The 13th edition (1870) was effected with the same assistance.

The edition of 1877 (14th) was again begun by Wood with the assistance of Dr. Bridges, but completed by his nephew and successor in the chair of materia medica at the University of Pennsylvania, Horatio C. Wood. "After the death of George B. Wood in 1879, his nephew decided to continue the work and invited Joseph P. Remington, at that time a well-known apothecary of Philadelphia, and Samuel P. Sadtler, Prof. of Chemistry at the Philadelphia College of Pharmacy, to share with him the editorial responsibility of the 15th edition."[121] This 15th edition, published in 1883, may, as the authors stated in the preface, "very justly be looked upon as a new book, though based upon the old "United States Dispensatory." How much the age and the obstinacy of the late George B. Wood had retarded the adoption of scientific progress in the last twenty years becomes evident from the statement that since the death of Bache in 1864 the chemical parts of the work "had no proper revision and adaptation to the needs of the day." The 16th, 17th, 18th and 19th editions (1888, 1894, 1899, 1907) appeared under the same editorship. During the preparation of the 19th edition Dr. Horatio C. Wood, Jr. had already taken the place of his father. The 20th edition, published in 1918, was mainly the work of Horatio C. Wood, Jr. and Remington, the latter not seeing "the fruit of his labor, dying while the book was going through the press."[122] The 21st (1926) as well as the 22nd editions (1937) were published by Horatio C. Wood, Jr. and Charles LaWall, who had previously contributed to the chemical part in the 20th edition. In some editions H. H. Rusby, Albert B. Lyons, Henry Kraemer, John T. Anderson, and Ivor Griffith participated as co-laborers.

The "United States Dispensatory" is not only the oldest book of its kind which has been continued without interruption up to the present, but it is also a unique example of long and successful cooperation between editors and publishers. The first 8 editions were published by Grigg and Elliot of Philadelphia. Then Lippincott—at that time Lippincott, Grambo & Co.—bought out Grigg and Elliot. From 1851 on (9th edition) until the present, i.e., almost a century, the book has been published by Lippincott.

The National Dispensatory. It was due to the obvious deficiencies of the "United States Dispensatory" from its 12th to the reorganized 15th edition, that the monopoly of this book was destroyed at least temporarily. In 1879 Alfred Stillé and John Maisch published the "National Dispensatory." That at the time the book filled a gap becomes evident from the fact that the first edition was sold out in a few months and that in the same year a second edition "thoroughly revised, with numerous additions" was issued, and had to be reprinted in the following year (1880). Further editions appeared in 1884 (third), 1889 (fourth), 1894 (fifth), a reprint of which "with supplement embracing the new edition of the National Formulary" was published in 1896.

Because of the special inclinations of their authors, two differences in tendency should be noted between the "National Dispensatory" and its older rival, the "United States Dispensatory." Alfred Stillé, as teacher of clinical medicine at a time when the physiological action of medicines was to become the subject of exact experimentation included "for the first time in a Dispensatory, a succinct account" of the results of those experiments, "moreover occasionally in the theoretical language of the day." He added "another feature, novel in a Dispensatory": a therapeutical index. "Such an Index," the authors stated in the preface to the first edition, "becomes to some extent a therapeutical classification of medicines, and it is believed must greatly enhance by its suggestiveness the working value of the book to the practitioner." The "practitioner," here referred to, was naturally the medical practitioner. The "National Dispensatory" appealed much more to the special interests of the physician than did the "United States Dispensatory." "Of the two works," a reviewer wrote: "the 'United States Dispensatory' seems to find greatest favor with pharmacists."[123] Another difference was given by the predilection of the German-born second author, John M. Maisch, for the German Pharmacopoeia. In the second edition of the book he included "nearly the entire German Pharmacopoeia."

The National Standard Dispensatory. John M. Maisch died in 1893, and the fifth and last edition of the "National Dispensatory" was edited by Stillé with the cooperation of the son of the deceased, Henry C. Maisch, and Charles Caspary, Jr. It was the latter who participated again in a continuation of the Stillé-Maisch book, which made its first appearance in 1905 under the title "The National Standard Dispensatory" and was edited by three men: H. A. Hare, of the Jefferson Medical College, Philadelphia; Charles Caspary, Jr., Maryland College of Pharmacy, Baltimore; and Henry H. Rusby, College of Pharmacy of the City of New York. The "National Standard Dispensatory" was a completely rewritten book, explaining and commenting on not only the individual drugs and chemicals, but also the groups to which they

belong, combining thus a reference and a textbook. The articles on inorganic chemistry had been prepared by Daniel Base, University of Maryland, and the section on volatile oils and their constituents by Edward Kremers, University of Wisconsin. Joseph F. Geisler, New York State Department of Agriculture contributed to the section on organic chemistry.

Although retaining the sections on physiological action and the therapeutic index, introduced by Stillé, the medical tendency was not so predominant as it had been in the older work. A second edition appeared in 1908, a third in 1916.

Companion to the United States Pharmacopoeia, sixth revision (1882). As previously stated, the sixth revision of the Pharmacopoeia implied a turning point in pharmacopoeial revision demanding a new orientation from pharmaceutical practitioners. The editions of the United States and the National dispensatories though they supplied the necessary comments, were not exclusively devoted to this task. Hence, the occasion seemed to call for a "Companion to the United States Pharmacopoeia being a Commentary on the latest Edition of the Pharmacopoeia" and nothing else. In 1884 Oscar Oldberg and Otto A. Wall published this "Companion." Unfortunately they did not adhere rigidly to their principle, adding "numerous unofficial drugs and preparations in current use in the United States" also a comprehensive chapter on microscopy. A second edition appeared in 1887. The title of the book was adopted from Peter Squire's "Companion to the British Pharmacopoeia," the first edition of which had appeared in 1864 and which has accompanied all further editions of the British standard.

King's American Dispensatory. While the dispensatories mentioned thus far emanated from the ranks of regular medicine, King's "American Dispensatory" was a book of a different kind. The first edition had been edited by John King and Robert S. Newton in 1852 under the title "The Eclectic Dispensatory of the United States." This book was not based on any pharmacopoeia but was itself a specialized formulary in combination with commentary, including directions for use, etc., such as characterize the usual English and American dispensatories. It had nothing to do with official medicine but was especially devoted to the American Eclectic School of Medicine, offering to this group of practitioners and to the pharmacists supplying their demands, all needed pharmaceutical and therapeutic information about the drugs peculiar to the "School" (see p. 161). Up to the year 1909 this book appeared in 19 editions. The 2nd to 14th editions bore the name of John King on the title page, the 15th, 16th, and 17th the names of King and John Uri Lloyd, the 18th and 19th, of which latter only the first volume appeared, the names H. W. Felter and John Uri Lloyd. The majority of these

19 "editions" were merely reprints. In reality four revised editions were published, namely in 1864, 1870, 1898 and 1900 (two volumes).

Dispensatories, designed primarily for physicians. In this category the first place in every respect belongs to the "Treatise on the Materia Medica," published in 1822 by Dr. Jacob Bigelow, the author of the botanical part of the first "United States Pharmacopoeia" (1820). This treatise, "intended as a sequel to the Pharmacopoeia of the United States, being an account of the origin, qualities & medical uses of the articles and compounds which constitute that work with their modes of prescription and administration," was a commentary to the Pharmacopoeia in a more restricted sense than the later dispensatories with their more encyclopaedic scope.

Of other dispensatories of predominantly medical character, mention should be made of John Mayne's (English) "Dispensatory and Therapeutical Remembrancer," the second edition of which was published in 1848 in America.

In the same year R. Eglesfield Griffith published in Philadelphia an enlarged edition of the English dispensatory of Dr. Christison, this book being especially arranged for the needs of the American pharmacists.

In 1878, Drs. John Buchanan and John F. Liggin of Philadelphia published a book under the title "The Dispensatory and Pharmacopoeia of North America and Great Britain."

Homoeopathic Pharmacopoeia. In 1897 there appeared "The Pharmacopoeia of the American Institute of Homoeopathy." It was reprinted in 1901 under the title "The Homoeopathic Pharmacopoeia of the United States" but designated as second edition. A third edition was published in 1914, a fourth in 1936, and a fifth in 1938.

7. *Local Formularies*

The first pharmaceutical formulary to be printed in the United States of America was the "Formulary for the Preparation of eight Patent Medicines Adopted by the Philadelphia College of Pharmacy," published in 1824 (see p. 178). "When, in 1829, a college of pharmacy was formed in New York City, it adopted the Philadelphia College of Pharmacy formulae . . . , simply adding one for balsam of honey."[124]

It was in 1857 that the young American Pharmaceutical Association appointed a committee "to collect and arrange . . . local unofficial formulae." The difference as to the motives that caused the formulas to be published in 1829 and those collected between 1857 and 1859 is obvious. While the former were exclusively devoted to the imitation of patent medicines, the chairman of the American Pharmaceutical Association committee, John Meakin of New York, denied publicly "any desire to collect the formulae for nostrums or proprietary medi-

cines." The collection of the "unofficial formulae," published in the proceedings of the American Pharmaceutical Association,[125] was restricted to those "recognized by the medical profession." As such they could be considered as semi-official rather than unofficial. Nevertheless the American Pharmaceutical Association did not feel very well satisfied in promoting such a collection. The chairman of the committee congratulated his fellow-members not so much on their endeavor to collect formulas, but "upon the limited number of such formulas which, however necessary, tend to complicate the labors of the pharmaceutist."[125] The report in the Proceedings of the American Pharmaceutical Association laconically states that "the committee was discontinued." In the "American Journal of Pharmacy," the best source of information about pharmaceutical events of any importance in this period, no mention whatever is made of these formulas. Doubtless the leading personalities in American pharmacy around 1860 wanted to hush up this apparently very delicate subject.

In 1886 the "American Druggist" gave the following information on local formularies: "The New York and Brooklyn Formulary has undoubtedly had the largest circulation of any local work. Other local formularies, which have been prepared for similar purposes, are those published by the Kentucky and the Pennsylvania Pharmaceutical Associations. Another was published by a joint committee of physicians and pharmacists in Washington, and still others elsewhere. There is not one which does not contain preparations omitted in one or more of the others. Besides there are the formularies published by individual authors."[126] Since Charles Rice was associate editor of the "American Druggist" at this time, the intent of this is evident. With such facts made known, the necessity of such formularies as well as of their unification could scarcely be questioned.

8. The National Formulary

It should be stated that when, in 1885, the idea of a semi-official formulary was revived, conditions were more favorable to such an undertaking than they had been in 1858. Under the influence of pharmacists, the Pharmacopoeia of 1882 had been radically purified so far as "obsolete and unused drugs" were concerned.[127] Not less than 121 preparations had been deleted, doubtless among them were some which conservative physicians in various parts of the country were in the habit of prescribing. Furthermore, representatives of so-called elegant pharmacy, preparations readily prepared by any pharmacist, were manufactured as "brands" and prescribed as such by physicians. The idea suggested itself of reconciling the conservative physicians and pharmacists by placing formulas at their disposal which had been more or less improved since

their appearance in the earlier pharmacopoeias and by popularizing the production of the "elegant" preparations by the pharmacists. It is significant that the father of the modern Pharmacopoeia of 1883, Charles Rice, was in 1885 the chairman of the American Pharmaceutical Association committee on unofficial formulas and their ardent advocate. In his report to the Pittsburgh (1886) meeting of the American Pharmaceutical Association Rice explained the origin and purpose of the suggested formulary as follows:

> Acting on the suggestion of Mr. S. J. Bendiner of New York, the College of Pharmacy of the City of New York, the German Apothecaries Society of New York and the Kings County Pharmaceutical Society, about two years ago, appointed a joint committee to prepare a Formulary of unofficial preparations which was to be brought to the notice of the medical profession, with the request to accept the formulae therein contained—after examination and approval—and thereafter to abstain from specifying on their prescriptions the products of special manufacturers, whenever ordering any preparation for which a formula was given in the book."[128]

According to the historical introduction of the "National Formulary," in addition to the "New York and Brooklyn Formulary" published in 1884, it was the book on elixirs, published by John Uri Lloyd in 1883 "which acted as a decided stimulus." The state pharmaceutical associations participated in the work. The manuscript was presented to the American Pharmaceutical Association in 1888 and was published in the same year both as an appendix to the "Proceedings" and as a separate book "by authority of the American Pharmaceutical Association." The second edition appeared in 1896, the third in 1906. "Very soon after the publication of this third edition, the passage of the Federal Food and Drugs Act made it a legal standard and placed it on a par with the Pharmacopoeia in legal standing." It was in order to meet this new situation that in the fourth edition (1916) the title of the book was changed from "The National Formulary of Unofficial Preparations" to "The National Formulary." In 1926 there appeared a fifth edition and in 1936 a sixth. In plan and arrangement the National Formulary is now identical with the Pharmacopoeia, "with the exception that its monographs on preparations show the amount of each active ingredient in each average dose."[129]

The aim of making the "National Formulary" a connecting link between the medical and the pharmaceutical professions has been served by an epitome of the Formulary, supplemented by therapeutic suggestions and a therapeutic index. In addition the pharmacists availed them-

selves of every opportunity to acquaint the medical practitioners with the text of this work.

9. *The Pharmaceutical Recipe Book*

The "National Formulary" having become official, there was now a need for another reliable book for "unofficial" formulae. Numerous books of this kind published by individual authors were in existence. Good as they might be, they could not guarantee the desired uniformity throughout the country, which could be insured only by the authority of a nationally recognized group. A suggestion referred to the American Pharmaceutical Association committee on unofficial standards was rejected. However, a committee of five men, with Otto Raubenheimer of Brooklyn as chairman, was appointed. A report of Raubenheimer together with 114 formulas was published in 1912.[130] In 1915 a standing American Pharmaceutical Association Committee on Recipe Book under the chairmanship of Otto Raubenheimer was appointed.[131] The result was a comprehensive group of formulas, published in monthly instalments in the "Journal of the American Pharmaceutical Association" in 1916 and 1917. In 1920 a new committee, composed of 25 members and headed by J. Leon Lascoff was appointed. In 1923 Lascoff presented the unedited collection containing 1500 formulas to the American Pharmaceutical Association and Ivor Griffith of the Philadelphia College of Pharmacy was elected editor.[132] The first edition was published in 1929 and the second in 1936. "The purpose of the Recipe Book which is issued by the American Pharmaceutical Association, is to supply definite formulas for those preparations which are not included in the official books but which are in fairly common demand in the retail pharmacy, the hospital pharmacy and the manufacture of products, concerning which druggists are called upon for advice or supply."[133]

10. *New and Nonofficial Remedies*

In 1905 the American Medical Association established The Council on Pharmacy and Chemistry which is, therefore, a medical and not a pharmaceutical institution. This Council was organized "primarily for the purpose of gathering and disseminating such information as would protect the medical profession in the prescribing of proprietary medicinal articles."[134] These articles, their advertising, labeling, naming and even the general policies of the firms manufacturing them have to comply "with definite rules" and have to "present some real advantage," to be admitted, i.e., to be described as to their essential features "in the annual publication of the Council, the New and Nonofficial Remedies (N.N.R.) . . . This description is based in part on investigations made by or under the direction of the Council, but in part also on evidence or infor-

mation supplied by the manufacturer . . ." Proprietary mixtures without originality or other important qualities but marketed in conformity with the rules of the Council are listed in the appendix of the "N.N.R."

The Council explicitly states, "that the admission of an article does not imply a recommendation. It means only that no conflict with the rules has been found by the Council."[134] In other words, not to be admitted to the "N.N.R." and, therefore, not to be described in them implies, that the remedies concerned are considered by the official representatives of American medicine as beyond the scope of medical and pharmaceutical if not even of general moral legitimacy. In recent years "articles which are accepted for inclusion in 'N.N.R.' or in the list of articles and brands accepted by the Council but not described in 'N.N.R.' " are allowed to be provided with the "official seal of acceptance" of the Council.[135]

Among the early members of the Council there were many pharmacists or persons with pharmaceutical as well as medical education and degrees, such as C. S. N. Hallberg of Chicago, R. A. Hatcher of New York, L. F. Kebler of Washington, J. O. Schlotterbeck of Ann Arbor, M. I. Wilbert of Washington and finally W. A. Puckner, Ph.G., secretary of the Council and chief of the chemical laboratory of the American Medical Association.[136] Of all these names only that of R. A. Hatcher of New York, Professor of Pharmacology, Cornell University Medical College has been retained.[137] Even the "list of consultants" records none of the well-known names of the many representatives of American scientific pharmacy.

However, the importance of the "N.N.R." cannot be overestimated. For many articles the volume represents the preliminary stage before their introduction into one of the official books. For other articles the "N.N.R." implies admission to the recognized materia medica of the American medical practitioner. Although pharmacy no longer has any large part in their preparation these annual publications should be given a position of pharmaceutical importance second only to the official pharmaceutical publications.

11. Text and Reference Books

In 1846, when the Philadelphia College of Pharmacy created a professorship of pharmacy and bestowed upon William Procter, Jr. the honor and the responsibility of this new charge, the professor looked "in vain amongst the medical literature of the English language for a single work devoted exclusively and systematically to this branch of knowledge" (see p. 206). What was the explanation of this? True, English pharmacy at that time was in a period of transition and reconstruction (see pp. 93, 94), and an English textbook of pharmacy, written

by an English pharmacist, could scarcely be expected. On the other hand there was just then an abundance in French and German textbooks (see pp. 67, 80). England had never—in literature as elsewhere—hesitated to take the good where she found it and translations of French and German books into English were not uncommon. The reason for the English reserve in taking over one of the continental European textbooks on pharmacy was due to the fact that these books were of no use to the average English druggist of that period. The scientific standards and objectives of these treatises were too high and the need for elementary instruction in practical pharmaceutical technique could not be filled by them.

As a matter of fact in continental Europe itself there was an obvious need for a detailed description and explanation of all the instruments, apparatus, and technical contrivances, invented since the rise of modern chemistry and employed by pharmaceutical scientists, manufacturers, and practitioners. In the 16th century the German Andreas Libavius (Libau) had given such a comprehensive description in an annex to his book "Alchimia." In 1662 the Italian pharmacist Antonio de Sgobbis described the pharmaceutical technique and apparatus of his time in his "Nuovo et Universale Theatro Farmaceutico." The book of the French pharmacist Antoine Baumé, "Élémens de Pharmacie théorique et pratique," published first in 1762, met the needs of that generation. Now, in the middle of the 19th century another man was required to fulfill the same task for his time. This man was the German Carl Friedrich Mohr,[138] who not only described the modern pharmaceutical contrivances and apparatus but invented many of them himself. With his "Lehrbuch der Pharmaceutischen Technik," Mohr gave to German and Anglo-Saxon pharmacy what it needed. On the continent it was a very useful and much used book. For England and for America it was to become for the time being *the* pharmaceutical textbook.

The first German edition of Mohr's book appeared in 1847. It was scarcely off the press when the English apothecary and professor at the school of the Pharmaceutical Society of Great Britain, Theophilus Redwood, translated the book and published it under the title "Practical Pharmacy founded on Mohr's Manual" first as a sequence of essays in the "Pharmaceutical Journal," the organ of the Society, and then in book form. As early as March 1849 William Procter, Jr. edited an American issue of Redwood's enlarged translation "with extensive additions" under the title "Practical Pharmacy" with the subtitle "The Arrangements, Apparatus, and Manipulations of the Pharmaceutical Shop and Laboratory." The earliest reference to the book in the April, 1849, issue of the "American Journal of Pharmacy" begins with the following significant remark: "The want of a treatise on practical

pharmacy, devoted to apparatus and manipulations, has long been a desideratum both in England and the United States."[139] As stated in a later review, the book comprised "the whole of Mohr and Redwood's book, as published in London, rearranged and classified by the American editor, who has added much valuable new matter, which has increased the size of the book more than one-fourth . . ."[140]

The book of Mohr-Redwood-Procter "did not go through a second edition by reason of the cost of proper illustrations, which the publishers refused to incur,"[141] and without which Procter obviously did not want a new publication. Thus the way was free for another book of the same or a similar kind. The "Introduction to Practical Pharmacy," published by Edward Parrish in 1855 is considered the first truly American textbook on pharmacy. This being granted, the question may well arise whether it was a textbook for pharmacists, designed primarily to meet their needs? The review of the first edition, published in the "American Journal of Pharmacy," gives the answer to this question: "It (Parrish's book) is not based on the superstructure of any foreign publication, as has usually been the case with books, on similar subjects, issued from the American press, but is original in conception with its author, who, from his experience both as a pharmaceutist and as a lecturer and teacher of practical pharmacy to *medical* students, has become aware of the want of a textbook in *this* department, which he has thus endeavored to supply."[142] This corresponds with the statement made by Parrish himself in the preface of his book as well as with its subtitle: "A textbook for the student and a guide to the Physician and Pharmaceutist." The physician came first.

It was not until 1864 that Parrish became a teacher at the Philadelphia College of Pharmacy. At the time he wrote his textbook, he conducted a private school of practical pharmacy for *students of medicine* (see p. 208). "The book . . . was commenced with a view to satisfy this want (of a book for medical students), but in its progress the author determined to enlarge on his original plan, so as, *without claiming for it the fullness of a handbook of Pharmacy*, to render it very useful to the strictly pharmaceutical students . . . , as well as to pharmaceutists in general . . ."[143] It is very likely that Parrish decided "to enlarge on his original plan" after having learned that no new edition of the book of Mohr-Redwood-Procter was to be expected. The review quoted above, having stated furthermore that the endeavor "to embrace so much of the extensive range of matters, suggested by the plan of the book, gives it occasionally a somewhat heterogeneous aspect," concludes as follows: "In this respect, however, as in others, it represents, not unfairly, the present state of pharmacy." It reveals indeed a "somewhat heterogeneous" state of pharmacy, when the first textbook on pharmacy, that

could be considered as typically American and was written by an American pharmacist, was designed primarily to aid physicians in practicing pharmacy and only secondarily to instruct pharmacists. In 1859 a second and in 1864 a third edition appeared. In this latter the title "Introduction to Practical Pharmacy" was changed to the less specific "A Treatise on Pharmacy." The reason for dropping the word "practical," is to be found in the enormous increase in theoretical and scientific matter. After the death of Parrish in 1872 Thomas S. Wiegand published a fourth (1874) and a fifth (1884) edition. Although the book retained the traditional subtitle placing the physician as the primary customer before the pharmacist, it became with each new edition more a treatise on pharmacy for pharmacists.

In 1885 Joseph P. Remington published the first edition of "The Practise of Pharmacy, a treatise on the modes of making and dispensing official, unofficial, and extemporaneous preparations, with descriptions of medical substances, their properties, uses and doses intended as a handbook for pharmacists and physicians and a textbook for students." The analogy to the title of Parrish's "Introduction to Practical Pharmacy" is evident. But here the pharmacist came first. With the book of Remington the era of the modern American pharmaceutical textbook started. As Remington himself said in the preface of the first edition, he tried "to frame a system which should embody their (Procter's and Parrish's) valuable features, embrace new subjects, and still retain that harmony of plan and proper sequence which are absolutely essential to the success of any system." The book became very popular. The main criticism concerned the inclusion of the "United States Pharmacopoeia" and the "National Formulary," rendering the treatise very voluminous, but making it more salable. The following 5 editions (1889, 1894, 1905, 1907, 1917) were published under the editorship of the original author. Among the many collaborators E. Fullerton Cook and Charles LaWall, assistants to Remington in the Philadelphia College of Pharmacy, were the most active. Thus it was only natural that after the death of Remington in 1918, these two men, more particularly Cook, edited the next (7th) edition, which appeared in 1926, and the 8th edition, issued in 1936. The editors were supported by a staff of more than 30 experts in the special fields of knowledge dealt with in the book.

Life implies constant change. The development from the introductory treatises on practical pharmacy to voluminous tomes covering the whole of pharmacy, created a renewed demand for smaller and more compendious guides. In 1887 Reinhold Rother published the first edition of a book of this kind under the significant title "The Beginnings in Pharmacy, an introductory treatise on the practical manipulation of drugs and the various processes employed in the preparation of medi-

cines." The book meant for America an entirely new type of hand-book, and was an attempt to install a real apprenticeship by presenting information perfectly adapted to the material and implements of the drugstore. The book, published by the author and sold at a price covering the expense thereof, met with a warm welcome. The "American Journal of Pharmacy" called it "well adapted for the tyro, and admirably fitted for a guide in 'the beginnings in pharmacy.' "[144] Ad. Tscheppe concluded a comprehensive review with: "We consider the book an eminently useful one, not only to (for) beginners in pharmacy but to pharmacists in general . . . By its original and masterly treatment and by the elegance of language, this book ranks far above the kindred and more voluminous works."[145] A year later, in 1889, the author died and his work was not continued.

The idea of a concise treatise on pharmacy also found a realization in the "Handbook of Pharmacy" written by Virgil Coblentz and published in 1894. A second edition appeared in 1895. This book was not restricted to an introduction to practical pharmacy but embraced "the theory and practice of pharmacy and the art of dispensing." It opened the series of American textbooks on pharmacy trying "to supply to the student of pharmacy a compendious and yet sufficiently detailed textbook for systematic study, and to those exercising the art a trustworthy guide to be consulted in daily practice." (Preface to the first edition.) It is of interest that among the 25 books mentioned by Coblentz as sources for the illustrations in his treatise, 19 are German and two Anglo-American adaptations of German books. The book was recognized as sufficiently considering "the chemical side of pharmacy" as well as "the manipulations incidental to the everyday life of the pharmacist."[146] That nevertheless it did not live to see further editions was most likely due to the appearance of another book, similar in kind, Charles Caspari, Jr.'s "Treatise on Pharmacy for Students and Pharmacists," the first edition of which was published in 1895.

Caspari's motive for writing a book was much the same as that of Coblentz. Moreover, he expressed it in almost the same words, adding however a direct "dig" at Remington's voluminous book. His treatise, he said in the preface, "should be devoid of all unnecessary material, such as official and unofficial formulas, etc., readily accessible in the Pharmacopoeia and such books of reference as are usually found in drug stores." Caspari's book became popular. A second edition followed in 1901, a third in 1906, a fourth in 1910, a fifth in 1916. One year later, in 1917, Charles Caspari, Jr. died. The editorial task of revision was taken over by E. F. Kelly, long the assistant and associate of the deceased on the faculty of the Maryland College of Pharmacy. Kelly not only continued the work but returned to the original intent of making a

concise book. The sixth revision, published in 1920, with its 954 pages, still retained the volume to which the book had gradually grown. The seventh edition (1926), however, contained only 615 pages and in the eighth edition (1939) the subject matter is covered in 553 pages.

Of the three American textbooks on pharmacy, most used at present, the Remington-Cook-LaWall represents the encyclopaedic, the Caspari-Kelly the systematic-informative, and the youngest, Arny's "Principles of Pharmacy" the text-book type. In the preface to the first edition of his book (1909) Arny stated that its "frank intention . . . is to explain the Pharmacopoeia from its pharmaceutical standpoint." The second edition appeared in 1917, the third in 1926 and the fourth, edited by Arny with the collaboration of R. P. Fischelis, in 1937. A noteworthy feature of Arny's "Principles" is its very complete bibliography at the end of each chapter, giving direct reference to the literature covered in the text.

Still another type of textbook was offered by Edsel A. Ruddiman in his "Pharmacy, Theoretical and Practical," published in 1917, and in an enlarged and revised edition in 1926. This comparatively small book (267 pages in 1917 and 387 pages in the second edition) had as its object "to present in as few words as possible essential facts which every pharmacist should know," thus representing a combination of a theoretical repetitorium and of a brief informative treatise on practical pharmacy.

While the textbooks on pharmacy mentioned thus far attempted to cover more or less fully the entire field of pharmacy, another type of pharmaceutical didactic literature developed with more modest but by no means less important objectives. This group of books specialized in the art of compounding and dispensing of medicines or, in other words, the theory and practice of the filling of prescriptions. As one of the earliest and best-known books of this kind mention should be made of Wilbur L. Scoville's "The Art of Compounding," the first edition of which appeared in 1895. It was followed by four more editions in 1900, 1904, 1914 and 1927. The latest edition has been prepared by Justin Powers. A more concise "Outline of a systematic course of study for the novice in extemporaneous compounding" was given by J. H. Beal. His "Prescription Practice and General Dispensing: an elementary treatise for students of pharmacy," published in 1908, is one of those rare books which respect self-drawn limits. With the book of Wm. J. Husa entitled "Pharmaceutical Dispensing," published in 1937, the hitherto usual elementary treatment of the subject-matter was replaced by a systematic scientific one. The most popular book, devoted exclusively to the problem of incompatibilities was published by Edsel A. Ruddiman in 1897 under the title "Incompatibilities in Prescriptions." A second edition appeared in 1900, a third in 1908, a fourth in 1917, a fifth in 1925, and a sixth in 1936.

The books mentioned represent by no means a complete list of all textbooks on pharmacy, published in America. They are, however, the most popular representatives of the different types of these books and they illustrate the development in the demand for professional pharmaceutical information.

It was not until 1882, that a textbook on a special branch of pharmaceutical science appeared: "The Manual of Organic Materia Medica," written for pharmacists by an American pharmacist, John M. Maisch. It was followed by several others covering the same subject, among them L. E. Sayre's "Organic Materia Medica and Pharmacognosy" (1894), and more recently the textbooks of Youngken (first edition in 1922) and Mansfield (first edition in 1926). The "Textbook of Pharmaceutical Botany" of Youngken was issued from 1914 until 1938 in six editions. Much used by students of pharmacy have been Bastin's "Elements of Botany," first published in 1887 the name of which was later changed to "College Botany" and the books of Henry Kraemer, the "Applied Economic Botany" and "Scientific and Applied Pharmacognosy," both first published in 1915.

In the field of pharmaceutical chemistry it was likewise comparatively late that textbooks were written by American pharmacists. For some decades the "Chemistry, Medical and Pharmaceutical." written by John Attfield, professor of practical chemistry to the Pharmaceutical Society of Great Britain, was the main textbook on chemistry for American students of pharmacy. The book, published first in London in 1867, was "in response to a call from professional friends in the United States in 1870, . . . revised by the author for the followers of medicine and pharmacy in America, the chemistry of the preparations and materia medica of the United States Pharmacopoeia being introduced" (preface to the first American edition). In 1881 John Uri Lloyd's "Chemistry of Medicines" appeared. In 1884 William Simon published the first edition of his "Manual of Chemistry." In 1887 Oscar Oldberg and John H. Long published a "Laboratory Manual of Chemistry, General and Pharmaceutical." In 1894 an "Elementary Course in Inorganic Pharmaceutical Chemistry," written by F. J. Wulling appeared, and in 1895 S. P. Sadtler and H. Trimble published the first edition of their "Textbook of Chemistry for the Use of Pharmaceutical and Medical Students." Several pharmacists wrote books on analytical chemistry, one of the first being the "Manual of Chemical Analysis, as applied to the examination of medicinal chemicals," published by Frederick Hoffmann in 1873 and followed in 1883 by a second edition written by Hoffmann and F. B. Power. In 1885 Trimble's "Handbook of Analytical Chemistry" appeared.

These publications, confined to a special field of pharmaceutical science

although adapting it to the needs of American pharmacy and pharmacists, show only the actual stages in the development of the respective sciences as such or in their application to pharmacy. In contrast to the textbooks on pharmacy they cannot mirror the general professional development.

12. Journals

The common task of journals is the collection and publication of current or otherwise interesting news or facts. Within the field of literature books represent the static and journals the dynamic aspect. Journals may be differentiated according to the purposes which they try to serve. These purposes may be informational or entertaining. If so the highest aim of the ambitious and honest journalist is to achieve educational objectives in the most entertaining way. Journals designed for a definite group of readers naturally have to serve the special needs and demands of these people. These needs and demands are by no means always identical. To ascertain the real needs and to educate the people to recognize them is one of the primary tasks and characteristics of the journals with higher ambitions. The following or even the creating of incidental demands without educational aims characterizes the others.

Accordingly, journals sprang up to serve the two-sided character of pharmacy. One group of publications catered to pharmacy's function in providing professional public welfare service based on its scientific knowledge. Another group catered to it as a trade, based on laws and necessities of commercial operation. Hence some are scientific-professional, others are commercial. Still others are of a dual nature. It can be said, however, that not only the scientific-professional pharmaceutical journals which of necessity served educational ideals but also the majority of the more or less commercial pharmaceutical magazines have endeavored to foster professional responsibility.

A. Association Publications

Scientific-Professional Journals: It is very significant that the first American pharmaceutical journal, which at the same time was the first journal of its kind in the English language, was the child of an association. Its European model was the French "Bulletin (Journal) de Pharmacie" (see p. 64), which was likewise published by an association. But what a difference in the circumstances creating these publications! In France pharmacy was an old, dignified and widely recognized profession, the members of which had prominently if not decisively contributed to the various literatures. When the French Société des Pharmaciens de Paris decided to publish a special pharmaceutical journal, it did so because of the desire to glean matters of special pharma-

ceutical interest from purely chemical, botanical, pharmacological, and other contributions for the greater convenience of the pharmaceutical practitioner. Moreover, it is known that French chemists, botanists, etc., objected because they feared losing the highly appreciated pharmaceutical contributions in the general scientific periodicals. When the Philadelphia College of Pharmacy published the first issue of its journal in 1825, no recognized professional pharmacy existed in this country and only a few people were able and willing to devote themselves to pharmaceutical scientific work. The French journal was nourished by professional wealth and came as a crowning achievement of pharmaceutical progress; the American journal was a child of need and came at the beginning.

As far as the ideological objectives were concerned, the American journal was amazingly successful. The "Journal of the Philadelphia College of Pharmacy," as it was called by its founders, soon received nationwide and even international attention. It was in recognition of this fact that in 1835 the title of the publication was changed. The local designation had to give way to a national one. Under the name "American Journal of Pharmacy" this oldest American pharmaceutical periodical has served its profession at home and abroad through more than a century. However, in spite of its national baptism and international reputation, it remained the journal of the Philadelphia College of Pharmacy. All of its editors were affiliated with the college.

It must be stated that in the early years of its existence the Journal could be kept alive only by sacrifices on the part of the Publication Committee. "Let it not be said," wrote Dr. Griffith in 1832, "the pharmacists of this country felt too great an apathy and so little a zeal in their profession as to permit the only journal devoted to the subjects of their pursuits to languish and die."[147]

The "American Journal of Pharmacy" was indeed the only one of the scientific periodicals, issued by colleges of pharmacy in their capacity as combinations of associations and schools, which survived. The "New York Journal of Pharmacy" (1852-1854) of the New York College of Pharmacy, was revived several times and under different titles, the "Journal and Transactions of the Maryland College of Pharmacy" (1858-1862), "The Pharmacist" (1868-1885) of the Chicago College of Pharmacy and "The Apothecary" (1891-1897) of the Illinois College of Pharmacy, all had only a short existence. Distinctively college organs such as the alumni reports and other publications, intended for alumni and students of the respective colleges represent a later development. Determined essentially to serve the internal communication between the members of their restricted groups, their claims on general interest have been rewarded only on rare occasions.

The "Journal of the American Pharmaceutical Association," published since 1912, was born out of a quite different situation than the one the "Journal" of the Philadelphia College of Pharmacy had to face. Mainly through the efforts of the men of Philadelphia and later through the American Pharmaceutical Association a recognized pharmaceutical profession interested in pharmaceutical scientific activity had been created. Like the "Bulletin de Pharmacie" in France more than a century earlier, the "Journal of the American Pharmaceutical Association" was the crowning of a development. The publication of a monthly journal instead of the annual "Proceedings" was discussed many years before it materialized. There was a wide aversion toward involving the American Pharmaceutical Association in any kind of business and competition. The "Journal" replaced the annual "Proceedings," published since the foundation of the American Pharmaceutical Association in 1852, (with the exception only of 1861) and the "Bulletin," issued since 1906. It did not include the annual report on the progress of pharmacy, which had formed an essential part of the "Proceedings" and which now found its place in the "Yearbook of the American Pharmaceutical Association." This Yearbook appeared from 1912-1935, the last (24th) volume being published in 1937. Since 1935 the annual reports are replaced by monthly Pharmaceutical Abstracts, annexed to each number of the "Journal." The year 1940 witnessed a further step taken by the American Pharmaceutical Association in the field of pharmaceutical journalism. A new journal, "intended to supplement and not to replace the present Journal" is to relieve the older publication from all not purely scientific matter and "appeal strongly to the practicing pharmacists," dealing principally "with their professional problems."[148]

In 1937 another pharmaceutical group of highest importance, the American Association of Colleges of Pharmacy, journalized its proceedings thus bringing its work to the knowledge and the criticism of the entire American profession of pharmacy and asking for its active interest and co-operation. The close connection between the Association of Colleges of Pharmacy and the National Association of Boards of Pharmacy makes the "American Journal of Pharmaceutical Education" the field of discussion for all problems of pharmaceutical education, the theoretical-scientific as well as the professional-practical. The National Association of Boards of Pharmacy also publishes a "Bulletin."

Commercial-Professional Journals: Having secured the passage of the requisite legislation (see p. 200), the main task of the local and the state associations has been to see to the proper enforcement of the laws concerning pharmacy and to take care of both the professional and commercial interests of their members. In the course of years the commercial interests have dominated more and more. As a result, associations served

only to promote and defend these commercial interests. This situation is reflected in the state association proceedings and in the journals which succeeded them.

"Apparently the first state association to journalize its Proceedings was that of California, which made a beginning in 1907, publishing the Pacific Pharmacist which included the Association Proceedings. Other State Associations which have journalized their Proceedings are those of Texas (1926), Maryland (1926), New Jersey (1928), and Wisconsin (1933). Much more rapid was the development of journals of local County and City Associations."[149] Sometimes the development went another way. In February 1927 appeared the first number of "The New York Pharmacist, Official Journal of the N. Y. Pharmaceutical Conference, Inc." In July 1932 it became also the organ of the New York State Pharmaceutical Association. In April 1935 the title was changed to "New York State Pharmacist," the journal being exclusively the official organ of the New York State Pharmaceutical Association and owned by it. Some of these publications disappeared after a longer or shorter time or became merged with independent commercial journals, or, with changed names, continued as such. Among local association journals still extant are especially noteworthy the "Chicago Retail Druggist's Association (C. R. D. A.) News" and the "Philadelphia Association Retail Druggist's Bulletin" (1901).

In 1902 the National Association of Retail Druggists journalized its proceedings, issuing the "N. A. R. D. Notes," which title in 1913 was changed to "N. A. R. D. Journal." The National Association of Drug Clerks has issued its own journal, the "National Drug Clerk" since 1913. A change of title to "Drug Store Merchandising" was only temporary (1921-1922).

B. Private Enterprises

Privately-Owned Journals. There are a number of private pharmaceutical journals which have been permitted to designate themselves official organs of associations. Bound to serve or at least to respect the special interests of the respective organizations, they form a link between the association periodicals proper and the independent journals. Noteworthy among them are the "Modern Druggist," founded in 1912, official journal of the Louisiana and Mississippi pharmaceutical associations; the "Southeastern Drug Journal," founded in 1926, official journal of the Florida, Georgia, South Carolina, Alabama and Tennessee pharmaceutical associations; and the "Rocky Mountain Druggist," founded in 1888, official journal of the Colorado Pharmacal Association, the Wyoming Pharmaceutical Association, the Denver Retail Druggists Association, and the Allied Drug Travelers of Colorado.[150]

> The first strictly independent trade journal to appear was "The American Druggist's Circular and Chemical Gazette" (since 1906 "The Druggist's Circular") the first number of which bears the date of January, 1857 . . . This journal was followed by a considerable number of independent journals published in various parts of the United States, though restricted for the most part to drug centers such as New York, Boston, Philadelphia, Baltimore, Detroit, Chicago and Cincinnati.[151]

The position of "The Druggist's Circular" within American pharmacy at least until 1880, i.e., the death of its second proprietor and publisher, Dr. Vandeveer Newton, cannot be indicated better than by the fact that Frederick Hoffmann placed it on the same footing with the "American Journal of Pharmacy." He stated that "The Druggist's Circular" differed from the "American Journal of Pharmacy" in devoting "in its larger space an equal consideration (as to the scientific and professional side of pharmacy) to the trade and commercial affairs," and he concludes that among the earlier American pharmaceutical periodicals these two "will ever prominently stand forth as models of their kind at their time."[152] A journal of the same type and of like merits was the "Pharmaceutical Era," founded in 1887 and discontinued in 1933, which in the years 1895 and 1896 published a series of articles, written by the best American pharmaceutical teachers of that time, under the caption, "The Study of Pharmacy."

One of the most characteristic features of the American pharmaceutical press is the incessant sequence of consolidations, of mergers, of changes in title, purpose, and outer appearance. The peculiar development within independent American pharmaceutical journalism, in which the dissemination of scientific-professional information was left almost entirely to a few association journals and to a house organ or two published by pharmaceutical manufacturers, cannot be explained entirely in terms of the general trend to commercialize the entire field of human activity. The rapidly increasing number of drug stores, which implied a corresponding increase in the number of presumptive readers, caused the independent pharmaceutical press to stress the commercial and entertainment features of their journals.

The most striking example of this development is given by "The American Druggist." The following data are taken from an article published in this journal in 1933.[153] The first number of a publication called "New Remedies, a Quarterly Retrospect of Therapeutics, Pharmacy and Allied Subjects" appeared in 1871, under the editorship of the physician Horatio C. Wood. In 1873 another physician, Frederick A. Castle, became the editor. In 1876 the sub-title of the "New Remedies"

was changed to "A Monthly Trade Journal of Materia Medica, Pharmacy and Therapeutics." The pharmacist Charles Rice, to whom American pharmacy is indebted for its first modern Pharmacopoeia (1882), became associate editor. In 1884 the transformation from a predominantly medical to a pharmaceutical journal, which had begun in 1876, found its expression in a further change of title. It now became "American Druggist, an Illustrated Monthly Journal of Pharmacy, Chemistry, and Materia Medica." The word "Trade" had disappeared. Pharmacy took the first place. The intention of making the magazine a representative of American pharmacy as a whole, including the allied sciences, and of putting it on a strictly professional footing was unmistakable.

In 1892 (Rice died in 1891) Caswell A. Mayo, who had been assistant editor of "The Druggist's Circular," drug editor of the "Oil, Paint & Drug Reporter" and editor of "Merck's Market Report," became editor-in-chief. He changed the title to "American Druggist, a Journal of Practical Pharmacy," thus restricting the scope of the paper as well as expressing the intent to cultivate more the "practical" than the theoretical side of the calling. In 1893, the "American Druggist" and the "Pharmaceutical Record" were consolidated, the title of the combined journal reading "American Druggist and Pharmaceutical Record" the subtitle remaining unchanged. In 1927, under a new proprietorship and editorship, the subtitle was changed to "The Pharmaceutical Business Paper." In 1931 the word "Paper" was replaced by "Magazine." In 1933 the sub-title disappeared entirely. In reality the paper has become a typical magazine, the illustrations predominating. Business and entertainment are cultivated as the attractive features. Scientific and professional items without being neglected have, naturally, to be dealt with in a way harmonizing with the style of the publication as a whole.

The same is true for most of the other independent journals, which have adopted the magazine type. In quite another way, by following the example not of the magazine but of the newspaper, "Drug Topics," founded in 1884 as a house organ of McKesson & Robbins, has gained the largest circulation of all pharmaceutical periodicals.

All these journals, in so far as they devoted a part of their space to scientific-professional information, disseminated information about the progress in the field of scientific and professional pharmacy and the allied sciences and callings. There was, however, one journal which had specialized in this task and therefore represented most perfectly the type of the reviewing pharmaceutical professional journal: The "Pharmazeutische Rundschau," founded by Frederick Hoffmann in 1882 and published until 1896 in German. In 1896 the journal anglicized its name to "Pharmaceutical Review" and changed to the English language.

Until 1900 it was edited by Hoffmann and Edward Kremers, from 1901-1909 by the latter. In 1909 it was consolidated with the "Midland Druggist," remaining alive under the title "Midland Druggist and Pharmaceutical Review" until 1926. At this time this title was changed to "Interstate Journal." The "Pharmaceutical Review" became the cradle of another monthly, which completed the coverage of information: the "Pharmaceutical Archives." The "Review" published surveys and abstracts. The "Archives" was devoted exclusively to the publication of more lengthy original papers.

There appeared also a series of journals devoted to medicine as well as to pharmacy. The many physicians practicing medicine and pharmacy were naturally interested in information covering both fields. The "American Lancet" began its career as the "Detroit Review of Medicine and Pharmacy" (1866-1876). "The Philadelphia Druggist and Chemist," founded in 1878, changed its name a year later to "Monthly Review of Medicine and Pharmacy" (1879-1882) and was followed in 1895 by a "Monthly Retrospect of Medicine and Pharmacy," published likewise in Philadelphia (1895-1902). In New York a journal with the title "Physician and Pharmaceutist"—from 1871 on "Pharmacist"—was published from 1868-1879. In 1879 the journal changed its name to "Physician and Pharmacist and the Bulletin of the Medical-Legal Society," a few months later dropping the word "Pharmacist" it was continued as "Physician and Bulletin of the Medico-Legal Society."

A similar development can be observed in the publication devoted to the wholesale trade in drugs or, as it was frequently designated, the trade in oils, paints, and drugs. Journals, founded as wholesale publications were changed to retail organs. Consolidations took place between representatives of both types and the same people continued as editors of their respective fields. The history of the "Oil, Paint and Drug Reporter," called by H. C. Kassner the "leading journal for manufacturers of drugs and pharmaceuticals and for wholesale distributors," is very instructive in this respect. The paper, founded in 1871, absorbed in 1883 the "Oil, Paint & Drug Review" and in 1885 the "Weekly Drug News" (which in 1883 had been consolidated with the "American Pharmacist," founded in 1882), and since then the following journals: "Drug, Paint and Oil Trade"; "New York Drug Bulletin"; "New York Druggist's Price Current"; "Soap Maker's Journal" and "International Petroleum Reporter."[153]

The fact that millions of foreign-born people have lived in the United States for many generations and have formed a considerable part of the population, raises the question of whether pharmaceutical journals in America have been published in languages other than English. Among the journals previously mentioned, the "Pharmazeutische Rundschau"

has been referred to. It was not the only one. There existed in 1875 a "Deutsch-Amerikanische Pharmaceutische Zeitung," designed for apothecaries and druggists as well as for physicians of German origin and published in Belleville, Illinois. In New York the "Apotheker-Zeitung" appeared from 1880 to 1933. Beginning with 1895 it was the official organ of the New York German Apothecaries Society. From 1885 to 1897 this Society published the "Monatsblatt des New Yorker Deutschen Apothekervereins," which was revived in 1934. Other foreign language publications, though short-lived, were the "Gaceta Medico-Farmaceutica de Nueva York" (1892-1898); "Monitor Medico Farmaceutico" (1883); "Revista Americana de Farmacia, Medicinary, Hospitals" (1895-1921).[154]

The general trend within independent pharmaceutical journalism in the United States has manifested itself in the "business" or "trade" papers, resembling magazines or newspapers not only in their formats, but also in their endeavor to devote themselves to the greatest possible breadth rather than depth of the presumptive interests of their readers. Without doubt these journals are a practical necessity and meet a present demand. However, for some time a steadily growing movement toward more strictly professional pharmaceutical work, which has always been recommended on all sides, has manifested itself. The "American Professional Pharmacist," founded in 1934 is an exponent of this movement. This journal is said to be "a national publication devoted entirely to professional pharmacy and prescription practice." It aims to serve "the Elite of the American Pharmaceutical Profession" and "is sent exclusively to a selected list of the country's leading prescription pharmacists and hospital pharmacists, and pharmaceutical educators."

House Organs. Periodical publications issued by manufacturers and jobbers as a means of direct contact with their customers, began their appearance in the pharmaceutical circles of the United States about 1880. They have represented almost every type of periodical, the purely scientific report, the scientific-professional journal, the professional-commercial paper, the magazine, and the newspaper.

The first known of these house organs was the "New Idea," published in 1879 by Frederick Stearns and Company, Detroit, which in its title reflected the conviction of the sponsor that it was something new as well as a means of conveying news. After 45 years the journal was discontinued in 1924.

Only one year after the first house organ of an American pharmaceutical manufacturer had made its appearance, it was followed by one published by a jobber. This publication was unusual in its origin as well as in its development. It owed its existence to the fact that a price-list had to be mailed as first-class matter, while a journal was considered

second-class matter and hence enjoyed a lower rate. Thus in 1880 Meyer Brothers and Company of St. Louis transformed their price-list into a journal, the "St. Louis Drug Market Reporter." In January 1888 the title was changed first to "The Druggist" and after a few months to "Meyer Brothers Druggist." In 1919 the word "Brothers" was dropped and the journal has since been continued as "Meyer Druggist." In 1885 the Meyer Brothers' Drug Company tried an unusual step. They placed their house organ, which like all other publications of this kind had been mailed free to customers, on a subscription basis—and succeeded. This house organ has developed into one of the well-accredited pharmaceutical journals of general circulation in this country.

The scientific type of pharmaceutical house organ was represented most distinctly by the "Ephemeris of Materia Medica, Pharmacy, Therapeutica, and Collateral Information," published at irregular intervals from 1882 to 1885 and from 1887 to 1904 by E. R. Squibb & Sons, New York and Brooklyn. In 1922 the same firm, having undergone a change in organization, started with a publication entitled "Squibb Message to the Professional Druggist," and developed it from the newspaper to the magazine type. Parke, Davis and Company, Detroit, from 1894 to 1904 published a periodical, entitled "Pharmacal Notes, a Practical Journal for the Retail Druggist." In 1904 the title was changed to "Modern Pharmacy." In 1933 this house organ was discontinued. Another well-known pharmaceutical journal, the "Bulletin of Pharmacy," founded as the "Druggists' Bulletin" in 1887 and bearing its later name from 1891 on, was for many years closely connected with Parke, Davis and Company, although it was not issued officially as a house organ. In 1928 it was combined with "Western Druggist" and continued as "Drug Bulletin" until the end of 1933.

The most significant feature in American pharmaceutical journalism is the almost confusing abundance of the journals and the incessant changes which they have undergone. The list of American pharmaceutical journals compiled by Minnie Marie Meyer[155] in 1933, includes some 350 titles, and even this list is not complete. The ups and downs, the unbalanced mass production, the courage to venture and experiment have not been restricted to American pharmaceutical periodical literature, they have been characteristic of American life, and are the most striking proof of the youth of this country. Now a trend towards a better regulation and balance for the benefit of all apparently has begun to manifest itself. This may imply that America has begun a new period of her existence: the period of manhood.

16

ECONOMIC STRUCTURE

1. Retail Drugstores

WITHOUT doubt the drugstore has its fixed place in public welfare. Its legal and educational responsibilities however are involved only in relation to its professional pharmaceutical activities. The other functions of the store are commercial and hence are subject to the general laws and rules affecting other commercial ventures.

The situation of the drugstore in colonial times and during the first decades of the young republic has been described in previous chapters. There were apothecary shops in Boston (see p. 139), Philadelphia (see p. 141), New York (see p. 140), and the majority of the few educated pharmacists who then practiced their calling in this country were to be found in these cities. For the most part they were wholesalers as well as retailers and the first pharmaceutical associations and schools were created because of the initiative of these men.[1] These wholesale druggists and retail apothecaries filled the prescriptions sent to them by the few physicians who did not dispense their own medicines. However, their main professional activity was to provide the country doctors with drugs, both imported and indigenous, and with compounded medicines which they often produced in their own laboratories.

Until the Civil War and even later, the number of such real pharmacists was comparatively small. The general store with drugs as a sideline and the physician who kept an open store left little opportunity for the pharmacist proper. American pharmacy, i.e., a unit of professional men with a common concept of a distinct task did not exist before the American Pharmaceutical Association created and developed it (see p. 189). One of the first actions of the American Pharmaceutical Association was to secure reliable statistical information about the condition of pharmacy throughout the country at that time, i.e., in 1851 and 1852. The situation cannot be characterized better than by quoting from some of the reports.[2]

> The State of Maryland contained in the year 1851 about 139 apothecary shops of all grades, about 100 of them in the city of Baltimore, but only 12 were estimated as being owned by real apothecaries.
>
> In the States of Maine, New Hampshire, Rhode Island and

Connecticut the number of drugstores kept by physicians surpassed those kept by apothecaries and the stores of general dealers trading also in drugs and medicines far surpassed the number of legitimate drugstores.

The situation in Philadelphia was typical of the few large American cities of that period. "The sale of medicines by general stores was common and extensive. Fifty-seven of the drugstores in Philadelphia were kept by physicians, who left them in the hands of medical apprentices or hired assistants. The competition among pharmacists in Philadelphia is so excessive as to be a chief obstacle to the attainment of a higher standard of knowledge and skill among them. There are retail stores in which the whole year's sales do not reach $1,000,—and in most of them the annual receipts range from $1,500 to $2,500."

Of California it was reported that in 1852 "two-thirds of all the drug stores . . . are kept by physicians." Of North Carolina it is stated that "throughout the State the dispensing and sale of medicines, including nostrums, was in the hands of the physicians." The report from Georgia states that "pharmacy was yet in its infancy, and pharmacists and physicians equally ignorant about materia medica in general. The use of nostrums was extensive." The conditions just mentioned held true for the early phases of cultural development in most of the southern and western States.

Professional oases could be found in places in which a distinct influence of European continental pharmacy was felt, as was the case in some parts of Pennsylvania, and above all in New Orleans, St. Louis, and New York. Even in these places, however, in 1852 "many physicians dispensed and dealt in medicines and kept clerks" (New Orleans), "nostrums are kept and are in general and increasing demand throughout the State" (St. Louis), and in one state (New York) an early "enactment to regulate the preparation and dispensing of medicines . . . had proved unavailing."

However, in these parts of the country there was a distinct pharmaceutical calling with professional ambitions, pride, and objectives. It was French pharmacy which dominated in New Orleans and made the 12 apothecary shops and 4 wholesale druggists professional. Of the 47 retail drug stores and the 10 wholesale establishments which existed in St. Louis in 1852, 24 of the former and 2 of the latter were kept by Germans. In 1852, the City of New York had 273 retail drugstores and 51 wholesale drug houses. The definite part which the Germans played at that time is not exactly known. It was, however, large. When in 1872 New York made the first attempt to test the professional and scientific knowledge of the proprietors of drugstores and their clerks, there were

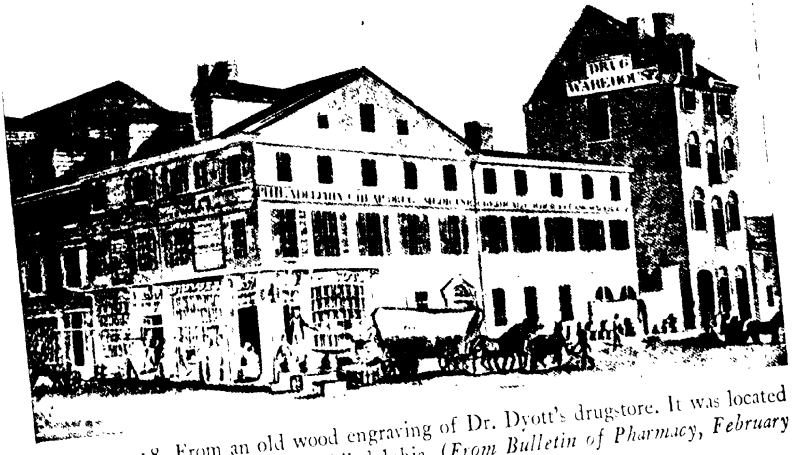


FIGURE 18. From an old wood engraving of Dr. Dyott's drug-store. It was located at Second and Race Streets in Philadelphia. (*From Bulletin of Pharmacy, February 18, 1904, p. 237.*)

FIGURE 19. Retail pharmacy of Hynson, Westcott & Dunning, Baltimore.

270 candidates of German descent and 207 of them proved to be scientifically educated people. What that meant becomes obvious from the fact that of the 276 American-born representatives subjected to the same test only 76 had some kind of scientific education. Here as in Cincinnati, Wisconsin and Texas in part, the German influence on pharmacy was obvious until about 1900 (see p. 183).

In its golden jubilee issue of 1907 the "Druggist's Circular"[3] published a series of very interesting reminiscences of old pharmacists, going back as far as the forties of the 19th century. They all show three basic facts: 1. That pharmacy at that time was mostly considered a simple trade, to be changed for another if the expected profit did not materialize. 2. That frequently the business was founded by a physician who later sold it to his clerk. 3. That due to circumstances the drugstore sometimes changed to a general store and often to a wholesale business, even if it had not been originally so intended.

There is a typical story of a pharmacy, opened in Baltimore in 1849 by a physician, "who had but recently graduated in medicine" and had "in his younger days learned the trade of house carpenter." After a few years as physician and pharmacist this man left his calling and sold his store to another "doctor" of the same type who made a partner of the young apprentice whom he found in the store. Shortly afterwards this doctor likewise discontinued the store and practice to become a lawyer and the young apprentice who had only had two years of very meager experience became the sole owner of the store.[4] Concerning Delaware Frederick W. Fenn reported that "except in a few instances there were no regular pharmacies outside of Wilmington in 1857. The town drugstores were usually combined with hardware, and additional side-lines were stationery and books, wall-paper, paints, and oils. Some druggists sent out wagons filled with all sorts of domestic medicines to supply country general stores."[4] The same author reported the career of the Wilmington druggist, A. H. Grimshaw, who "raised a company and went to the Civil War, became a colonel, and afterwards a doctor." These pioneers in the first place had to be men of courage and industry. It was not without the usual pioneer discomforts that these early pharmacists were obliged to study and practice their calling. They did as well as could be expected under the circumstances. By way of illustration, it was not easy to conduct a business in the town of Helena, Montana, where for three months of the year goods could be brought only by way of the Missouri River and for the remaining months had to be carried overland a distance of 1500 miles subject to the constant danger of robbery. "During the winter of 1863 and 1864 a vigilance committee was organized which hung all the 'roadagents' who did not escape, and restored law and order."[5] On the other hand business was

profitable as the following account of a druggist in Helena testifies: "With a capital of $3,500 we sold $99,600 worth of goods the first 15 months we were in business and made a profit of over $18,000."[5]

Of Chicago's first druggist, Philo Carpenter, A. E. Ebert relates that originally, in 1832, he wanted to run a drugstore exclusively but was unable to do so, for "owing to the scarcity of currency a large part of the business done was by a system of barter, called 'store pay.' Farmers and others who needed goods took what they had to sell and traded it at the stores for what they needed. The storekeeper then had to dispose of the goods so left in whatever way might be most advantageous."[6] In Detroit the hunters brought buck, beaver, and fox skins in exchange for the goods they needed. This paved the way to the combination of drugstore, general store and wholesale establishment. A large portion of the drugstore business in the country consisted of all kinds of dye-stuffs, of oils and paints. Houses were built and had to be painted. Homespun textiles were made and had to be dyed. The need for these articles was greater than for medicines and drugs and the latter very often became a sideline at least as to the volume of business transacted.

All this changed with the Civil War, the great and decisive turning point in the development of the North American continent. Pioneer society had been self sufficient as well as primitive. It was scarcely touched and by no means penetrated by the intellectual spirit that radiated from individuals and the few centers of learning and culture along the eastern seaboard. Now society was confronted with a rapidly developing industry that demanded the highest technical achievements. The drugstore business in dye-stuffs and similar goods vanished with the rise of the American textile industry, which became one of the largest in the world. A similar dismemberment was suffered with the growth of the building industry which took away the drugstore's paint and oil business. With these changes pharmacy had its great opportunity to develop its professional character. Had full advantage been taken of this, the "pharmacy" would have permanently replaced the "drugstore."

In some districts, a return to real pharmacy was effected, but it could not sustain itself and never became general in scope. The rise of a large and powerful pharmaceutical industry in part accounted for this. Favored by alcohol tax regulations which made it all but impossible for druggists to use this indispensable substance profitably in the small scale production of remedies, these organizations took over the manufacturing previously carried on to a large extent in the drugstore laboratories. Another cause of the curtailment of real pharmacy was the fact that on the one hand there were too many stores in proportion to the demand for

pharmaceutical service, and on the other hand the number of educated pharmacists available was comparatively small.

A comparison with the development in Europe proves the truth of this statement. There also the rise of a powerful pharmaceutical industry during the second half of the 19th century diminished the manufacturing previously carried on within the pharmacies. However, only the face and not the character of continental European pharmaceutical practice was changed. It was controlled by high educational requirements. The number of stores were restricted to the proportion needed to handle the demand for pharmaceutical service. The scientific training and economic security of the pharmacists, furthermore, enabled them to concentrate profitably on their function as the responsible distributors of medicinal goods. The standardization of pharmaceutical products according to their strength, which began in the sixties of the 19th century, was no challenge to them; the manufacture of galenicals within the laboratories of the pharmacies was already inspired by professional ambition.

As previously shown, in America the development of pharmaceutical industry encountered conditions very different from those which existed in continental Europe. On the one hand, the proprietary business was of great importance to the American druggist at a time when it meant nothing to European continental pharmacy. On the other hand, the increasing medical tendency to prescribe proprietaries instead of writing individual prescriptions, so dangerous to the continental European pharmacist accustomed to a large prescription business, was of much less importance to the average American druggist. Since most of the American physicians dispensed their own medicines, even if they did not have open stores themselves, the average American druggist had never enjoyed a large prescription business. The situation is best illustrated by the fact that when in 1900 a law in Missouri excluded the registration of physicians as pharmacists until they had passed the pharmaceutical examination, a privilege previously granted to them, "2,242 physicians registered before the new law went into effect."[8] As late as 1904 an inquiry, answered by 41 retail druggists in Illinois, showed that "in 7 cases the physicians write prescriptions, in sixteen they dispense their own medicines, and in eighteen they do both."[9] Hence, in this respect the situation could scarcely be made worse for the American druggist by the influence of industry. It could and can only become better by an increasing "tendency for a greater amount of prescribing and a lesser amount of dispensing from the doctor's office."[10]

Another factor of quite a different nature, rising out of the sharp competition between the too numerous drugstores, had a very remarkable influence on the "store" and the economic structure of the entire

calling, and affected even the really professional part of the business. This factor was price-cutting.

Competition in prices is an integral part of trade and as old as commerce itself. Its advantage to society has its limitations at that point where it becomes profitable only for a certain group of individuals and threatens the actual general economic order upon which society is built. It is this concept from which the terms of "fair" and "unfair trade practices" are derived. As early as the first decades of the 19th century price cutting was a striking feature of the American drug business. For a long period after 1823, when the Massachusetts College of Pharmacy was founded "almost all the business transacted was in reference to prices" (see p. 179). The "uniform" prices fixed by the College concerned drugs as well as patent medicines. Considered America's first price-cutter, T. W. Dyott not only sold drugs and proprietaries—principally well-known brands of uniform price—more cheaply than his competitors, but he also offered the example of his own success in the establishment of price-cutting and its continuous advertising as a deliberate practice. He came to Philadelphia in 1806 from England and opened a patent medicine warehouse, which until its demise during the financial crisis of 1837, enjoyed many years of success. As a retail druggist the founder of the George A. Kelly Company of Pittsburgh practiced price-cutting and his methods are considered as a forerunner of the chain store system. Under the firm name of Beckham & Kelly he owned, around 1860, 4 drugstores in Pittsburgh. The signs on these places of business read "Cut-rate drugstore."

However, the dangerous general expansion of price-cutting followed the expansion of the American pharmaceutical industry which glutted the market with proprietaries. This was caused partly by the fact that proprietaries could be bought in department stores which advertised them at a price lower than that marked by the manufacturer on the package. It was also caused in part by the business methods of the manufacturers and wholesalers. In order to induce the retailers to purchase large amounts of the goods in question, the manufacturers as well as the wholesalers rewarded such purchases by granting special discounts, bonuses, etc., thus enabling them to sell the respective goods under the usual resale price.

"It was in the early eighties that the pioneer price-cutting of the 'big four'—Evans of Philadelphia, Robinson of Memphis, Dow of Cincinnati, and Jacobs of Atlanta—aroused national attention . . . Price cutting became, in a few years, practically universal . . . The first cut-rate drugstore in New York City was established by George Ramsay, of the Hegeman Company."[11]

It is very significant that some of the most successful cut-rate drug-

Samuel Whiting,

Next Door to the Court-Houſe, Great-Barrington,
Has a handſome (little) Aſſortment of

Dry Goods and Groceries.

He flatters himſelf that thoſe who pleaſe to call on him, will not be diſſatisfied with the Quality or Price of his GOODS.

Abraham K. Whiting,

At the ſame Store,
Is furniſhed with a moderate retailing Aſſortment of

MEDICINES:

Where Gentlemen of the Faculty, who favour him with their Receipes, may depend on having *juſtice* done their Preſcriptions.

☞ *THEY deal for* ready Pay *only, and will allow the higheſt Price for* ASHES in their Seaſon, *and other Articles of Produce uſual in the Mercantile Line.*

NEW YORK. Printed by W. Morton, at his Printing-Office No. 231, Queen Street

FIGURE 20. Advertisement of the 18TH Century. Note the offer to take wood ashes in trade.
(*From LaWall: Four Thousand Years of Pharmacy.*)

stores were established not by educated druggists but by enterprising businessmen. Impressed by the success of Hegeman in New York, the man who with borrowed money founded the "Economical Drug Store" in Chicago in 1892, had made and lost a "fortune in the show business" before "he got the banks interested and finally established his store."[12] The man who in 1900 established in the same city "The Public Drug Company . . . a large drugstore organized and conducted on the Department Store Plan" is described as "not being a pharmacist by training or education, but on the contrary a shrewd and resourceful commercial man."[13]

The exploitation of all the possibilities involved in the price-cutting as a specific business system as well as the fight against it, i.e., attack as well as defence, had to use the same means: the unification of as many stores as possible in one organization. This led to the co-operative movement among the individual drugstore owners on the one hand and to the chainstores on the other hand.

The simpler method of defence against the damage caused by the price cutters, and hence the one tried first was the attempt of the other druggists to replace the respective proprietaries by their own preparations or by products made for them by some manufacturer. The next step was co-operative manufacturing. In 1895 the Minnesota Pharmaceutical Manufacturing Company was incorporated. In 1896 "companies were formed in almost every section of the United States."[14] Especially noteworthy among these companies were the Empire State Drug Company, with headquarters at Buffalo, and the Wisconsin Pharmacal Company. In the same year the United States Pharmacal Company of Chicago was founded, the first attempt to put this co-operative manufacturing on a nationwide basis.

The next co-operative manufacturing pharmaceutical concern which aimed to become a national undertaking was the United Drug Company of Boston. This undertaking, however, was not so much a defence measure of the small druggists against the aggressive cutters as it was an attempt to enter the manufacturing business on a co-operative basis; and therefore other retail druggists were, under certain conditions, allowed to join.[15] The inaugurator and first general manager of the United Drug Company was L. K. Liggett. In 1933 the United Drug Company became "a subsidiary of Drug Incorporated, a large organization which also manufactures proprietary remedies and conducts an extensive chain store system," producing the so-called "Rexall" pharmaceuticals and toilet articles and supplying them to the Rexall stores. "There were approximately 10,000 Rexall stores in 1930." They are "independent financial units, but agree to purchase at least minimum amounts of Rexall products in exchange for special discounts, local and national

advertising advantages and a distinctive window sign."[16] Another nationwide co-operative manufacturing corporation of much the same kind and likewise founded under the auspices of the prominent price-cutting druggists, is the American Druggists Syndicate, established in 1905.[17] "There were, in 1930, about 20,000 retail stores purchasing from the syndicate which in 1926 had been taken over by the D. A. Schulte interests, operators of a large retail chain-store system."[18]

Thus a movement, initiated in order to defend the independent small druggists has to a large extent turned into a link between independent and chain stores, assisting the latter by strengthening their manufacturing and buying power. In 1930 another company, The Independent Druggists Alliance was founded. "The Independent Druggist's Association members are alleged to reap all the administrative advantages and economies of chain store organization, but to retain independent financial status."[19]

The co-operative manufacturing companies also did more or less co-operative buying. Co-operative buying proper, however, took its rise as a movement of its own, although naturally following the same general trend. It represents not so much a special means of defence against price-cutting as an attempt to economize in taking advantage of all the allowances, bonuses, etc., granted by manufacturers and wholesalers to big buyers. "The growth of this movement has been rapid, and its history is filled with fewer fruitless attempts and failures than that of co-operative manufacturing."[20] From 1886-1907 one buying club after the other was founded, and among them we find the following: The New York Consolidated Drug Company "doing business as a regular wholesale institution" and turning over "its $60,000 capital stock about ten times a year," The Brooklyn Consolidated Drug Company, The Calvert Drug Company of Baltimore, The Washington Wholesale Drug Exchange, and the Philadelphia Wholesale Drug Company.[20] The last mentioned company, having been founded in 1886 under the name "Apothecaries' Union, Limited," and one of the oldest if not the oldest of the American retail druggists' buying clubs, "has been so successful as virtually to monopolize the wholesale drug business in Philadelphia," its sales to its 800 members and to other retail dealers in 1930 exceeding $12,000,000. "These 'co-operative' or 'mutual' wholesale drug companies usually specialize in the distribution of well advertised products and limit their stocks to certain specified items and brands. Some 'mutuals' have grown to tremendous size."[21]

The first attempt at a national buying club association seems to have been made with the establishment of the Associated Drug Companies of America, in New York in 1906. It was superseded in 1916 by the Federal Wholesale Druggist's Association.[22] According to L. H. D.

Weld, there existed at that time buying clubs of larger importance in the following 13 cities: Philadelphia, Baltimore, Washington, Providence, New York City, Rochester, Buffalo, Cincinnati, Indianapolis, St. Louis, Kansas City, Atchinson, and Minneapolis. In addition Weld mentions "a company in Cleveland with branches in Chicago, Columbus, and Detroit, which operates in a similar manner to that of the co-operatives, but which is owned and operated largely as a private enterprise."[22] The growth of the movement becomes evident from the fact that in 1930 the national organization mentioned, the Federal Wholesale Druggist's Association, consisted of about 25 members.[23] "Not to be outdone by a chain composed of former 'old line' jobbers, a group of mutual or co-operative drug companies in 1929 organized a chain system" under the name "Mutual Drug Company." Retail dealers could become shareholders or merely profit by special discounts according to the amount of their purchases. Remaining independent they could take advantage of all chain store profits by joining the company and identifying their stores by the name "Ure (your) Druggist, Inc."[24] The "chain composed of former 'old line' jobbers" which the Mutual Drug Company desired to counteract, was the combination brought into existence by McKesson and Robbins, Inc. in 1928. "This company comprises a group of wholesale houses, 67 in number at the close of 1930. By August 10, 1929, it was announced that approximately 17,000 independent retail dealers had signed contracts to feature McKesson and Robbins products and thereby to be advertised as McKesson stores."[25]

Large as has been the co-operative movement in the American retail drug trade, it has not led to the establishment of a large national manufacturing and wholesale institution like the French Pharmacie Centrale (see p. 66), representing both the scientific and commercial potentialities of the profession. There have been two reasons for this failure, the one lying in the inner structure of the American retail drug trade, the other brought about by circumstances. The inner cause of failure was that the American retail drug trade although including pharmacy proper, lacked the uniformity of education, interests, and objectives which is necessary for the establishment and even more for the maintenance of such an institution. The circumstantial cause of failure was that in contrast to continental Europe and partly even to Great Britain the legal position of the calling as a profession or at least as a specialized trade had not been established. To achieve this the calling needed the good will and the support of the manufacturers as well as of the regular wholesale dealers. The official representatives of American retail drugdom could, therefore, not sanction or at least could not support a movement the final objective of which was the possible exclusion of these two groups. "The members of the buying clubs are all or nearly all, strong National Association of

HIGBY & WARDNER,

DEALERS IN

Drugs Medicines

PAINTS, OILS,

Dye-woods & Stuffs

&c. &c.

HAVE just received an extensive assortment of Drugs Medicines, Paints, Oils, Dye Woods, and Stuffs, Brushes, Perfumery, and patent Medicines together with a general assortment of physician's and Chemist's preparations etc. etc., among which are:

Aloes,	White Lead,
Alcohol,	Red Lead,
Alum,	Ven Red
Annatto,	Vermillion
Balsam Cepaiva,	Varnish
Borax,	French Yellows
Brimstone,	Spanish White
Sulphur,	Lemp Black
Salt Petre,	Spirits Turpentine,
Epsom Salts,	Linseed Oil
Camphor,	Lamp Oil
Castor Oil	Camwood
Cloves,	Logwood
Nutmegs,	Fustic
Cinnamon,	Nicaragua
Corrosive Sub	Indigo
Red Precip.	Coperas
Opium	Madder
British Lustre,	Paint Brushes

Camel's Hair Brushes.

The subscribers, dealers in the above line, solicit the attention of the public and the trade generally, to their stock which will be sold on terms reasonable for CASH. Orders from any part of the Territory promptly attended to and packed with particular care.

HIGBY & WARDNER,

Milwaukie, Sept. 20, 1841. 6t

Facsimile of an advertisement in the Milwaukee *Commercial Herald*.

FIGURE 21. Advertisement of an Early Milwaukee Druggist.

Retail Druggists (N. A. R. D.) men, although, paradoxically, the National Association of Retail Druggists is theoretically opposed to the buying club idea," wrote the "Druggist's Circular" in 1906.[26] In 1907 the National Association of Retail Druggists adopted a resolution declaring the co-operative manufacturing and buying clubs "to be entirely a local matter."[27] This declaration of neutrality, expressing the desire as an association to remain out of the war, was the greatest concession which the National Association of Retail Druggists could make to the co-operative movement.

Co-operation with manufacturers and wholesale dealers was already the program of the forerunner of the National Association of Retail Druggists (N. A. R. D.), the National Retail Druggist's Association (N. R. D. A.), founded in 1883 and disbanded in 1887. In following this program plans designed to abandon or at least to mitigate the threat of price cutting were worked out and tried. First came the so-called Campion plan which provided a rebate system applying only to druggists selling at regular prices. Concerns which did not employ the rebate system were supposed to be under obligation not to sell to cutters at all.[28] The plan proved to be a failure. Other plans were discussed rather than put into force when, in 1898, the National Association of Retail Druggists came into existence and started with a successful drive "to relieve the retail trade of the burden of taxation resulting from the imposition of the Spanish-American war tax on proprietary medicines and toilet articles."[29] After this several plans were tried with more or less success until finally the so-called tripartite plan came into being. It derived its name from the fact that it was the result of an agreement between three parties, the National Association of Retail Druggists, the National Wholesale Druggist's Association, and the Proprietary Association of America. This agreement, limiting effectively the sale and distribution of many preparations to dealers who maintained established resale prices, led to action by the United States Department of Justice. A decree was entered in the United States Circuit Court for the District of Indiana, May 9, 1907, which, under the Sherman Anti-Trust Act, declared all the essential and effective measures of the agreement to be illegal. It enjoined the three associations participating in the tripartite plan "from combining and conspiring to restrain trade, from fixing prices by agreement and blacklisting retailers, and from continuing in force the direct contract-serial numbering plan as heretofore enforced."[30] Other decisions abolishing every possibility for even the individual manufacturer to maintain resale prices for his products followed.

In as much as legislation had enabled the price-cutters to defeat their adversaries, the National Association of Retail Druggists "promptly entered the legislative field."[31] Until 1930 there was not much success ap-

parent. "Into this picture we now have the introduction of the Fair Trade Laws, first in California in 1931, and since copied by 41 other States, making it again possible for the manufacturer to use contracts binding on all in enforcing his prices. These laws have been fortified by a Federal Enabling Act (Miller-Tydings-National Fair Trade Enabling Act) and have been upheld by the Supreme Court . . . December 7, 1936."[32]

These fair trade laws are not simply other legislative acts favorable to the interests of the retail drug trade. They are of profound general importance. They represent the first obvious signs of a fundamental change in American public opinion as to the concept of liberty, the avowal that "the real difference between anarchy and an organized free society lies in the degree of individual restraint and in the kind of rules set up to insure mutual satisfaction in the economic relations of life." The period in which it seemed necessary "to protect the individual against the group" (i.e., the big corporations with monopolistic trends) apparently is being superseded, at least in part by another "establishing, through Social Control, the protection of the group (i.e., here the retail trade as a whole) against the unscrupulous individual."[33]

This change in general attitude and legislation would, if it indeed should prove to be more than a temporary reaction against too obvious evils, also put an end to another peculiar type of cut-price stores, the so called pine-board drugstores. These stores, using the simplicity of their set-up, the "pine-board," as an advertisement of their ability to sell cheaper than their competitors, are a product of recent years. Having in stock only the best sellers and working with the lowest possible costs of doing business, they make extreme price-cutting their principle. The parasitic antisocial nature of these stores is made apparent by the fact, that in asking for nothing else but an easy profit, they destroy the economic base of real drugstores, to which they leave the responsibility of supplying the balance of the drug needs of the people.

As previously stated, the chainstore arose from the same circumstances which later produced the co-operative movement. In the large cities in comparatively early times there were druggists who owned two or even three drugstores in their community. These people, however, always considered themselves "independent" druggists like the one-store owners. The suggestion of Rorem-Fischelis of using the term chainstores only for "four-store enterprises and sectional and national systems"[34] is perfectly arbitrary but, in a measure, meets the real situation. The first "chains" of drugstores were established in England and Scotland, known there under the name company-pharmacy, and had developed to a remarkable degree by 1900.[35] It is highly probable that the American movement in its later growth followed deliberately the English example.

However, the first attempts made before 1900 by Hegeman & Company, of New York, by Charles B. Jaynes, of Boston, the Hall & Lyon Company, of Providence, and Miss Cora Dow, of Cincinnati, were doubtless the results of the American conditions and not the result of any English example.

The rapid development of the chain drugstores in America was due to the work of two men: Louis K. Liggett, who five years previously, in 1907, had initiated the foundation of the United Drug Company; and that of Charles R. Walgreen about 1910. In 1916 Liggett operated 45 stores and added to them the 107 stores of the Riker-Hegeman-Jaynes combination, which he bought out. In 1921 he had 229 stores. In 1930 the Liggett concern "touched its all-time peak of 672 stores." Plans of dominating the retail drug trade of the Anglo-Saxon world ripened. "Combining with various large manufacturers to form Drug, Inc., the concern extended its operations to England, building up the Boots, Ltd., drug stores there. At the height of the boom of the late 1920's 1,000 drug stores in the two countries came under this single ownership. The Boots stores were disposed of in 1933 and Drug, Inc. disbanded into the several parts."[36] About 1905 Charles R. Walgreen, the other big man in the chainstore business, worked as a drug clerk in Chicago. In 1916 he had a chain of nine retail drug stores in the same city. In 1922 his stores numbered twenty-nine, in 1927, 116 and in 1929 there were 441 under his control. "While the total number of retail stores in 1935 was considerably less than in 1929, this loss was suffered by independent drug stores, for we find that the number of drug chain units increased from 3513 units in 1929 to 3744 in 1935."[37]

Since the drug chain managers have always chosen only the urban districts and the best situated places within them for the establishment of their units, these stores present naturally a very different turnover than do their independent competitors. While in 1935 "less than 4% of all the independent drug stores did an annual business of over $50,000, . . . over 64% of chain stores did a business of over $50,000."[38] As another factor of importance it should be noted that in recent years there is a tendency among the drug chain managers to develop the professional side of the business. According to Delgado a chain with approximately 120 stores in the Middle Atlantic area increased its prescription business from 270,000 prescriptions in 1932 to 540,000 in 1935, to 643,000 in 1936 and to about 750,000 in 1937. In these stores "only highest grade registered pharmacists" are employed and they are paid "beginning salaries of $45 a week."[37] It is this same attack on the very heart of independent or individual pharmacy which has been tried in recent years by some big department stores, more particularly by Macy's in New York.

The attempt of several states, first New York, then Illinois, Michigan, and Pennsylvania to prevent professional competition by non-professional persons by legally restricting the ownership of drug stores to registered pharmacists according to the continental European pattern was rendered ineffective by a decision of the United States Supreme Court, November 19, 1928, declaring such laws unconstitutional.[39] Among the arguments presented in favor of pharmacist ownership that of J. H. Beal is very likely the strongest because it opposes the psychological reality against the legal fiction.[40] It emphasizes the fact that in all cases here coming in question, the professional manager has to obey the directions of the non-professional owner and therefore, for cogent personal reasons cannot meet the legal responsibility imposed upon him.

It is of interest that for this very reason the most recent pharmaceutical legislation in Germany denied the right even of widows and orphans, of proprietors disabled by old age or long illness to conduct their pharmacies personally, or to exercise any influence on the management of the business. These pharmacies have to be leased to registered pharmacists and have to be conducted on the responsibility of the lessee.

In the reports previously quoted concerning the general pharmaceutical situation within the United States around 1850, data comparing the number of drugstores with the population are lacking. Estimates of that kind are given only for the state of Massachusetts. It is stated that in Massachusetts in 1852 the number of drugstores in cities of 10,000 and more inhabitants was 1 to 1,500, in towns of about 6,000 inhabitants 1 to 2,000, and in "thickly-settled districts" 1 to 3,000. Statistics of later years reveal no great change in the ratio. A recent survey estimates the ratio of drugstores to population as 1 to 3,154 in rural districts and 1 to 1,525 in urban districts.[41] The following table gives a survey of the development between 1880 and 1929.[42]

DRUGSTORES AND POPULATION IN THE UNITED STATES, 1880 TO 1929

Year	Population	Number of drugstores	Population per store
1880	50,155,783	25,105	1,958
1890	63,100,000	34,317	1,838
1892	65,700,000	34,886	1,883
1895	69,600,000	39,885	1,746
1899	74,800,000	38,215	1,957
1903	81,000,000	39,899	2,030
1905	84,200,000	42,281	1,991
1910	92,300,000	45,661	2,021
1916	100,800,000	46,561	2,165
1921	107,800,000	47,653	2,262
1922	109,200,000	48,689	2,243
1925	116,000,000	53,304	2,176
1929	120,000,000	59,413	2,020

The population data are taken from the Statistical Abstracts of the United States. The numbers of drugstores are the estimates published in the respective issues of the "Era Druggists Directory."

The above table reveals a slight tendency to a proportional decrease after 1900. However, this decrease is insignificant. Practically the number of drug stores in proportion to the population has not changed notwithstanding the changes that have taken place in the business. Three reasons may be mentioned: 1. The rapidly growing wealth of the people creating new needs and therefore stimulating buying. 2. The adoption of new sidelines such as books, magazines, cigars, and so on. 3. The soda fountain and its auxiliaries, the ice cream, sandwich and, finally, the luncheon business.

It was the soda fountain which saved many drug stores from a more or less radical decline. It is a question of principle for American pharmacy, whether this rescue was to the advantage or disadvantage of the real task of the drug store, its professional pharmaceutical public welfare service.

The development of the soda fountain business in American drugdom is described in an unsigned article in the "American Druggist."[43] It was the French-born pharmacist Elias Durand (see p. 177) who in 1825 in his apothecary shop in Philadelphia operated the first soda fountain in an American pharmacy. Moreover, it was the first seen in this country. "The most important part (of the new pharmacy) was the stock of drugs and chemicals he (Durand) had selected, including many novelties, and the apparatus for making and vending carbonic acid water."[44] In 1835 Durand was the first to introduce the bottling of mineral waters in this country. For manufacturing the waters and also for bottling them he used an apparatus of his own invention.[45] The soda fountain came into its own during the eighties of the 19th century with the fight against the liquor business and with the passage of local and state legislation banning saloons and liquor stores. When finally in 1919 national prohibition under the provisions of the so-called Volstead Act became a fact, the fountain business reached its climax. "From 1919 to 1929 new installations went on to the tune of $19,500,000 a year." According to the Federal Census of Distribution, for the year 1929, of the 54,745 independent drug stores, 31,813, had fountains, of the 3,513 retail drug chain units, 3,031 had fountains.[46] In 1935 drugstores with fountains took in $121,000,000 from the sale of meals and from fountains, accounting for 6.8 per cent of the total sales of meals for the whole country.[47]

The soda fountain with its side-lines, ice cream, sandwiches, and luncheons, has become so significant a feature of the average American drugstore that in the imagination of many people the concept of a drugstore includes the fountain. Rorem-Fischelis tell of a prominent Philadelphia pharmacist who operates a prescription pharmacy and was asked to move to a new location in a physicians' office building. "The physicians who

urged him to make the move added that of course they would expect him to provide a quick lunch counter in his establishment to make it possible for the physicians in the building to conserve their time by running down to the soda fountain for a bite to eat."[48] Fr. A. Delgado confirms that "particularly for professional pharmacists located in professional buildings, it is sometimes necessary to have a soda fountain and the like for the convenience of the physicians and others who frequent the building." He adds, however, that "none of the four St. Louis professional pharmacies which form the basis of this report had soda fountains."[49] This last statement seems to prove that real professional pharmaceutical service seriously meeting all demands lying in its proper sphere, can afford to restrict itself to this sphere.

As previously pointed out, since the beginning of the 18th century, there have always been professional or so-called "ethical"[50] pharmacies in America. Some of these pharmacies were well-known for their exemplary professional standard as well as for their economic success, e.g., those of Marshall (1729-1825), owned for a century by members of the same family, of Durand (1825-1873), of Marshall's successors, Ellis and Morris, of Daniel B. Smith and other Philadelphia pharmacists.[51] American practical pharmacy can always be proud of the fact that the men who have laid the foundation for American scientific and professional pharmacy, Procter, Parrish, Grahame and others have been investigators and teachers while still operating as practical pharmacists and owners of "stores."

In New York the store of John Milhau, conducted by its founder from 1830 to 1869, and until 1903 by his son Edward L. Milhau, has been one of the best-known representatives of the older American professional pharmacies. Like Durand of Philadelphia, John Milhau had received his pharmaceutical education in France.[52] In Boston the pharmacy of Theodore Metcalf, founded in 1837, became not only a well-known professional pharmaceutical institution but the rendezvous of eminent American people and European visitors.[53] The German influence on New York pharmacy, as previously mentioned evinced itself in a number of professional pharmacies established by people of German descent, e.g., Alfred G. Dung, Adolph Heyl, and George A. Cassebeer. Their pharmacies were "very popular prescription stores."[54] Reporting his experience during a trip to the United States, Thomas Maben, a distinguished English pharmacist in 1903, wrote: "The Germans practically monopolize the practice of pharmacy in New York, though, curious to say, some of the most prosperous establishments are conducted by Englishmen and Scotchmen." As such real pharmacies of Anglo-Saxon coinage Maben named the establishments of Caswell, Massey & Company, founded in 1780 in Newport and extended to New York in

1859, and of Fraser & Company, founded in 1881. He calls the former "first-class prescription pharmacists," and attributes to the latter the honor of being "representative of the few retail drug establishments in the United States which realize in their operation the dreams of the educated, scientific pharmacist."[55] Many of those pharmaceutical retail businesses however which considered themselves professional between 1870 and 1920 were only old-fashioned drugstores, not professional pharmacies. It is this type of old druggist, of whom L. K. Liggett ironically wrote that he sold all kinds of goods but "did not feature them" and displayed in his windows "festoons of dusty sponges, exhibits of cochineal bugs, rock sulphur and flyspecked cards announcing the 'Old Folks Supper' at the Methodist Church."[56]

The obvious trend towards professionalizing the drugstore is a recent one. According to C. B. Jordan from 45 per cent. to 50 per cent. of the strictly professional drugstores of the United States have been opened between 1925-1931. He estimated the number of stores "receiving 50 per cent or more of their total sales from their prescription departments" to be between 350 and 400.[57] In the meantime this number has continuously increased. However, it may be doubted whether such a high percentage of prescription receipts is essential to the conduct of a professional pharmacy. With so many physicians dispensing their own medicines, with a disproportionately high number of drugstores and comparatively little legal protection of professional pharmaceutical objectives, some experts estimate that from 10,000 to 20,000 people are necessary to support a professional pharmacy. Other experts, themselves owners of professional pharmacies, consider even less than 10,000 people "a sufficient population for this purpose."[58] There are said to be 3,200 drug stores in the United States, which can be considered as primarily interested in the filling of prescriptions. However, it is doubtful whether these stores are necessarily "professional pharmacies,"[59] i.e., meeting the condition of receiving 50 per cent. or more of their total income from their prescription department. Surely most of them do not.

According to Fr. A. Delgado the total number of prescriptions filled or refilled annually in the United States "may be placed at close to 165,000,000." He estimates that between 10,000,000 and 11,000,000 prescriptions, in other words, 6 or 7 per cent. of the total number are filled annually in the 400 stores which are considered "professional" according to the above definition. Obviously, taking the present number of drug stores as a matter of fact, subject perhaps to some unimportant decline but not to a radical change, Delgado regards "the professional pharmacy" not as an objective or even a possibility to be achieved by

and for the entirety of the American retail drug trade, but for "a specialist in the retail drug field."[60]

It is, however, a general pharmaceutical professional status and not the claim of a group of specialists, which is supposed to be promoted by slogans such as "The druggist is more than a mere merchant" and primarily by "Pharmacy Week." It was in 1924 that Robert J. Ruth made known his plan of an annual propaganda week for professional pharmacy, i.e., stressing the service rendered to the world in general and to the American people in particular by professional pharmaceutical work. American pharmacy in its entirety, including the wholesale druggists and the pharmaceutical manufacturers, stood and stands behind "Pharmacy Week" and has made it an annually increasing success. No doubt "Pharmacy Week" influences the public mind and attitude towards pharmacy as well as the attitude of pharmacists toward their own profession.[61]

It is obvious that this annual battle for the recognition of the calling as a whole is fought primarily with the armament of the small group of specialists, representing professional pharmacy.[62]

2. *The Equipment of the American Drugstore*

So far as the early American drugstores were general stores, their fixtures and equipment were those of these stores supplemented by pharmaceutical tools such as mortars, presses, sieves, funnels, etc. So far as they had or pretended to have the character of a professional pharmacy, fixtures and equipment were mostly imported and represented the French, English, or German style of the period.

Often the wholesale druggists and drug importers dealt in drugstore fixtures and pharmaceutical equipment. On June 18, 1750 an advertisement in the New York Weekly Post-Boy offered "to all Practitioners in Physick" drugs imported from London and "the utensils of a neat apothecary's shop." On October 5, 1789 Effingham Lawrence of New York announced in the New York Daily Advertiser that he had "received from Bristol, a large assortment of shop furniture of all kinds; large show globes, specie and stopper bottles . . . , ointment, syrup and pill pots." etc. At the end of his "catalogue of the materia medica and of pharmaceutical preparations," issued in 1817 the druggist Charles White of Boston offered "apothecaries shop furniture." The equipment of Durand's pharmacy in Philadelphia, regarded as "the handsomest drugstore in the Quaker City"[63] was brought over from France in 1825.

Fortunately some of this equipment of old-time American pharmacies has been preserved. Aside from miscellaneous collections, possibly the first instance of the preservation of an old-time drugstore as a museum

unit is to be found in the 17th century house of the Essex County Historical Society in Salem, Massachusetts. Some colleges are the fortunate possessors of old pharmacy fixtures. Thus the Philadelphia College of Pharmacy owns the fixtures and furnishings of the drug store of George Glentworth of Philadelphia, founded in 1812,[64] and the New York College of Pharmacy possesses pharmaceutical fixtures and equipment of the same period. The same era is represented by the Stabler-Leadbeater pharmacy[65] of the American Pharmaceutical Association. Of a later period, about 1850, are The Pioneer Drug Store of the Wisconsin Historical Society, established in 1913[66] and the old-time pharmacy in the Milwaukee Public Museum, installed in 1934.

The modern development in American pharmacy has brought forth as many types of fixtures and equipment as there are different types of drugstores or pharmacies; commercial or professional or mixed types, with or without soda fountain and luncheonette, with the prescription counter as the center of the business, in the rear, or not visible at all. The most striking examples of two special types of professional American pharmacies are: 1. the store of Hynson, Westcott, and Dunning in Baltimore, displaying in the large sales room only a few objects of special medicinal interest including apparatus, and representing deliberately a scientific institution rather than a private business enterprise; and 2. the apothecary shop of J. Leon Lascoff & Son in New York, which in architecture, equipment, and spirit of responsibility reflects the historical aspects of pharmacy.

Varied as the American drugstores and pharmacies have been in the nature of their business and equipment, most of them have used the old-fashioned Anglo-Saxon device of making obvious their character as pharmaceutical workshops with show bottles filled with colored liquids and illuminated after dark by lights placed behind them.

3. Wholesale Establishments

There is some doubt as to whether European professional retail pharmacy emerged from the early general store or from the pharmaceutical work done by the monks in the monasteries. Probably both conjectures are true (see p. 36). However, there is no doubt that in Europe professional retail pharmacy existed before the specialized wholesale drug trade came into being. The North American continent offers the paradoxical contrast that here the wholesale drug trade came first.

Like most paradoxes this one surprises only when first presented. In Europe with its comparatively early separation of medicine and pharmacy the apothecaries from the 13th century on met the medicinal needs of the population. They were collectors of drugs and, on a small scale manufacturers buying only limited amounts of imported drugs. It was

not until the sixteenth century that the use of imported drugs had grown to a considerable extent, and manufacturing on a large scale began to supersede the preparative work within the pharmacies. With this change an organized wholesale trade in medicinals could establish itself.

This development did not and could not take place in America. As previously stated on several occasions, the medical and the medicinal needs of the populace in colonial times had to be and were met by the same persons. Although indigenous plants were collected and used, the official therapy of the colonies was that of Europe, more particularly that of England. This necessitated importation on a large scale. Hence, the wholesale drug trade was organized at an early date since most of the American medico-pharmaceutical practitioners wanted to employ the same preparations which the pharmacists in Europe at that time usually prepared themselves. Thus it came about that American professional pharmacy became the legitimate offspring of the wholesale business (see p. 165). The country doctors had to be supplied with the necessary drugs by someone in a not too distant town. Thus an opportunity arose for locally restricted wholesale trade, usually in combination with retailing. This condition continued to a large extent until the Civil War. By way of illustration, it was not until 1868 that George A. Kelly of Pittsburgh disposed of his retail stores and devoted himself entirely to the wholesale business, the George A. Kelly Company. Based on import, the American wholesale trade in drugs had its first centers in the great seaports, Philadelphia, New York, Boston, Baltimore, and New Orleans. Later on the trade followed the inland waterways. Important establishments sprang up in Pittsburgh, Cleveland, Cincinnati, Detroit, St. Louis, Chicago, and finally in California and the other western and southern cities.

Some of the wholesale drug firms, founded between the end of the eighteenth century and the Civil War, are in existence today. The oldest of these is the Schieffelin Company in New York, the origin of which goes back to 1794.[67] Henry H. Schieffelin, the second in the long chain of members of the family heading the growing concern, was not only among the founders of the College of Pharmacy of the City of New York but its first vice-president during the first two years of its existence (1829 and 1830) and "its president in 1831, in which year the first charter of the college was granted by the legislature."[68]

As new territories were opened and rapidly settled, canals and railroads built, and the telegraph invented, the opportunities for wholesale trade seemed to be inexhaustible. However, this picture of progress had its reverse side. The period in which the retailer or sub-wholesale druggist traveled once or twice a year to "his" wholesaler "in the East" to purchase a large stock was over. Now the broker entered the picture.

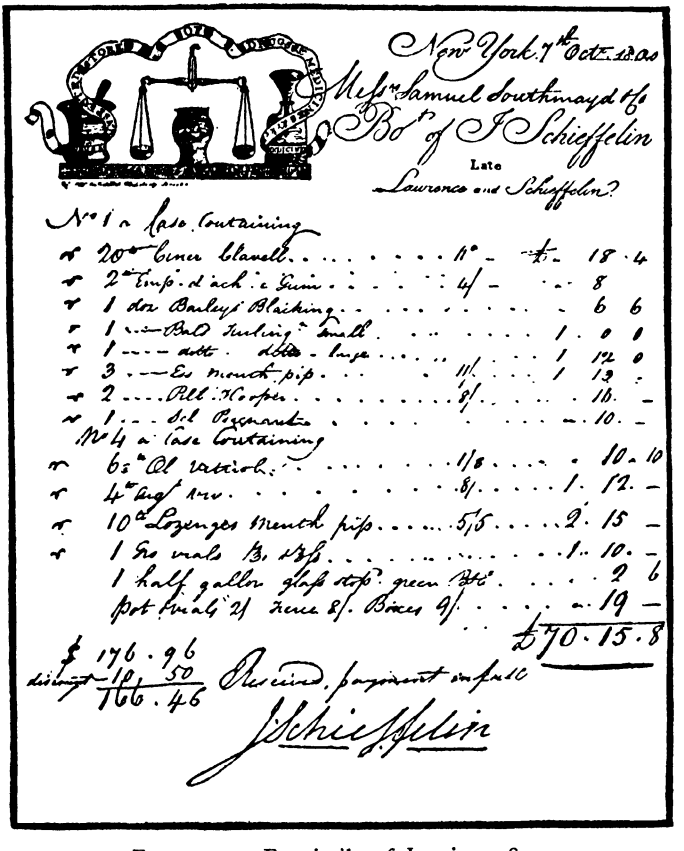


FIGURE 22. Fac-simile of Invoice, 1800.
(Reproduced from "One Hundred Years of Business Life," New York, 1894.)

A new kind of competition started. The Civil War interrupted the development, but only to give way to a new boom. In 1866 a "review of the New York Market" described the change of conditions as follows: "A great change in the business has taken place within the last few years. The means of communication are now so numerous and frequent, that the old regime of periodical business has in a large measure given way to smaller purchases and more frequent orders . . . Another change . . . is the more prominent position given to brokers, a class of middlemen. We do not believe this service has any value to the small dealers who have established relations with the jobber, and which ought not to be disturbed except by his own choice."[69] In 1868 the same reviewer pictured the situation after the Civil War saying: "Popular ideas of slow and laborious accumulation are exploded, and the quick growth of riches on all sides, suggests short avenues to wealth . . . These changes are not accomplished without a loss of moral tone, illustrated in the greater immunity to fraud."[70]

By 1870 demoralization was at its height. Men rushed into business "imbued with the idea of 'getting there first.' "[71] "A spirit of intolerance and discontent prevailed. Adulteration, trickery, shortweight, reprisals sometimes crept into business. In the wholesale drug field, destructive competition was the order of the day. Price, not quality, usually governed the sale."[72] In 1876 the representative wholesale druggists of the Middle West met in Cincinnati and founded the Western Wholesale Druggist's Association, which at the Chicago meeting of 1883 became the National Wholesale Druggists Association. The new organization was created to "correct excessive and unmercantile competition" and "remove, by concert of action, all evils and customs that are against good policy and sound business principles."[72]

The association has done a remarkable work. As to the ratio between the number of drug wholesale houses and drugstores, The Meyer Druggist wrote in 1927: "In the sixties St. Louis had over a dozen wholesale drug houses and some fifty retail stores. Now with two wholesale distributing concerns there are in the neighborhood of six hundred and fifty drugstores."[73] According to the census of 1930 there were 638 drug wholesalers in the United States who carried a general line of drugs and sundries. They turned over a combined volume of $575,000,000 annually. In addition there were 849 others, doing a business of $193,000,000, who specialized in drugs, sundries, patent medicines, sanitary supplies, rubber goods, and liquors.[74]

In 1880 there were 2,700 different items and sizes of proprietaries on the market. Three years later this amount had almost doubled and thereafter increased enormously. "The industry assumed that it had reached an absolute limit in 1916 when the wholesaler was able to list

some 38,000 different items and sizes, but today (1933) the total is 60,000. This has meant that the retailer . . . has become increasingly dependent on the 'stockroom' facilities extended by the wholesaler. Not even the best equipped manufacturer is prepared to make the instantaneous deliveries or to sell in the diminutive quantities stipulated by the neighborhood druggist in his average order. Fully 70 per cent. of the line extensions on wholesalers' invoices today run well under two dollars each."[74]

The co-operative wholesale drug trade has already been referred to. (see p. 300). "A fusion of the orthodox mercantile functions is taking place rapidly in the wholesale drug trade, with the manufacturers and retail stores on the one hand reaching across the field once covered by wholesale firms, and with the wholesale druggists on the other hand reaching into the fields of manufacture and retail distribution."[75] Outside this battle zone, although not absolutely untouched by the competitive warfare, are the manufacturers of special brands which are prescribed by physicians or definitely asked for by the public.

4. Manufacturing Pharmacy

Manufacturing pharmacy in America has been the child of wars. It was born during the Revolutionary War (1775-1783). It took the decisive step from childhood to manhood after and in consequence of the Civil War (1861-1865), and it became independent from Europe and dominant on the world market after the First World War (1914-1918).

In 1778 the apothecary general Andrew Craigie initiated and later on managed "a general laboratory" in which medicines for the needs of the military hospitals and the fighting army were prepared (see p. 154). Only three years after the war, in 1786, the firm of Christopher, Jr. and Charles Marshall, wholesale and retail druggists in Philadelphia, "entered quite extensively into the business of making muriate of ammonia and Glauber's salt,"[76] being probably the first to produce pharmaceutical chemicals on a large scale in this country. The Philadelphia wholesale and retail druggists Samuel P. Wetherhill & Company announced in Poulson's Advertiser, August 18, 1826, that they were "now engaged in manufacturing on a large scale a variety of paints and drugs." Among the advertised preparations of their own manufacture were "Tartaric Acid, Sup. Carb. of Soda, Rochelle Salt, Lunar Caustic, Red Precipitate, White Precipitate, Nitrate of Ammonia, Corrosive Sublimate, Blue Vitriol, Spirit of Hartshorn, Carbonate of Soda, Calomel, Sulphate of Quinine, Alcohol, Sulphuric Aether."[77] In an advertisement of May 1830 the Philadelphia wholesale and retail druggist John Elliott likewise offered "articles of his own manufacture." Among them were

some of the products mentioned above. It is of interest to note that the term "Sup. Carb. of Soda" was replaced by Bicarbonate of Soda. His advertisement also lists tartar emetic and Seidlitz salts.[78]

All these men were among the founders of the Philadelphia College of Pharmacy. Also a member of the college since its foundation was John Farr who in 1818 established a manufacturing plant. After the druggist Thomas H. Powers and William Weightman, the nephew of J. Farr, had become partners in the business in 1838, the firm name became John Farr & Company. Upon the death of Farr in 1847, it was changed to Powers & Weightman. "The reputation of the house grew rapidly until it became the leading establishment of its kind in the country and perhaps in the world engaged in the manufacture of medicinal and other chemicals."[79] The next pharmaceutico-chemical manufacturing plant to be founded at Philadelphia and to become of importance in the development of pharmaceutical chemistry in this country, was that of Rosengarten and Sons, established in 1822. A year later the firm was the first to produce quinine sulfate in the United States. "They manufactured Morphine Salts in 1832, Piperine in 1833, Mercurials and Strychnine in 1834, Veratrine in 1835 and . . . Codeine, Bismuth and Silver Salts in 1836."[80] The trend towards consolidation after 1900 first brought about, in 1905, the amalgamation of Powers & Weightman and Rosengarten & Sons.[81] Finally, in 1927 the consolidation of Merck and Company, of New York, and the Powers-Weightman-Rosengarten Company, of Philadelphia was effected.[82]

Before the Civil War Philadelphia was the most important center of pharmaceutical manufacturing but by no means the only place in America in which there were such undertakings. Of establishments outside of Philadelphia which are still in existence, the oldest is that of the William S. Merrell Company, Cincinnati, founded in 1828. It was this firm as well as the firm of H. M. Merrell & Company of Cincinnati which worked successfully in the so-called eclectic field (see p. 161), using indigenous plants as the basis of manufacturing. In 1876, after John Uri Lloyd had entered into partnership, the H. M. Merrell Company changed its name to Merrell, Thorp & Lloyd; in 1881 to Thorp and Lloyd Brothers; in 1885 to Lloyd Brothers and in 1924 to Lloyd Brothers Pharmacists, Inc. Under John Uri Lloyd the concern assumed not only a leading position in the field of plant preparations of every kind but became the world's most valuable sources of progress in plant chemistry, colloidal chemistry, and new pharmaceutical methods and devices.

The Tilden Company, likewise in the line of eclectic medicine, grew to importance. Founded in 1848 at Lebanon, New York, the firm received its supply of indigenous drugs from the Shaker community there.

These religious sectarians had settled in Lebanon in 1787 and originated "as a trade in this country the business of cultivating and preparing medicinal plants for the supply and convenience of apothecaries and druggists."[83] The Shakers manufactured some preparations themselves. In a catalogue printed in 1860, "The United Society of Shakers at New Lebanon, New York" offered not only medicinal plants, etc., advertising "their therapeutic qualities and botanical names," but also "pure vegetable extracts, prepared in vacuo; ointments, inspissated juices, essential oils, double distilled and fragrant waters, etc."

Besides these specialized manufacturing plants there were two prominent firms who, founded before the Civil War, proved their usefulness and improved their business during the war to such an extent that they became leaders in the field of American pharmaceutical manufacturing: Frederick Stearns & Company of Detroit, and E. R. Squibb & Sons (until 1890 E. R. Squibb & Company) of Brooklyn. The founders of these two firms have accomplished more than the laborious work involved in creating and operating a prosperous business. By example and by incessantly emphasizing the ideal of purity, uniformity, and reliability as the first and most important basis of the manufacturing of goods destined to be used in the fight against disease and death, they have made this concept a generally recognized one. This implied more than an ordinary reform since during the trying years in which these firms developed, honesty in general had yielded largely to the mania for gain.

The manner in which Stearns started his work was characteristic. His original "laboratory" was a 12 by 12 foot back-room of the drug-store, opened by him in Detroit on New Year's Day, 1855. Without any capital on hand he could not manufacture a stock of preparations. "Samples were, therefore, prepared. These were shown to druggists on trips through the State of Michigan and, upon his return, the would-be manufacturer made up the goods for which he had received orders."[84] It was the war, in which Stearns acted as medical purveyor for the Michigan troops, which caused the small store laboratory to develop into a plant covering the entire floor space of a four-story building and equipped with steam power, milling machinery, extraction apparatus, etc. Gradually the concern grew into an establishment known the world over. This success would have meant more to the owners or the stockholders of the firm than to pharmacy, had it not been the result of a new idea of great general importance. This "New Idea," started in 1876 and fostered since 1879 by a house organ called "The New Idea," was the creation of "popular non-secret family medicines."[85]

"Disgusted with the rampant quackery of the time, Mr. Stearns resolved to offer a few simple preparations in popular sized packages, bearing full directions for use and in addition a plain statement of the

names and quantities of their ingredients . . . Other druggists, lacking Mr. Stearns' manufacturing facilities, adopted the plan and had him manufacture and finish similar preparations for them, bearing their names. And from this beginning it spread over the country and within a few years had extended even to the Old World, so great was its popularity."[85]

Thus did the concept of the "ethical specialty" come into being. Frederick Stearns must be considered the father of this new class of pharmaceutical preparations. His firm has also been one of the largest manufacturers of pharmaceutical galenicals in bulk. In advertisements published in the eighties and nineties of the nineteenth century the firm calls itself "the oldest and largest laboratory of its kind in the world."

The development of the Squibb laboratory differed from that of the Stearns establishment in much the same way as did the two men whose ideas were realized in the two plants. Stearns was the practical druggist, not without scientific knowledge but led primarily by his practical sense and his desire to improve the practice of pharmacy. Squibb was an educated physician who had served five years of pharmaceutical apprenticeship before he took up the study of medicine.[86] By no means was he without knowledge of the practice of pharmacy, but he was led primarily by his scientific interests and his desire to improve the practice of medicine. Stearns created new kinds of preparations and placed them at the disposal of the pharmacists. Squibb found new ways to prepare purer and more reliable products and placed this improved medicinal armament at the disposal of the physicians.

In the naval service from 1847 to 1857, first as a surgeon and from 1852 as assistant director of the pharmaceutical laboratory of the navy, Squibb was in 1858, a year after his return to civil life, induced to establish a moderate-sized laboratory of his own by the Chief Medical Purveyor of the army. However, it soon became evident that the medical wants of a peace-time army of 25,000 men could not support even a laboratory of that size. It is significant that it was his medical friends, who, recognizing the value to the medical profession of a manufacturer of his type, saved the young establishment from ruin in the first difficult years. From the very beginning "the medical profession of Brooklyn took a great interest in the movement," and when on the evening of December 24, 1858, the laboratory building was entirely destroyed by fire, these physicians furnished Squibb the capital necessary to rebuild it. Only two years later the Civil War broke out. "The needs of the army became very large, and additional buildings were hired and equipped . . . In 1862 another site was purchased and a large and commodious laboratory was erected . . ." Squibb's earliest and most valu-

able contributions to medicine were the new methods developed by him for the preparation of pure ether and pure chloroform, resulting in products whose use rid anesthetization almost completely of the dangers which had been associated with it. One of Squibb's greatest services to pharmacy was his research work on percolation, the results of which he published.[87]

It may be mentioned that Frederick Stearns as well as E. R. Squibb very actively supported the endeavor to elevate the general standard of American pharmacy. Stearns served the American Pharmaceutical Association as second vice-president (1856/57) and as president (1866/67), Squibb as first vice-president (1858/59), refusing to be elected president as he also declined the presidency of the American Medical Association.

The method of percolation, to which E. R. Squibb devoted so much work, was valued not only as a special mode of drug extraction but as an important contribution to the development of pharmacy. Joseph P. Remington wrote in 1900: "Fluid extracts would never have been evolved had it not been for percolation, and this class of concentrated preparations originating in America will always remain among the most solid achievements of American pharmacy. The labors of Procter, Grahame, and Squibb (particularly from 1845 to 1875) and the freedom with which they gave the results of their researches to their pharmaceutical brethren, greatly influenced the elevation of pharmacy into a profession."[88]

It is true that fluid extracts may be made by the retail pharmacist. It must be stated, however, that most of the druggists have bought and still buy these preparations just as they themselves no longer make plasters or sugar and gelatine coated pills. It was in 1838 that the Philadelphia druggist Robert Shoemaker "successfully developed a process for making plasters other than by hand and became a large manufacturer of this article."[89] In 1866 when the Philadelphia druggist William R. Warner, a retail pharmacist since 1856, "engaged in the wholesale business, combining it with the manufacture of pharmaceuticals," he became the first who "manufactured pills in which sugar was used as a coating."[90] In 1879 the firm introduced the so-called parvules, very small pills which could be produced only on a large scale. The compressed tablets, invented by the Englishman Brockedon and patented in England in 1843, superseded almost entirely the dosed powders prepared by the pharmacists. In America the first tablet machine was constructed by Dunton in 1864.[90] The number of large-scale manufacturers of galenical products grew with each of these innovations. Although rather efficient apparatus for the limited preparation of some of these products was constructed, the purchase of the manufactured products by the druggists became common. Besides the apparatus mentioned it will re-

quire a change of mental attitude before a revival of the laboratory of the retail pharmacy can be expected even if regarded as economically desirable. It must be admitted, however, that the small scale preparation of products containing alcohol, such as tinctures, fluid extracts, etc., is rendered unprofitable, and hence impractical because of the taxes on alcohol.

After the Civil War the number of pharmaceutical manufacturing firms increased rapidly. It was on May 7, 1867, that Dr. S. P. Duffield formed a partnership with H. C. Parke under the firm name of Duffield, Parke & Company, in Detroit. In 1869 the firm became Parke, Jennings & Company and on November 16, 1871, Parke, Davis & Company. This firm, like most of its predecessors and many of its successors, started with the production of only "a few chemicals," and "a line of fluid extracts." "The history of manufacturing pharmacy as a whole and of Parke, Davis & Company," says Fr. O. Taylor, "may be divided into four periods characterized by the most important activity of the time, which periods are practically identical in date especially the last three, as this firm in each of these was the leader in the special work involved. These periods are as follows: 1. Formative Period, 1867-1874; 2. Botanical Research Period, 1875-1882; 3. Standardization Period, 1882-1894; 4. Biological Period, 1895 to present time."[91] As early as in 1902 Parke, Davis & Company established their own research institute.

One after the other the pharmaceutical manufacturing plants, founded between 1860 and 1880 and rising from modest beginnings to large establishments, some of them at least, of worldwide importance, traveled the same course from the preparation of galenicals to a few chemicals. Finally, on the basis of research, they progressed to a systematic production of certain groups of chemicals, biologicals, and "ethical specialties." Most of them started with fluid extracts. When in 1860 A. P. Sharp, Louis Dohme, and Charles E. Dohme, all graduates of the Maryland College of Pharmacy, organized the firm of Sharp & Dohme in Baltimore, "they first undertook the manufacture of galenical preparations and did not enter the field of chemical manufacturing until 1886, when they began the production of pure plant principles." In 1929 the company acquired the H. K. Mulford Co. in Philadelphia and "thus has become the owner of one of the leading producers of biological products in this country."[92] The small laboratory opened by the druggist and colonel of Civil War fame Eli Lilly in Indianapolis in 1876 "with cash capital amounting to $700 and goods . . . amounting to $600," started with the production of "fluid extracts, elixirs, syrups, a few wines and then new liquid pepsine preparations."[93] It may be mentioned that Eli Lilly & Company was the first American manufacturing firm to establish a branch house, i.e., at Kansas City, Missouri, in 1882. "What

is now known as the scientific division had its beginning in 1886."[94] Not only was the founder of Eli Lilly & Company an educated pharmacist, his only son and successor, Josiah K. Lilly, graduated from the Philadelphia College of Pharmacy.

Most of the establishments mentioned, constituting important units of the great assets of American scientific and commercial life, have been founded by pharmacists, although the small laboratory of a drug store was not always the nucleus of the later plant. However, there is one American pharmaceutical firm of importance, Hynson, Westcott, and Dunning of Baltimore, which continues to maintain the drug store from which its plant emerged and which has made this store a pattern for American retail pharmacy. "The firm . . . was organized in 1889 by Messrs. Henry P. Hynson and James W. Westcott, both of whom were graduates of the Maryland College of Pharmacy. In 1894 Mr. H. A. Dunning, who is also a graduate of the Maryland College of Pharmacy, entered the employ of the firm, became a member some years later and is now its president. The business was first operated as a type of retail pharmacy in which the scientific and professional sides of the calling were emphasized. The venture was successful and in 1899 the firm conducted a strictly professional retail business in which about 40 people were employed."[95] In 1910 the successful conclusion of a piece of scientific research submitted to Dr. Dunning by physicians "was probably responsible for the firm entering into the field of chemical manufacture."[95] To the production of chemicals the manufacture of biologicals was soon added.

The few firms which started with the systematic production of pharmaceutical chemicals shortly after the Revolutionary War did not have to face much American competition. Even after the great impulse exerted by the Civil War and its consequences, the then emerging establishments devoted themselves, as previously shown, first to the manufacture of galenicals, and in their further development until 1917 to plant research work and finally to the production of biologicals. The systematic synthesis and production of organic chemical compounds, in other words, chemotherapy, came last. The reason was that in the second half of the nineteenth century, or at least after Kolbe's salicylic acid synthesis in 1874 and Knorr's preparation of antipyrin in 1883, the field of pharmaceutical chemistry was dominated by the Germans. As stated in the introductory remarks of this section, it required a third war to establish national pharmaceutical independence.

So far as there was an American production of pharmaceutical chemicals before the First World War (1914-1918), it was mostly based on German research and conducted by people of German origin or having German scientific education. The firm of Rosengarten & Sons, previ-

ously mentioned, was founded by German-Swiss people and based essentially on German and partly on French discoveries. It held its own through a whole century and its later amalgamation with Merck & Company, was quite natural. The Mallinckrodt Chemical Works of St. Louis, one of the very few important American firms which specialized from its beginning in 1867 in the manufacture of "pure chemicals for use in medicine, photography, and the arts" was founded by three brothers of German descent, two of whom, "Edward and Otto Mallinckrodt had just returned from a four years' residence in Germany where they had completed their chemical education."[96] Some large German firms had their own factories in the United States long before America entered into the First World War as for example the American firm of Merck & Company which had been started here in 1891. Fritzsche Brothers and Heyden both established laboratories in New Jersey during the early nineties. These firms, so far as they could prove their business independence in 1914, were considered as members of American industry. However, most of the products of the German pharmaceutico-chemical industry were only sold, not manufactured, in the United States, being protected from imitation by American patents. The entrance of America into the war against Germany in 1917 gave to the interested circles the opportunity of securing requisite legislation to seize these patents and to make them available to American industry. "The development of an American synthetic organic chemical industry was made possible by the late President Woodrow Wilson when he gave his approval to the organizing of The Chemical Foundation, Inc., to take over seized German chemical patents. Under the Foundation's charter, American manufacturers were enabled to use these chemical patents on equal terms and conditions. The use of these patents by American chemists was the beginning of a real effort to build up a 100 per cent self-contained American synthetic organic chemical industry."[97]

What these spoils of war meant to American pharmaceutical industry economically as well as in the quality of the chemicals manufactured here, becomes evident from the following quotation from a catalogue of the Abbott Laboratories in Chicago published in 1925. "For many years The Abbott Laboratories have manufactured fine medicinal chemicals; but this part of our business received a tremendous impetus during the World War, when we were asked by our Government to undertake the task of producing some of the synthetics formerly procurable only in Germany. The difficulties of making organic medicinals in America have been and still are very great but we are proud of the fact that in spite of the technical complexity of the problems to be dealt with, and in the face of destructive competition from sources intent on breaking the American chemical industry, we have gone steadily forward." In the

list following these remarks and containing several compounds of German invention, mention is made of chlorazene, dichloramine-T, arsphenamine, neoarsphenamine and sulpharsphenamine as first made in America by Abbott. The Abbott Laboratories were founded in 1891 by Dr. Wallace C. Abbott, at that time a practicing physician in Chicago. Later it absorbed other plants, the Dermatological Research Laboratories of Philadelphia, the Milliken Company of St. Louis, and the Swan-Myers Company of Indianapolis. From the beginning the firm specialized "in the manufacture, in convenient dosage forms, of the alkaloids and other active principles," i.e., in "ethical specialties."

Certainly there are only very few if any manufacturers of pharmaceutical chemicals, biologicals or galenicals, who do not also prepare "ethical specialties." The reasons are given by A. R. L. Dohme as follows: "No pharmaceutical manufacturer can survive in solvency if he confines his business to official and standard preparations because competition in these by the vast number of manufacturers precluded the possibility of maintaining the vast research laboratories and experts required to properly control the uniformity and accuracy of products. Therefore, the pharmaceutical specialty . . . New specifics for disease are usually the result of studies of the manufacturing chemist and pharmacist and the hope of increased specifics in medicine is hence the success and growth of the pharmaceutical specialty."[98]

In 1912 the manufacturers engaged chiefly in the production of druggists' preparations organized as the National Association of Manufacturers of Medicinal Products (American Drug Manufacturers Association). According to Rorem-Fischelis the term "druggists' preparations" meant "official and other non-secret preparations to be dispensed by pharmacists on prescription, or to be used in compounding prescriptions."[99] This association consisted in 1931 of 58 members and it is estimated that these firms produce more than 80 per cent of all "druggists' preparations," manufactured in America.[100] The manufacturers of "ethical specialties" belong either to this organization or to the American Pharmaceutical Manufacturers Association, founded in 1908 as the American Association of Pharmaceutical Chemists, or to both. The physicians' supply houses "engaged chiefly in the preparation of tablet formulas and liquid compounds of a non-secret nature which are supplied in containers ready for dispensing to the patient,"[101] belong mostly to the American Pharmaceutical Manufacturers Association. The manufacturers of so-called patent medicines (not patented medicines!), i.e., "medicines of secret composition bearing coined names protected by trade-marks and intended primarily for self-medication,"[102] are organized as the Proprietary Association of America, founded in 1881, and as The United Medicine Manufacturers Association of America, founded in

1921. It is of interest that several patent-medicine manufacturers, among them the producers of best-selling preparations, are closely interrelated as subsidiaries of the same holding company. Thus the Sterling Products, Inc. controls the manufacturing of Bayer's Aspirin, Cascarets, Castoria, Phillip's Milk of Magnesia, and Vicks' Vapo-Rub.[102]

The value of the products prepared and sold annually by the pharmaceutical industry has been steadily increasing. Amounting to $51,000,000 in 1905 it grew to $325,000,000 in 1929. Divided according to the classes of medication there were received in 1929 $120,000,000 for druggists' preparations, $56,000,000 for "ethical specialties" and $149,000,000 for patent-medicines and proprietaries for sale to the general public.[103] In the same year the sales of cosmetics, perfumes, etc. amounted to $161,246,000.[104]

It should be stated that during the last 25 years American manufacturing pharmacy as well as the legal and educational standards of American pharmacy have progressed quite as much as American medicine has progressed during the same period. As to proprietary medicines and their advertising, conditions have improved very much due to the unremitting efforts of the American Medical Association. The remodelling of the Food, Drug and Cosmetic Act in 1939 with its rigid regulation of the labeling of drugs, cosmetics, and food-stuffs and with its prohibition concerning the introduction of new remedies on the market except after examination of the claims by the Department of Agriculture, will doubtless improve the situation even more.

Of general importance is the fact that scientific research has become the general basis of American pharmaceutical industry. Some firms devote their research institutions not only to the immediate objectives of their business but also to problems of general importance to public welfare. The Research Institute of Parke, Davis & Company has already been mentioned. In 1933 Merck & Company, Inc. dedicated The Merck Research Laboratories at Rahway, New Jersey. In 1934 Eli Lilly & Company opened the new Lilly Research Laboratories in Indianapolis. In October 1938 The Abbott Research Laboratories in North Chicago and a month later, in November 1938, The Squibb Institute for Medical Research were opened.

Pharmaceutical industry has doubtless enriched and in some directions even educated retail pharmacy. The latter, however, was the nucleus of industrial pharmaceutical manufacturing. It was retail pharmacy which has given and continues to give some of its best men to industrial pharmacy. The industry has good reason to foster the continuance of the desire as well as the ability of the rising pharmaceutical generation to aid the staffs of the manufacturing establishments.

PART FOUR

DISCOVERIES, INVENTIONS, AND OTHER CONTRIBUTIONS TO SOCIETY BY PHARMACISTS

17

THE PHARMACIST AND SOCIETY

AT THIS stage the term pharmacist does not need an explanation. What, however, do we mean by the term society? There are two main conceptions: the first being the discriminative designation of a group of people representing, actually or supposedly a cultural or financial standard higher than that of the common people, the other a synonym for the social organism, i.e., the organization of peaceful and fruitful human relations. "Without this intersubjective intercourse mankind would remain a herd; with it they become a society."[1] It is the service in and the promotion of this second kind of society by American pharmacists which is here dealt with.

1. The Pharmacist in Social Life

All the pharmacists to whom the foundation of the Philadelphia College of Pharmacy can be attributed played an important part in social life. The first president of the college, Charles Marshall, was very active within the Society of Friends, executed several public activities and is said to have been "one of the picturesque figures of the Revolution on the patriot side" . . . and "a deep student of Latin and Greek."[2] The first vice-president, Peter Williamson, was especially interested in Masonry and achieved the highest degree in American Masonry.[3] The second president, William Lehman, was a very active member of the Pennsylvania Legislature and one of the leaders of the Philadelphia Athenaeum to which he left a bequest of $10,000.[4] The third president, Daniel B. Smith, "was elected a member of the Franklin Institute immediately after its organization in 1824 and was an incorporator of the Historical Society of Pennsylvania in 1826 . . . He was elected a member of the American Philosophical Society in 1829, and was also a member of the Academy of Natural Sciences." Furthermore he was elected to the chair of moral philosophy, English literature, and chemistry at Haverford School (now Haverford College) in 1834, and principal in 1843, resigning in 1846 "to give increased attention to his business," i.e., his pharmacy.[5] Henry Troth whose energy did much to bring about the foundation of the Philadelphia College of Pharmacy is said to have been "one of the most progressive citizens of Philadelphia of his day . . . active in many philanthropic, business, and scientific organizations."[6]

It is clear that to these men their profession, i.e., pharmacy, could not be anything else than a special aspect of their general view—a particular service to society. This idea became more general as the professional status of pharmacy became more generally recognized. Thus American pharmacists participated to a remarkable extent in the development of American social life. It could be taken for granted that the pharmacist was an educated man. His advice and assistance was always at the disposal of his fellow citizens. Very often he grew up in his hometown and with his business. It was, therefore, but natural that he enjoyed the confidence of his fellow citizens and sometimes became the guardian of the general cultural development in his place of residence.

In the rural districts and the smaller towns the pharmacist has been now and again the mostly unpaid expert in all questions requiring chemical and especially botanical knowledge. The method of the famous botanist G. H. E. Mühlenberg of asking "apothecaries . . . for the medicinal qualities and the trivial names of the officinal indigenous plants," collected by him,[7] has been followed in numerous noticed and unnoticed cases by other professional botanists as well as by laymen interested in botany.

Often the pharmacist became the historian of his parish, his city or even his state. There is a splendid example of recent days illustrating this fact; the retail pharmacist, Roy Bird Cook of West Virginia. Besides several pamphlets on historical subjects Dr. Cook is the author of: "Family and Early Life of Stonewall Jackson" (1924/25); "Lewis County (W. Va.) in the Civil War" (1924); "Lewis County in the Spanish-American War" (1925); "Washington's Western Lands" (1926); and "The Annals of Fort Lee" (1931 and 1935). Although excelling by far the more dilletantish endeavors of his colleagues, Roy Bird Cook can be considered the representative of American pharmacy in the great and successful American historical movement as he has never left practical pharmacy and has even devoted his talents to the history as well as to the actual progress of pharmacy. He has written a remarkable monograph on "The Rise of Organized Pharmacy in West Virginia" (1931), which was reprinted in The Silver Anniversary Proceedings of the West Virginia State Pharmaceutical Association (1931), and has been active in the interests of American pharmacy as secretary of the association, as president of the National Association of Boards of Pharmacy, and in other capacities. When in 1938 the University of West Virginia bestowed upon him the honorary degree of Doctor of Laws it was expressly declared that this honor indicated appreciation of the historian as well as of the exemplary pharmacist.[8] In addressing the members of the House of Delegates of the American

FIGURE 23. David Henshaw.

(Journal of the American Pharmaceutical Association, XXIV:866, 1935.)

Pharmaceutical Association at the meeting of 1936 Dr. Cook made the following remark: "Strange as it may seem, as we look about us, we meet in a land of romance."[9] In saying that he referred to Texas. For a man like Dr. Cook, however, every land to which he devotes his thought and his profession will be "a land of romance."

2. The Pharmacist as a Public Servant

Pharmacy as a profession is and has to be public service and each pharmacist honestly serving his profession is, therefore, a public servant. In general, however, the label "Public Servant" is restricted to people holding public office either by appointment or by election.

In the offices open to all citizens of the United States pharmacists have always taken their part. Members of the profession have held offices in city, state, and federal administrations and many of them have served in legislatures of their states and in Congress. In 1927 the State of Georgia had not less than nine pharmacists among its legislators. The State of Idaho counted at the same time three senators and three representatives from the ranks of pharmacy. The Michigan Legislature had in 1927 two senators and nine representatives who had been pharmacists.[10]

The citizens of Toledo, Ohio, elected as Mayor in 1926 the pharmacist Fred Mery, and in 1936 the pharmacist Roy C. Start.[11] In Raleigh, North Carolina, pharmacists have been mayors or other municipal officers in almost uninterrupted sequence. For a score of years with the exception of only two or three years one pharmacist and frequently two have been at the head of Raleigh's most important departments. The druggist G. Stanhope Wynne served several terms as mayor as did after him the druggist James Iredell Johnson, who died during his fourth term. In 1931 the pharmacist George A. Isely was elected Mayor and Commissioner of Finance and was re-elected in 1933. "The people of Raleigh," wrote R. O. King, "recommend the 'pill rollers' to the world as honest, progressive, and efficient city officials."[12]

Only one case is known in which a druggist rose to the rank of a member of the President's Cabinet. This was the Bostonian, David Henshaw who became Secretary of the Navy.[13]

David Henshaw was an enterprising and successful druggist. In the short time of about thirteen years of operating his own drugstore, which he started at the age of twenty-one, he made his business one of the largest in Boston. Besides this he had become a banker, a railroad director, and the founder and owner of a newspaper, the "Boston Statesman."

He was appointed Collector of the Port of Boston in 1829 by President Jackson and had this office for nine years to the acceptance

of all who had occasion to do business with that department. He had great practical experience with high executive ability . . . His Navy Secretaryship dated from July 23, 1843 to February 19, 1844, when the Senate rejected his appointment in deference to Webster and other Whigs. But he had charge of it long enough to evince eminent talents and qualifications for the place. While Secretary he introduced a system of strict accountability for funds and materials of the department far beyond previous custom and also advocated the annexation of Texas as preliminary to the acquisition of California.[14]

The inscription on Henshaw's tombstone, totaling 232 words and giving an extensive account of his activities, relates that the deceased was "an ardent politician of the Jeffersonian school and true to its principles as the needle to the pole."[15]

The frequent election of pharmacists to political office proves the confidence the public has had in them, their ability and common sense, which doubtless is related to the part which pharmacy plays in the life and the minds of the people. But what of the rôle pharmacy has been assigned in government service? Here things have changed since the Revolutionary War very much and, it must be confessed, to the detriment of pharmacy until comparatively recent periods.

In the Revolutionary War the apothecary serving in the army of the patriots in his professional capacity, held a rank equal to that of the surgeon, i.e., as a commissioned officer (see p. 152). This was not changed in the War of 1812, in which James Cutbush "attained the distinction of being appointed Assistant Apothecary General in the U. S. Army on August 12, 1814."[16] However, in the long period between 1814 and 1861 there was not much need for a regular pharmaceutical service in the insignificant army and navy of the United States. Moreover pharmacists evinced little interest in this service.

It is very significant that it is not before 1862 that the existence of something like a pharmaceutical service in the armed forces of the United States has been recorded and commented on by the representatives of organized American pharmacy. This mention, an editorial in the American Journal of Pharmacy under the title "Military Pharmaceutists" is of great historical interest. Its essential part is as follows:

Occasionally, for many years, apothecaries have been employed on some of our naval vessels to facilitate the duties of the surgeons; but from the fact that no rank attaches to the position, we are told, it is but little sought after, as the "surgeon's mate" is socially ill situated on ship-board. We are not aware, that the apothecary has heretofore been employed in the medical department of the

> "regular" army of the United States . . . To make this service more effective, it should be separated sufficiently from that of the surgeon to give a distinct standing and rank to the pharmaceutist, as in the French army, with clearly defined duties, that his proper self-respect, and ambition to be eminent in his sphere, may have ample room for display. Unless such an arrangement can be made, it is not probable that the better class of graduates in pharmacy would seek positions of this kind.[17]

A law of May 20, 1862, created a special group of pharmaceutical professionals in the military service by authorizing the Secretary of War "to add to the Medical Department of the Army, Medical Storekeepers, not exceeding six in number, who shall have the pay and emoluments of Military Storekeepers of the Quartermaster's Department, who shall be skilled Apothecaries or Druggists."

The duties of these men were specified as being "under the direction of the Surgeon General and Medical Purveyors, with the storing and safe keeping of medical and hospital supplies, and with the duties of receiving, issuing and accounting for the same according to regulations." These "U. S. Army Storekeepers were granted the pay and the allowances of a first lieutenant of the Army but no actual rank."

> By custom and courtesy those in the Quartermaster's and ordnance departments are styled Captain and the same title is at some ports adopted for Medical Storekeepers . . . A uniform has been established by regulations for Storekeepers in the department to which they belong, but practically no attention is paid to it, each one wearing what fancy or convenience dictates, without any mark of rank, however.[18]

It is clear that this small group of apothecaries has to be considered rather a civil than a military addition to the army. It was in a similar civil rather than military quality that John M. Maisch served the United States during the Civil War by conducting the laboratory of the United States Army at Philadelphia after a two years' collaboration with the manufacturer and former United States Navy Surgeon E. R. Squibb (see p. 318).

As far as pharmacists were engaged in their professional quality within the regular military service of the Army and Navy they ranked as Hospital Stewards.[19] In a semi-monthly publication, "The Caduceus," edited by the Hospital Stewards of the United States Army this group stated their demands asking for the "increase of rank and pay of this class of Government employees to that of Brevet Second Lieutenants, to rank after the graduates of West Point Military Academy."[20]

With the close of the Civil War the attempt to better the position of

the military pharmacists seems to have ended. For about thirty years no mention is made of any step in this direction. In 1894 we find for the first time among the committees of the American Pharmaceutical Association a "Special Committee on the Status of Pharmacists in the Army and Navy of the United States."[21] In the following year (1895) this Committee made a report consisting of a detailed survey about the regulation of the pharmaceutical service within the armies of all civilized countries, and of two proposals for a legal change of the status of the pharmacists serving in the United States Army and Navy.[22] Five hundred copies of this report were printed in order to send them to members of Congress and to "the journals that wish to use it."

As early as 1898 the Committee mentioned could report a first success, and it may be assumed that the Spanish-American War provided the necessary favorable atmosphere. In the Navy the situation complained of during the Civil War still prevailed and the naval apothecary had no legal status at all. The endeavor of the Committee was centered, therefore, upon this question as the most urgent one. It succeeded in so far as the so-called Hale Bill for the first time recognized pharmacists as representatives of a special profession with just claims to an appropriate designation, rank, and pay. The bill established a Hospital Corps of the United States Navy consisting of "pharmacists, hospital stewards, hospital apprentices, and for this purpose the Secretary of the Navy is empowered to appoint twenty-five pharmacists with the rank, pay and privileges of warrant officers."[23] On February 1, 1902, the pharmaceutical "hospital stewards" too were granted the title of pharmacist.[24]

In 1900 came a significant interlude. The State of New York passed a bill assigning a pharmacist to each regiment of the New York National Guard with the title of pharmacist and the rank of first lieutenant in the State of New York.[24] One year later this bill was repealed because of the inadequate "social standing of pharmacists."[25]

The year 1903 in some ways was a landmark in the relations between official pharmacy and the agencies in which pharmacists were or should be working as public servants. At the 1903 meeting of the American Pharmaceutical Association the United States Navy and the Department of Agriculture were represented by delegates. More disappointing was the fact that the United States Army declined to be represented stating that "the position of pharmacist or apothecary does not exist in the Army," that "there are some graduates of pharmacy and many others competent to fill prescriptions . . . among our Sergeants . . ." and that "the Sergeant must be first a soldier, the dispensing of the 'ready-prepared tablets' or compounding of the 'simple medicines required' being only 'one of his secondary duties.' "[27]

No further progress was made until 1916, in which year two new grades, those of Master Hospital Sergeant and Hospital Sergeant in the United States Army were created, and "the pay and allowances that are now or may hereafter be allowed a lieutenant in the United States Navy" were granted to the Chief Pharmacist on the active list of the Navy.[28]

In 1922 the experiences of the First World War in connection with the increasing educational requirements for pharmacists began to become effective. According to a letter of the Surgeon General dated August 10, 1922 there were at this time "about fifteen commissioned officers of the Medical Department, who are pharmacists, these being commissioned . . . in the grades of captain, first and second lieutenants" besides 69 pharmacists "already commissioned in the Medical Administrative Reserve."[29] In 1924 the number of pharmacists in the Reserve Section of the Medical Service had increased to 89 and "twenty-five commissions have been granted with a rank above that of Captain in the Sanitary Corps."[30]

In the same year a bill was passed, vetoed by the President, and finally set in force in 1926 concerning the governmental service "based upon the established principles of a profession or science and which requires professional, scientific, or technical training, equivalent to that represented by graduation from a college or university of recognized standing." With this bill the requirements for pharmacists as applicants for professional public service were clearly defined. The difficulties which had to be overcome did not come from outside. In the same moment in which professional pharmaceutical education was on an equal footing with that of other professions the pharmacist could be certain of obtaining a commensurate position within the governmental service.

In 1936 a bill finally made graduation from a recognized four-year school or college of pharmacy a prerequisite for appointment to the Medical Administrative Corps, appointees receiving the grade of second lieutenant, i.e., making the pharmacist in the Army service a commissioned officer from the very beginning of his career. The development cannot be characterized better than by the following quotation from a report read by H. E. Kendig at the meeting of the American Pharmaceutical Association in 1937:

> Ten years ago, pharmacy was still listed as a sub-profession . . . To-day, pharmacy is recognized fully as a profession; pharmacists are classified in the professional as well as the sub-professional groups under the Civil Service . . .[31]

The development was crowned by two acts of Congress which became effective in 1943 and 1944, the one creating a special Pharmacy-Corps of the United States Army (1943), and the other putting pharmacists in the Public Health Service on the same plan as other P.H.S. officers (1944). There have been, naturally, always individual pharmacists in public service with rank, authority, and pay, commensurate with the high standard of their special work. They were, however, granted this not as professional pharmacists but for abilities and training in the field of chemistry or medicine.

Dr. Lyman F. Kebler who did meritorious work as Chief of the Drug Division, United States Department of Agriculture was not only a pharmacist but had the degree of a Doctor of Medicine as well and was a chemist of recognized training and experience.

Dr. Frederick B. Power, from 1916 until his death in 1927, head of the Phytochemical Laboratory of the United States Department of Agriculture, member of the National Research Council and until the present the only American pharmacist considered worthy of election to the National Academy of Science, was an international authority whose knowledge secured him a unique position and recognition.

The work of these men gave evidence of what could come from pharmacy. It was, however, not representative of the general standard which American pharmacists could be expected to have as the result of the regular phamaceutical education then required. It is significant that, when in 1904 a pharmacist was engaged for a leading position within the Public Health and Marine Hospital Service, the title he was given was "pharmacologist" and not "pharmacist."[32]

Besides the public service performed in the daily routine of a profession or in fulfilling the obligations of a public office there is a third one asked for and dictated by emergency and requiring above all a special human quality and unqualified readiness to help.

It has been in the great floods which this country has experienced now and again that American pharmacists have proved themselves equal to great tasks.

> When the dramatic flood history of 1936 is written, the choicest superlatives will be reserved for druggists. Their selfless loyalty to the public trust will furnish a bright chapter in that grim tale of destruction and misery . . . They worked by candle and lamplight in unheated stores with ice water slopping over their boot-tops. They braved treacherous currents in calling for and delivering prescriptions by boat. They saved biologicals, first-aid supplies, flashlights, and foodstuffs . . . They gave unstintingly of their professional knowledge, helping bacteriologists test water and food.

> They manned relief centers . . . They fought a successful battle for others against a rampant, hostile nature . . . Throughout the dire period, they proved, in a thousand different ways, the truth of that slogan: "The druggist is an asset to your community."[33]

3. The Pharmacist in Literature

There are only a few pharmacists who have attained more than local fame in American literature. A thorough and discriminating examination leaves in fact only one member of the profession whose writing was comprehensive and valuable enough to give him a place and a high rank among American novelists: John Uri Lloyd. The versatility of this man is almost miraculous. Not only did he work in many different fields but he attained high rank in all of them.

In fiction Lloyd may be grouped with those authors whose books always have found a hearty reception and a broad distribution not so much because of their literary values, although they have not lacked such values, but as recognition of the sound philosophy of life, the knowledge of human nature, and the genuine love for justice upon which they are built and which they inculcate.

It is of interest that the first book of fiction published by Lloyd, "Etidorhpa, or the End of the Earth" (1893), which went through not less than 18 editions up to 1936, represents a scientific vision of high literary as well as informative value. In addition he wrote "The Right Side of the Car," the story of a sentimental journey (1897); "Stringtown on the Pike," a folklore study of Kentucky (1900); "Warwick of the Knobs" (1901) and "Redhead" (1903), both based on the feudal past of Kentucky; "Scoggins" (1904), a peculiar story of an early and imperishable love; and finally "Felix Moses, the Beloved Jew" (1930), the story of a Jewish peddler who fought in the Confederate Army during the Civil War.

> Each (book) rapidly became a best seller and continued to be reprinted year after year. The demand for his books grew rapidly until suddenly he found himself confronted with the choice of turning author or sticking to pharmacy. He chose the latter course.[34]

The combination of historian and poet, so typical of the literary pharmacist, was also characteristic of the Chicago druggist Edwin Oscar Gale (1832-1913) who conducted his retail pharmacy until his 66th year. He published "Reminiscences of Early Chicago" and a booklet of poetry "Falling Leaves." "His verses," says his necrologist in the Druggists' Circular, "have enjoyed more than a local vogue."[35]

The other man who must be mentioned at this time, the cartoonist and writer of short stories, O. Henry, or to call him by his real name, William Sidney Porter, in contrast to John Uri Lloyd did not stick to pharmacy. On the contrary he shortly left this profession of his early years. He had learned pharmacy in his hometown of Greensboro, North Carolina and had worked for two months as a clerk in a drug-store in Austin, Texas. He became a bookkeeper in the steward's office, a bank clerk and finally on a charge involving national bank funds, the inmate of a penitentiary. It was here that Henry, who never admitted his guilt of the crime he was charged with, returned to pharmacy and "was placed in the hospital as night drug clerk."[36]

Bookloving pharmacists are, naturally, much more numerous than their bookwriting colleagues. The fact that books and magazines are common sidelines of the retail pharmacies in this country is surely not accidental. There were, however, two American pharmacists who not only paid special attention and reverence to poetry but devoted themselves to the memory of the poets they particularly loved. The apothecary Joseph Jacobs of Atlanta whose poetical idol was the gifted Scot Robert Burns, and William Alfred Speck of New York (later of New Haven) who greatly admired the great German poet, Johann Wolfgang Goethe, did much to foster love and admiration for these writers.

It is because of the love of Jacobs for the poetry of Burns that the New World can boast of a unique Burns Club founded in 1896. This Club, open to all lovers of the poet, has on its grounds the only replica of the original cottage of Burns in existence.[37] Jacobs' comprehensive private collection of all the editions ever published of the works of Burns, according to the last will of the collector, is open to the public once a month.

The collection of items connected with the life and work of Goethe was begun by the apothecary Speck when, only a fifteen-year-old boy, he bought a complete set of Goethe's works. At the age of 49 he sold his pharmacy, which he had inherited from his father, in order to devote his time exclusively to the study and collection of the work of Goethe.

> In 1913 Mr. Speck gave up his business and promptly transferred his collection to New Haven, depositing it with the Yale University Library. He was made its Curator during the extent of his life. The collection then numbered 6,000 unique, rare, and costly items. At his death on October 9, 1928 the collection had mounted to roundly 20,000 items . . . Collecting was the nimbus of his life; to know and to live by Goethe was its profound significance . . . To instruct was his greatest delight . . . On Ger-

man-English literary relations during the Goethe period he had no peer.[38]

These unique accumulations of items and knowledge concerning these two great poets, and finally the conservation and cultivation of the spiritual values involved, made the work of the two pharmacists mentioned an asset of the nation if not of the whole world. There have been, however, not a few American pharmacists who likewise, although more modestly attempted to make their own devotion to literature and philosophy fruitful for other people. The number of articles, etc., written by American pharmacists on topics of literary and philosophical interest is amazing. The many autobiographic sketches, published in the pharmaceutical journals and as separate pamphlets, are almost without exception imbued with poetry and philosophy. One of the finest attempts of a pharmacist to open to his friends the world which gave so much inspiration to him, is a volume arranged by the well-known Chicago apothecary Henry Biroth and published by his friends in 1913, a year after his death. Biroth, whose own poetical talent is evidenced by articles and poems scattered through the pharmaceutical journals, did not publish a collected edition of his own writing but preferred to make an anthology of what our great contemporaries have said in the simplest and most beautiful way concerning the essential principles of humanity. The book bears the title "Tolerance in Religion: Liberal Thoughts of Modern Thinkers," and the following not less significant motto: "There is a religion behind all religions, and that is, Love and Charity in all things."

Finally may be mentioned two men coming from pharmacy whose literary work secures them a place among the writers, not of fiction, but of general cultural subjects. These men are Sir Henry Wellcome and James Henry Breasted.

The American pharmacist Henry S. Wellcome, whose mercantile genius made him the founder and the principal of Burroughs, Wellcome & Co., one of the largest and most important pharmaceutical concerns in the world, wrote in 1887, when he was thirty-four years old, and amidst the difficulties connected with a rapidly growing business, a work of some 500 pages on the Indians of Alaska. In this book, "The Story of Metlakahtla," he paid his tribute to the American Indians whom he regarded as the noblemen of God's primitive peoples.

In his later life Sir Henry Wellcome was more the promoter of cultural and scientific writings than an author himself. First among his contributions to our knowledge of the past rank his discovery of several Ethiopian archaeological sites in the Upper Nile region and the excavations carried on under his personal supervision.

It was in the field of ancient cultures, especially that of Egypt, that James Henry Breasted, graduate of the Chicago College of Pharmacy, Class of 1886, achieved world-wide recognition. His "History of Egypt" is a classic in its field. It has become one of the most popular books of its kind, and has been published in many languages, and even in an edition for the blind.

The part of American pharmacy and pharmacists in the life of the nation naturally could not fail to attract the attention of many writers of fiction. More or less accurately portrayed, dealt with as a type or as a remarkable individual, the American druggist is met again and again in novels and short stories as the hero of the narrative or as a modest background figure.[39]

How people really visualize the American pharmacist and his part in the American scene is suggested by the fact that a pharmacist has been made the central figure of a series of photoplays mirroring the spirit, the ambitions, and the attitude toward life of an ideal average citizen. In seeing and appreciating the films of "The Jones Family" millions of Americans have approved this choice.

18

CONTRIBUTIONS BY PHARMACISTS TO SCIENCE AND INDUSTRY

AS SHOWN in the earlier chapters, pharmacy as a profession has produced many scholarly representatives who applied to their calling the results of research in the several natural sciences upon which pharmacy rests, both as teachers and as authors of textbooks. These representatives and their activities have been pointed out in connection with the pharmaceutical history of the countries concerned. Had they done nothing more, pharmacy as a profession would have led but a parasitic life. Fortunately for our calling some of them made fundamental contributions to science. It is their story which is here to be told.

Writers on pharmaceutical history have shown a tendency to claim as representatives of their calling anybody and everybody who had spent even a brief period in a pharmacy. Thus Liebig has been claimed by pharmacy though he spent but ten months as apprentice in the Apotheke at Heppenheim. Davy is another of whom it has been said that he was "an apothecary's clerk at the beginning of his career."[1] The facts are that Mr. John B. Berlase, with whom Davy spent three years as apprentice, was "a surgeon in large practice in Penzance."[2] The young man availed himself of the opportunity thus offered to conduct chemical experiments. No doubt he assisted in the preparation of remedies, but he can scarcely be regarded as having been a pharmacist. It has been a custom among French writers on the history of pharmacy to claim men who taught at educational institutions of pharmacy.[3] Claude Louis Berthollet, Louis Pasteur,[4] and Louis Jacques Thénard were not genuine representatives of pharmacy. The well-known Danish physicist, Hans Christian Oersted was an apothecary's son, and not himself a pharmacist.[5] The eminent Swedish chemist Joens Jacob Berzelius did not "first earn his living as apothecary."[6]

All of the representatives of pharmacy here to be mentioned practiced pharmacy sufficiently long to be regarded as true representatives of pharmacy even if in later life they joined another profession or devoted themselves to some special branch of science.

1. General Chemistry

Whereas Harry Jones claimed that the science of chemistry was born in 1887, the year in which Ostwald issued the first numbers of the

"Zeitschrift für physikalische Chemie," Ferdinand Hoefer points out that the "first materials of chemistry . . . were to be met with in the shops of the smithy, the enameler, the painter, in the boutique of the pharmacopolist or druggist, as a matter of fact in the practice of all the useful arts, including the culinary art. In other words, science is born of the needs of life." At the close of the Middle Ages metallurgy flourished in central Europe. It was in mining localities and from miners that Paracelsus acquired much of his chemical knowledge. A wealth of chemical knowledge, processes, and apparatus, is to be found in the "De Re Metallica" of Georg Agricola (1494-1555), physician and for a time official geologist and metallurgist of the mining industry in Joachimsthal, Bohemia; in the "Alchimia" of Andreas Libavius (1540-1616), physician and later teacher in Koburg, Saxony; and in the writings reflecting the comprehensive life work of Johann Rudolf Glauber (1603-1670).[7]

What the chemists of the post-renaissance period needed was not so much additional empirical knowledge, as a more satisfactory theory than that of the four elements of the Greek thinkers or that of the three elements attributed to Paracelsus. Even the unifying phlogiston theory suggested by the German physician Johann Joachim Becher (1635-1682) and elaborated by Georg Ernst Stahl (1660-1734) proved unsatisfactory since it was the product of speculation based on unsatisfactory explanations of observed phenomena rather than on exact experiment. A sounder hypothesis was made possible by the discovery of oxygen by men who died in their faith in the phlogiston theory.

The qualitative period of chemical history is sometimes divided into two equal periods; the iatrochemical period and the phlogistic period. A survey of the representatives of these two sub-periods reveals that whereas the representatives of the former were mostly physicians, those of the latter were largely apothecaries. The classical experimental researches of Lavoisier with their correct interpretation were made possible by phlogistonists of whom two were apothecaries. In 1774 the French apothecary Bayen (1725-1798) reported before the Paris Academy of Science on "un fluide elastique" escaping when mercuric oxide was heated.[8] The credit for the independent discovery of this substance is commonly given to the English clergyman Joseph Priestley (1735-1804) who called it "life air" and to the German-Swedish apothecary Carl Wilhelm Scheele who designated it "fire air." Lavoisier later misnamed it oxygen (acid former) although he knew it was a base former as well. Thus two apothecaries helped lay the foundation for the antiphlogistic theory which cleared the way for the rapid progress of chemistry during the 19th century.

The ancient Greek philosophers had conceived the atom as something

FIGURE 24. Medals commemorating the achievements of Scheele.

FIGURE 25. The Apothecary-House of Scheele at Köping.

which could not be further divided. In 1661 Robert Boyle in his "Sceptical Chymist" defined an element as a substance which could not be resolved into simpler substances. About fifty years later, the French apothecary Etienne-Francois Geoffroy, made the first attempt to define the specific relationships existing between different elements. In his chemical relationship table published in the memoirs of the Paris Academy of Science he laid down the principles of chemical affinity.[9]

Twenty-five years later there appeared in the same place a contribution by Guillaume Francois Rouelle,[10] also a French apothecary, which solved the problem as to the nature of salts, a problem which had baffled the best chemical minds for centuries. He defined a salt as the product of the union of an acid with a base.[11] Soon thereafter Lavoisier, a student of Rouelle, defined an acid as the product of the union of a non-metal with oxygen and a base as that of the union of a metal with oxygen. Thus was laid the foundation of the chemistry of the early decades of the quantitative period, the chemistry of acids, bases, and salts.

If the theory of affinity of the French apothecary Geoffroy served as the starting point of numerous speculations, the grouping of analogous elements as triads by Johann Wolfgang Döbereiner, a German apothecary, was destined to become the forerunner of the periodic table of the elements, a classification which has proven fundamental to all systematic and theoretic chemistry.

But even before Döbereiner conceived his triads, the atomic weight of the middle member of which was the arithmetic mean of the sum of those of the two extremes, another pharmacist had pronounced a mathematical rule. It was Joseph Louis Proust who pointed out, as a result of numerous investigations, that the elements in combining with one another do so in definite proportions which are constant. Dalton's law of simple, constant, and multiple proportions followed and was based upon the experimental statements of Proust.

Almost of equal importance was the discovery of chlorine, iodine, and bromine: the first by Scheele (1774), the second by Courtois (1811), and the third by Balard (1826), all being pharmacists. Individually important by themselves, this group of elements brought about the overthrow of Lavoisier's oxygen theory of acids and thus gave rise to the newer concepts of acids, bases, and salts which played so important a rôle in the development of the new chemistry. Also, as already pointed out, they constituted one of Döbereiner's groups of triads which, with Newland's octaves, became the foundation on which the periodic system was constructed by Mendelejeff and Lothar Meyer.

As is well known, the metallic elements potassium and sodium, magnesium, calcium, strontium, and barium were first isolated by Sir Humphrey Davy, the father of electrochemistry. However, the preparatory

work which led to their discovery had been done by German apothecaries. Thus derivatives of sodium and potassium, magnesium, calcium and barium had been studied by Andreas Sigismund Marggraf (1709-1782); those of barium by Scheele; and lastly those of strontium by Martin Heinrich Klaproth (1743-1817). Klaproth has been acclaimed one of the most gifted discoverers who owed his discoveries, not to accident, but to his extraordinary skill in both qualitative and quantitative analysis.[12] Although he did not discover any of the elements enumerated above—unlike Davy he did not have the tools to effect their isolation—he has been credited with the discovery of uranium (1786), zirconium (1789), and cerium (1803). In addition he has to his credit the verification of the elemental character of tellurium, strontium, titanium, chromium, and yttrium.[13] It should be mentioned in this connection that cerium was discovered simultaneously and independently by Berzelius and Hisinger. Although Klaproth's announcement of the discovery of chromium was made several months later than that of Vauquelin in 1797, the credit of its isolation nevertheless goes to pharmacy. Louis Nicolas Vauquelin (1763-1829) came from the ranks of French pharmacy.

Elemental carbon, both as charcoal and as diamond, has been known since antiquity although its elemental nature was not suspected at that time. However, the discovery of some of the most important properties of amorphous carbon was made by pharmacists. As early as 1793-1794 the German apothecary Karl Gottfried Hagen[14] explained the adsorptive quality of powdered charcoal as a physical property. Whereas Lowitz experimented exclusively with vegetable charcoal, Figuier, in 1810, published his results with animal charcoal which proved the latter to be superior to the vegetable variety in several instances. Lastly, the French pharmacist Tuéry demonstrated the antidotal properties of charcoal to the sceptical members of the French Academy of Medicine by swallowing a gram of strychnine after having previously taken fifteen grams of charcoal.[15]

However, the list of pharmaceutical discoverers of elements does not end with Klaproth. In 1844, the apothecary Heinrich Rose (1795-1854) announced the discovery of a new element which he named niobium. This discovery has been contested by those who claim that it was but a rediscovery of columbium isolated by the English chemist Charles Hatchett (1765-1847) from columbite. However, the controversy does not end here, for the prevailing opinion is that Hatchett did not discover niobium but tantalum which is very closely related to niobium and is commonly associated with it. Columbium is the name used exclusively in the United States to designate this element, whereas niobium, the name given to it by Rose, is used in all other countries.

As pointed out in connection with the discovery of the alkali metals and alkali earth metals by Davy, their isolation was made possible by the painstaking work of his predecessors, several of whom were German apothecaries. This holds true also of the discovery of fluorine, the only halogen which was ever found by a non-pharmacist. It was the apothecary Marggraf who in 1768 obtained hydrogen fluoride by the distillation of fluorspar with sulphuric acid. Using a glass retort, the apparatus was attacked by the product. In checking Marggraf's results, Scheele made the same mistake. It was Johann Carl Friedrich Meyer (1733-1811), owner of an "Apotheke" in Stettin who, in a detailed communication, advised Scheele to use lead instead of glass.[16] With this modification in the apparatus the real nature of hydrogen fluoride could be revealed. It may be of interest to record that the announcement of the isolation of fluorine was made before the Société de Pharmacie de Paris in 1886.[17] The discoverer, Moissan, not himself a pharmacist, was then professor of toxicology at the Ecole Supérieure de Pharmacie de Paris.

In like manner the discovery of the halogen derivatives is to be attributed in no small part to pharmacists. Thus Balard, who had isolated bromine, also studied its compounds. The apothecary George Simon Serullas (1774-1832) studied derivatives of iodine. In 1827 he prepared ethylbromide and medicine is indebted to him for the preparation of iodoform in the same year. If the discovery of iodoform is attributed to Serullas without question, that of chloroform has been claimed by three individuals: the American physician Guthrie, the German chemist Liebig, and the French apothecary Eugène Soubeiran (1797-1858). According to Max Speter, who has made a thorough study of this question, it was the German apothecary Friedrich Moldenhauer (1797-1865) who first (1830) obtained a product which he, as did Guthrie, regarded as a "chloric ether," whereas both Liebig and Soubeiran pronounced the product obtained by them in 1831 a new compound. The apothecary Soubeiran correctly recognized it as a compound of carbon, hydrogen, and chlorine, whereas Liebig overlooked its hydrogen content. The correct formula was assigned to it by Dumas, who replaced the designation formyl chloride by chloroform.[18]

Research on halogens and their derivatives was not new to Dumas in 1834. While engaged in a Geneva apothecary shop he was requested to look in sponges for iodine, shortly before isolated by Courtois. A local physician, Dr. Coindet, desired to use it as a specific against goitre. Dumas was successful and suggested that it be used in the form of an alcoholic tincture, or as potassium iodide, or in the combination of iodine and aqueous potassium iodide. With the publication of these results Dumas made his first appearance in print. The pharmacy Le Royet,

in which Dumas clerked, in turn profited by the increased demand for iodine preparations.[19] Though Dumas left the profession he was always grateful to pharmacy. Wherever opportunity offered, whether as Senator of France or as Secretary of Agriculture, he promoted pharmacy (See p. 69).

The chemical activity of Louis Nicolas Vauquelin (1763-1829), who also came from pharmacy, was not restricted to the halogens and their derivatives. In 1806 he discovered cinchonic acid, in 1817 daphnin, in 1818 cyanic acid, and in 1819 lecithin. More than that, his laboratory became a practical school of chemistry from which emerged a number of prominent chemists who followed in his footsteps.[20] The famous Liebig, who is commonly credited with having established the first chemical laboratory at a university, for a time worked in the laboratory of Vauquelin.

Like Vauquelin, the apothecaries Marggraf and Klaproth did not owe their chemical reputation to restricted work in a narrow chemical field. Marggraf has been designated "The second father or renewer of chemistry" by Joecher.[21] No less an authority than Berzelius, himself one of the greatest analyists, pronounced Klaproth "the greatest analytical chemist" of Europe.

A characteristic of Marggraf was that he never was content with having solved a specific problem but tried in addition to find out all about it regardless of its immediate practical value. He also avoided the fanciful generalizations so common during his time. He worked out an inexpensive method for the preparation of phosphorus and of phosphoric acid thus laying the basis for important industries. He prepared and described phosphorus pentoxide and demonstrated that phosphorus is contained in urine as phosphates. When he first prepared potassium cyanide, he also showed its capacity of forming double salts with those of the heavy metals and gave to chemistry the ferro-ferri-cyanides as reagents for iron. His discovery of sugar in the sugar beet is one of the rare accomplishments which, influencing industry, shape national economy. The use of ethyl alcohol as the solvent for extraction of the raw material paved the way for a new technique, as did his use of the microscope in the examination of the sugar crystals.

The painstaking care and exactness so characteristic of the experimentation of Marggraf are likewise typical of the experimental work of Klaproth. Like Marggraf he published nothing without having verified his first results. Unlike many if not most of his contemporaries he not only published his results, but also in detail the methods by which they were obtained thus making available his technique to others. In a way this was revolutionary and ultimately put at end to questionable publications.

> Many manipulations which appear self-evident to the analytical chemist of today originated from Klaproth. He was the first to point out the necessity of drying at a definite temperature before weighing and to ignite precipitates until constant weight was obtained. He also took into account the contaminations resulting from grinding hard minerals in iron mortars, prior to analysis. He realized the importance of analysing salts to determine the exact composition of precipitates, and he devised many efficient methods for preparing analytical reagents.[22]

Marggraf had been thoroughly educated as an apothecary and for several years assisted his father in the latter's "Apotheke" in Berlin. However, when thirty years of age, he became connected with the Royal Society of Berlin, known later as the Royal Prussian Academy of Science, and discontinued the practice of pharmacy. Klaproth, on the other hand, accomplished most of his remarkable experimental work in the laboratory of his "Apotheke" while busily engaged as a pharmaceutical practitioner. It was not until he had reached the age of 57 years that he sold his pharmacy to devote his entire time to research and teaching.

The author of the article about Klaproth in "The Laboratory" from which the quotation cited above has been taken, refers to his hero as "the forgotten chemist." Since all histories on chemistry give Klaproth his due, this designation is scarcely correct. It does apply, however, to a contemporary of Klaproth, viz., to Tobias Lowitz (1757-1804).[23] Like Klaproth, he accomplished most of his results in an apothecary laboratory, that of the Imperial Russian Court Pharmacy in St. Petersburg (Leningrad). Here he served, first as apprentice, then as assistant, and from 1776 until his death as manager. This long experience was interrupted only by a three years' absence which he spent at the University of Goettingen in his native city.

In 1793 Lowitz discovered mono- and trichlor acetic acids. He first prepared absolute alcohol and pure ether (1796). He first employed the specific gravity test as a means of determining purity. He was the first to employ the seeding of solutions to induce the crystallization of the solutes. However, possibly his most important contribution to mankind was the discovery of the decolorizing and deodorizing property of charcoal (1785). Fully aware of the importance of this discovery, he made a thorough investigation of the subject. As early as 1794, he could report on rendering contaminated water potable for the Russian navy. He introduced it in the alcohol distilleries to remove fusel oil. He demonstrated its antiseptic power in its use for the preservation of meat, and as a disinfectant of the gums when used in tooth powder.

As this survey shows there is scarcely a field of general chemistry

without some important if not decisive enrichment brought about by pharmacists. Thus it is but natural that they have also contributed to the development of chemical apparature. The introduction of the microscope as a means of chemical research by the apothecary Marggraf has already been mentioned. Less known is the fact that it was another apothecary, the French pharmacist Nicolas LeFebvre (1610-1669?) who introduced the use of the thermometer into chemistry. In 1768 the French pharmacist Antoine Baumé created with his hydrometers (or aerometers) the possibility of an easy and fairly exact determination of the density (specific gravity) of liquids, a method widely used up to the present. The German apothecary Carl Friedrich Mohr (1806-1879) gave to volumetric analysis most of its auxiliary implements among them the "Mohr"-pinchcock. The specific gravity balance, likewise bearing his name, is an important piece of laboratory apparatus. At the end of the 19th century the apothecary Ernst Beckmann (1855-1923) presented chemistry with two different pieces of apparatus for the determination of boiling points and freezing points. Finally the most modern methods of analytical chemistry, the micromethods, owe their development and present status to a very great extent to apothecaries. The Austrian pharmacist Richard Wasicky (1884-), an honorary member of the American Pharmaceutical Association, has constructed an apparatus for continuous extraction of micro-quantities of solids[23a], and one of his pupils, the Austrian pharmacist Ludwig Kofler (1891-) has invented a melting point apparatus for use on a microscope in cooperation with Hilock, one of his students.[23b]

2. *Phytochemistry*

The vegetable kingdom has at all times supplied more items for the apothecary's materia pharmaceutica than have the mineral and animal kingdoms combined. It was not merely the romance of these items that produced a particular charm. An insight into their chemical constitution was even more intriguing.

After Koenig has classified all natural objects as belonging to the mineral, vegetable, or animal kingdoms, we find it but natural that the materia chemica should be classified in like manner. However, the vegetable part of the apothecary Lémery's "Cours de chimie," considered the first attempt of this kind, comprised only a very few individual chemicals. The items of this division of his treatise consist for the most part of vegetable drugs. Camphor, flowers of benzoes (benzoic acid), and sugar were almost the only chemicals. Even oil of turpentine (mostly pinene) could scarcely be regarded as an organic chemical.

The isolation of either constituents of plants or plant drugs was a goal to be sought zealously. In this endeavor apothecaries, whose materia pharmaceutica consisted so largely of vegetable drugs, played an important rôle. As stated in an earlier chapter, the art of distillation of aromatic spirits and waters, and subsequently of volatile oils, was of actual importance in the practice of the apothecary, particularly during the phlogistic period of chemical history. Just as the distillation of aromatic waters, supposed to represent the quintessence of the respective plants, led to the isolation of volatile oils, so the storage and observation of the latter led to the isolation of the so-called camphors. Thus Caspar Neumann, administrator of the Royal Court Pharmacy, in 1719 observed thyme camphor (thymol), and Johann Christian Wiegleb, in 1774 discovered mace camphor (myristic acid).

Each and every observation constituted a notable contribution to the list of the few organic chemical individuals known. However they as well as others could not be regarded as contributing anything directly, at least not at the time of their discovery, to chemical theory. To the list of camphors, other substances should be added. Only a few may here be mentioned. The discovery of "Oelsüss" by Scheele while making lead plaster is an instance universally known and recorded. In 1806 the French apothecary Joseph Louis Proust isolated mannitol. He also has leucin, gliadin, and hordein to his credit.

Of far greater significance, however, is the recognition of the acid character of the flowers of benzoes, which derived their name from the process of sublimation (later known as the dry method) by which they had been obtained, when Scheele learned to prepare them by what was designated the wet method, viz. the extraction of gum benzoes with milk of lime and precipitation of the organic acid from its calcium salt by means of hydrochloric acid. The application and extension of this method led to the discovery of several new plant acids: tartaric acid in 1769, citric acid in 1784, and malic acid in 1785. It also enabled him to demonstrate the wide distribution of oxalic acid in the vegetable kingdom, an acid which Savary[24] had isolated in 1773. Incidentally it may be mentioned that Scheele also obtained oxalic acid upon oxidation of sugar with nitric acid, an accomplishment of no mean significance later on when the study of the structure of organic molecules by means of the "Abbau" method revealed many secrets of organic chemistry.[25]

These organic acids constituted the organic counterpart of the inorganic acids, which in the oxygen chemistry of the elements, together with the bases, played so important a rôle in the newer chemistry. Salts of organic acids with inorganic bases (e.g., cream of tartar, Rochelle salt, etc.) were known but no organic analogues to the inorganic bases.

As previously indicated, the isolation of each and every chemical unit

from a plant or plant drug constituted a notable contribution, not only to the knowledge of the drug plants from which they had been obtained, but to organic chemistry as well. During its infancy organic chemistry leaned heavily on its older sister and formulated its theoretical concepts accordingly.

In 1805 the German apothecary Friedrich Wilhelm Sertürner, then 22 years of age, published his first paper about the "principium somniferum" (somniferous principle), found by him in opium in 1803-1804. One year before, in 1804, the French pharmacist Charles Louis Derosne (1780-1846) had reported a "matière végéto-animale toute particulière" —it was a mixture of morphine and narcotine—isolated by him out of the same raw material without, however, recognizing the special character of this "particuliarity." In contrast to Derosne Sertürner recognized immediately the alkaline character of the substance found by him and the fundamental importance of this fact. His statement in 1806 received, however, no attention. It was not before the appearance of his comprehensive publication, "Über das Morphium, eine neue salzfähige Grundlage . . . " in Gilbert's Annalen der Physick that the real character and with this the full bearing of the discovery of the young apothecary was recognized.

Thus, in 1817 the salifyable property of this "plant base," was emphasized and the organic analogue to the inorganic base was supposed to have been found. It formed salts with organic acids (morphine acetate) as well as with inorganic acids (morphine hydrochloride). Thus organic systematics were supplied with a theory of acids, bases, and salts, analogous to the inorganic classification. How this classification later gave way to the recognition of the alcohols as the true bases of organic chemistry is another story. It is sufficient here to point out that just as a technique had enabled Scheele to isolate a number of plant acids, so the new technique of Sertürner enabled others to isolate plant bases from other drugs. The very name alkaloid, "alkali-like," is suggestive of the rôle these substances played in organic theory and systematics. During the next ten years no less than ten alkaloids were isolated from vegetable drugs: to Joseph Pelletier and Joseph Bienaimé Caventou, two Parisian apothecaries, the world is indebted for the discovery of strychnine and brucine (1819), colchicine (1819), and above all quinine and cinchonine (1820). Of such significance have these discoveries been to medicine as well as to pharmacy, that a late pharmacologist dated the birth of his science with Sertürner's discovery.

The history of alkaloids is a story by itself. Here only a few additional milestones may be mentioned. Pelletier and Dumas isolated narceine in 1832 and thebaine in 1833. In 1821 the apothecary Runge had isolated caffeine from the coffee bean. A year later the same alkaloid

was isolated independently by Pelletier, Caventou, and Robiquet. The apothecary Pierre Jean Robiquet had previously isolated narcotine in 1817 and reported codeine in 1832. In 1819 the apothecary Brandes had isolated atropine in an impure state. Later the apothecary Philipp Lorenz Geiger, with the cooperation of Hesse, obtained it in a pure state. They also isolated aconitine.

In 1831 Geiger prepared pure coniine, previously isolated by the non-pharmacist Carl Giesecke in an impure condition. In 1848 the apothecary Georg Franz Merck discovered papaverine and in 1855 the apothecary Gaedcke isolated "small needle-shaped crystals" from Erythroxylon Coca, presumably cocaine.[26] In 1890 the apothecary E. Jahns synthesized arecoline, an alkaloid which, with arecaidine and guvacine, he had isolated from the areca nut. These results he accomplished in the small laboratory of his "Apotheke" in Goettingen.

However, the impression should not be left that pharmacists had interested themselves exclusively in the study of alkaloids. In 1817 the apothecary Rudolph Brandes isolated delphinine and in 1830 the apothecary Kabler discovered santonin. Possibly no drugs afforded greater difficulty in the unraveling of their constituents than digitalis and ergot. In the early study of both pharmacists had a conspicuous part. The same holds true of the study of volatile oils. Whereas Sir William Tilden,[27] a pharmacist in the true sense of the word, introduced nitrosyl chloride as a reagent for terpenes in the seventh decade of the nineteenth century (a reaction perfected to such an extent by Wallach during the eighties that Flueckiger called the latter the messiah of the terpenes), it was his earlier work on volatile oils that caused Flueckiger to appreciate the great significance of Wallach's researches. In the United States it was Frederick B. Power[28] who increased our knowledge of the volatile oils as well as other constituents of plants in a remarkable series of researches. Having begun his investigations in Flueckiger's Pharmaceutical Institute at the University of Strassburg, he continued them at the Philadelphia College of Pharmacy and the University of Wisconsin. As Scientific Director of the laboratory of Fritzsche Brothers, in Passaic, New Jersey, and later as Director of the Wellcome Research Laboratory in London, he, with his co-laborers published an epoch-making series of papers on phytochemical subjects. By no means least of these is his study of chaulmoogric and hydnocarpic acids. These not only constituted a most valuable contribution to the fight against leprosy, but made necessary a revision of the definition of the fatty acids. Having returned to the United States, his phytochemical work, continued in the Bureau of Chemistry of the Department of Agriculture in Washington, caused him to be elected a member of the National Academy of Science. This is possibly the only instance that a man with pharmaceutical educa-

tion and training, the best years of whose long life were devoted to pharmaceutical research, has thus been honored. Students of the history of pharmacy will look in vain for any reference to Power as a pharmacist by chemists and others who have praised his work. History repeats itself. Chemists refer to Scheele mostly not as pharmacist but as "one of the greatest chemists who ever lived."

It would scarcely be appropriate to refer to Flueckiger without at least mentioning the names of Daniel Hanbury, Tschirch of Bern, and Thoms of Berlin. All these men came from pharmacy, Flueckiger for some years owning, Thoms managing a pharmacy.

3. *Physiological Chemistry*

Physiological chemistry in a somewhat restricted sense has been defined as the application of chemistry to the study of the normal processes of the human body. In a broader sense it has been made to cover the normal processes of all animal life and may even be applied to the normal processes of plant life. Today its use has largely been replaced by biochemistry which includes both applications.

One of the most important products of animal metabolism, urea, was discovered in 1773 by the French apothecary Hilaire Marie Rouelle, brother of another French apothecary previously mentioned. Another French pharmacist, Vauquelin, was one of the group of scientists to make a special study of this substance which has played so important a rôle, not only in physiological chemistry, but also in the theory of vitalism. Rouelle further was the first to recognize the iron content of blood. The apothecary Baumé first pronounced milk an emulsion. Of the ten eminent early physiological chemists who, according to Lieben, made important contributions to the study of milk, no less than six were apothecaries, namely Geoffroy, Baumé, Rouelle, Parmentier, Vauquelin and Scheele.[29] Among other observations, Vauquelin noticed that the addition of acid prevents fermentation.

The discovery of sugar in beets by the apothecary Marggraf has already been mentioned. For a time, Proust, who isolated grape sugar from grape juice in 1806, was credited with the discovery of this substance. However Tobias Lowitz had isolated it from honey fourteen years earlier and had obtained it in a pure crystalline form. Henri Braconnet who was pharmacist in Strassburg previous to his appointment to a professorship at Nancy, and Director of the Botanical Garden, was the first to obtain grape sugar in 1819 by treating sawdust with sulphuric acid, thus laying the foundation for an important chemical industry. In addition he discovered pectin and pectic acid (1824), and dextrin (1833). As early as 1820 he had obtained glycocoll, the first amino acid

resulting from the hydrolysis of albumen with the aid of a mineral acid.[80]

The amino acid leucine had previously (1819) been discovered by Proust, whom Lieben regards as an "exact analyst" and "as one of the early albumen and nutrition investigators."[81] The first to characterize albumen was the English apothecary William Thomas Brande (1788-1866). The albumen reagent, an acetic acid solution of mercuric chloride in potassium iodide, was invented by the French pharmacist Charles Joseph Tanret (1847-1917) in the laboratory of his Troyes pharmacy.

It was Scheele who first recognized the acid reaction of normal urine[82] and it was his French colleague Proust who taught the prevention of the spontaneous fermentation of urine which renders it alkaline and thus unfit for analytical tests by reagents. In the elaboration of the numerous reagents and methods employed in the analysis of urine, pharmacists or men trained in pharmacy have successfully participated. In this connection it may suffice to call attention to the inventor of Fehling's solution (1850) used for the detection of inverted sugar in the blood as well as in urine. Hermann v. Fehling, was an apothecary for about eight years before he gave up his profession in order to devote his life to scientific research.

In concluding this brief account on the contributions made by pharmacists to physiological chemistry, mention should be made of two men whose work was of greatest importance, namely the Frenchman Claude Bernard (1813-1878) and the German Max v. Pettenkofer (1819-1901). Both men started their early careers as pharmacists but later studied medicine. Whereas Claude Bernard, at an early date, devoted himself exclusively to scientific research, Pettenkofer spent his life as apothecary in ordinary to the King of Bavaria and Director of the Royal Bavarian Court "Apotheke." Their medical work may not be claimed by pharmacy. However, their development as physiological chemists may, no doubt, be traced to their early activities in the pharmaceutical laboratory. Pettenkofer at least has stated his indebtedness to pharmacy for accuracy in work, for manual skill, and for the prevention of scientific onesidedness.

4. Industry

Scientific research has supplied the basis of industry at large and of special industries in particular to such an extent that each attempt at recounting the work of scientists and its effect on the development of industry of necessity entails some repetition.

Thus several industries owe their existence to the discovery of glycerin by Scheele already reported, among them the manufacture of explosives (nitroglycerin). Another discovery of Scheele, that of chlorine, became

the basis of the bleaching and laundry industry. The importance of Scheele's discovery of the fruit acids, especially citric acid, for the foodstuffs industries and especially for the production of beverages is obvious. The decolorizing and purifying power of charcoal, discovered by Lowitz, plays an important part of the processes of production in a number of industries.

A few words more may be devoted to the discovery of beet sugar by the apothecary Marggraf, already mentioned, since this discovery became a part of world history. It was Napoleon, who in the course of his attempt to bar England from all commerce with those parts of continental Europe then under French dominion (1806-1813), recognized the importance of Marggraf's discovery in liberating Europe from the English monopoly in cane sugar. Furthermore he saw and appreciated the possibility inherent in this discovery, of making sugar a general foodstuff for all instead of a luxury of the rich. Of special pharmaceutical interest is the famous Napoleonic edict of January 15, 1812 which became the basis of the further development of the beet sugar industry. In this edict provision was made for the training of 100 young people in the manufacturing of sugar. This was to be done in the plants then in existence. "These apprentices," declares paragraph 3 of the edict, "are to be chosen among the students of pharmacy, of medicine and of chemistry."[33] It will be noted that students of pharmacy are listed first.

There are other discoveries of apothecaries not yet mentioned which also may be considered of world-wide importance. The discovery of catalysis by the apothecary Döbereiner and the finding and characterizing of aniline in coal tar by the apothecary Runge, both men already mentioned before, were of vital significance.

The scientific and industrial values of both discoveries proved to be almost immeasurable. In 1816 Döbereiner already had found that alcohol could be changed to acetic acid through catalysis by platinum. In 1832 he obtained aldehyde in the same way. In 1823 he published his memorable pamphlet "Über Neu Entdeckte Höchst Merkwürdige Eigenschaften des Platins" (about recently discovered highly peculiar qualities of platinum). In the same year, fully aware of the technical as well as of the scientific bearing of his invention, he made known his famous platinum tinder box explaining in detail the principles of its function and manufacture. H. Kopp devoted to this statement the following admiring comment:

> What science and practical life owe to this invention (of catalysis) is known. With the employment of it for the construction of his so widely used tinder box Döbereiner presented it to his con-

temporaries, while frequently the practical employment of scientific discoveries of much less importance has been used as a private speculation in order to gain riches.[34]

The number of industries using if not entirely dependent upon the process of catalysis—this term was coined by Berzelius in 1835—is very large. Mention may be made of the so-called "contact process" for the preparation of sulfuric acid. The entire industry of artificial fats, margarine, etc., is based upon the coagulation of liquid oils to solid fats of the desired consistency by means of catalytic processes.

In 1834 the apothecary F. F. Runge published in Poggendorff's "Annalen" his classical essay "Über Einige Merkwürdige Produkte der Steinkohlendestillation (Kyanol, Pyrrol, Leukol, Carbolsäure, Rosolsäure und Brunolsäure)." With the discoveries announced in this essay especially that of aniline, i.e., the "kyanol" of Runge, in coal tar, the ground was laid for the entire industry of dyestuffs and synthetic organic remedies using the aniline derived from coal tar as its raw material. The discovery of carbolic acid furnished the essential germicide for Lister's surgical antisepsis (see p. 40). Like Döbereiner Runge was fully aware of the importance of his discoveries and himself took the first steps to prove them practically. He was the first to observe, in 1834, the blue color of aniline after the addition of chloride of lime and to find that by treating aniline with other oxidizing substances dark green to black dyestuffs can be obtained. "He already had in his hands the emeraldin and the aniline black, so eminently important until to-day."[35] Runge furthermore gave the first impetus to the processing of cottonware with sulfonized oils and was the first to produce the oxidation product of aniline on the textiles themselves. It is because of this that some historians see in Runge the first to recognize and employ practically the principles of capillarity. The statement of Kränzlein that the apothecary Runge opened with his discoveries a new epoch is uncontested. "The world," says Kränzlein, "can consider Runge the first inventor of coal tar dyestuffs without by this taking away anything of the immortal fame gained in the same field by A. W. Hofmann and his pupils, and especially by W. H. Perkin."[36]

The genius of F. F. Runge was not exceeded although perhaps almost paralleled by that of another apothecary, Adolf Frank (1834-1916), whose inventions establish him as the founder of several industries and who became—an even rarer case—on the basis of his scientific findings an industrialist himself. Frank invented in 1882 the process of purifying water by filtration through infusorial silica (Berkefeld filter). Together with Caro he discovered the possibility of binding free nitrogen to calcium carbide thus creating the calcium cyanamide industry. The de-

velopment of the calcium carbide and acetylene industry is to a large extent due to the technical inventions of this apothecary who likewise is considered one of the founders of the German potassium salts industry. Frank's studies on enamel and glasspastes laid the groundwork for the modern mosaic industry.[37]

It was a similar combination of scientific genius and commercial and administrative talent that made the apothecary Fritz Hofmann (1866-) one of the leading figures in modern chemical industry. His world fame is derived from his successful work in the synthesis of caoutchouc which has been rewarded by a flood of honors, among them the Emil Fischer Medal, the highest proof of appreciation organized German chemistry (Verein Deutscher Chemiker) has to offer. In addition Hofmann has done much work in other fields of chemical research including pharmaceutical chemistry. The following extract from a letter written by Hofmann in 1934, conveys an idea of the man and his work.[38] Having reported about the six years spent by him in practicing pharmacy, his pharmaceutical and his post-graduate study and finally his appointment as a member of the staff of the Elberfelder Farbwerke (now the center of the concern I. G. Farbenindustrie), Hofmann continues as follows:

> In Elberfeld I became director of the pharmaceutical scientific laboratory and vice-president of the concern. *My collaborators and I invented a long row of well-known synthetic remedies which belong until the present to the medicinal armamentarium.* Besides my activity in the pharmaceutical field the problems I worked on were those of the chemistry of perfumes, the chemistry of fermentation, that of light, and finally the search for chemical means against plant-diseases and vermin . . . By 1909 I had succeeded in the synthesis of caoutchouc in the laboratory of the Elberfelder Farbenfabriken . . . In Elberfeld I founded and conducted for six years the Institute for Chemotherapy which later under the leadership of Professor Hörlein reached the highest degree of perfection . . . and presented the world with Germanin, Plasmochin, etc."

Hofmann remembers gratefully his work as a practising pharmacist to which he, as he says, felt indebted for the general skill "which became so helpful to me in my later work."

"My collaborators and I invented a long row of well-known synthetic remedies—," this statement of Hofmann is a revealing one. It shows why in recent years the invention of remedies is not so closely connected with the name of one individual as it was in earlier times. In this epoch of mass problems and mass production even invention has become a matter of organization rather than of individual genius. And yet this

organized research also requires men of ingenuity, talent, and even genius, with ambition and vision as well as skill. There is no doubt about the fact that within this army of anonymous workers on the problems of joint research the contingent of people coming from pharmacy is a large and important one. This has been proved now and again when, in cases like that of Hofmann, the impact of exceptional results has broken down the wall of anonymity which conceals the name of the individual research worker within the group of workers.

Dulcine (phenetidine-urea), discovered by the apothecary Hermann Thoms in the nineties of the 19th century, is 220 times as sweet as the sugar discovered in beets by Marggraf or that derived from sugar cane. This was a fact startling enough to end the anonymity of the inventor although the discovery was made and worked out by Thoms while in the service of a commercial concern.[39]

That dimethylamino-antipyrine (pyramidine) was a result of researches of the apothecary Friedrich Stolz (1860-1936) became known when the new substance gained general appreciation.[40] The honor of succeeding in the synthesis of adrenaline, i.e., the preparation of synthetic suprarenine, is shared by Stolz and the chemist Franz Flaecher.[41]

Sometimes an individual apothecary not only has made an important scientific discovery outside of industry but has succeeded in utilizing it. In 1888 E. Ritsert (1859-), then a clerk in a pharmacy in Frankfort-on-the-Main, found that the acetanilide then on the market was not chemically pure and invented a special process for manufacturing a pure product which he sold to an industrial concern. In pursuing his private research he prepared in 1890 the p-aminobenzoic-acidethylester, called by him anaesthesine because of its anaesthetic effect. He made this product the basis of a factory of his own. Anaesthesine has not only been used extensively the world over in external and internal therapy but most of the modern substitutes for cocaine, among them novocaine, have been built on the basis of the invention of the apothecary Ritsert.

Concluding his report Ritsert wrote:

> I state with satisfaction that my observations . . . have laid the ground for an entire group of remedies of greatest importance. Even more satisfaction I take in the fact that, although being an apothecary relying completely upon myself and without the means and the aid of big institutes or chemical plants, I was able to overcome all difficulties encountered and to carry the results of my work to victory.[42]

As has been already indicated in the preceding chapters modern pharmaceutical industry is to a great extent derived from retail pharmacy. In Germany the laboratories of the "Apotheken" developed

in so many cases to industrial plants which later on gained wide, frequently even international recognition, that it does not seem exaggerated to call German retail pharmacy the nucleus of the German pharmaceutical industry.[43] In other countries the situation has been similar, differing from the German development chiefly in that the laboratory of a pharmacy less often became a manufacturing plant, since pharmacists have tended to found industries without a pharmacy as a foundation.

As shown in the chapter on Economics, however, there are in the United States some examples of retail pharmacies serving as nuclei of large plants. Furthermore the success of some of the American pharmaceutical plants owned by pharmacists is due to a great extent to the personal scientific research of their owners, e.g., Alfred Dohme, head of the concern of Sharp and Dohme, and Henry A. B. Dunning, head of Hynson, Westcott and Company.

5. *Miscellaneous*

Wherever we glance over the pages of the book of science we meet the phenomenal figure of the apothecary Scheele. In describing researches concerning the chemical effects due to the spectrum Friedrich Dannemann wrote:

> Already Scheele had proved that the parts of the spectrum show different chemical effects (1777). Knowing that silver chloride gets gradually blackened if exposed to light, he brought a piece of paper prepared with silver chloride into the spectrum and observed that it blackened much quicker under the influence of violet than by exposure to other colors. *This simple experiment may be considered the beginning of the spectral photography so highly developed in our days.*[44]

The physicist who later, in 1801, proved the existence of chemically efficient rays beyond the violet, Johann Wilhelm Ritter (1776-1810), had worked for four years in a pharmacy before he devoted himself exclusively to science and became one of the best known physicists of his time.[45] In the experiments by which he established with certainty the more powerful chemical effect of the rays—later to be called "ultraviolet" rays—he used Scheele's method of testing the differences in the rapidity of the destruction of silver nitrate.[46]

Early in the 18th century a former apothecary clerk, Johann Friedrich Böttger, supposedly acquainted with the mystery of the transmutation of base metals into gold, presented the precious invention of the manufacture of porcelain to the covetous King August of Saxony who kept him a prisoner. About this chemical invention Ferchl-Süssenguth wrote: "The greatest progress came to the European ceramic industry

with the re-invention of the genuine Chinese porcelain which we owe to the apothecary clerk Johann Friedrich Böttger."[47]

Out of the many pharmacists who devoted themselves to botany, the "lovable science," remaining in or leaving the practice of pharmacy, only two eminent men may be selected: Oskar Brefeld (1839-1925)[48] and Ferdinand v. Müller (1825-1896).[49] Of Brefeld's contribution to his special field of botany J. R. Green wrote: "The work of Brefeld included a very careful study of the biology of many of the fungi and the nature of their dependence upon external conditions, together with the effect of the latter upon their pleomorphy and their reproductive processes."[50] It was Brefeld who introduced the method of cultivation into mycological research.

The German Ferdinand v. Müller, educated as an apothecary as well as in the science of botany, emigrated to Australia and became that continent's greatest botanist. He recorded his studies of the flora of Australia in 40 volumes and his advice was very influential in the agriculture and horticultural development of his adopted country. One of Müller's chief services was his advice that the eucalyptus tree should be cultivated in the Mediterranean countries, South Africa, and the United States as a means of saving the soil from erosion. Thus he has been credited with having preserved and even created wide areas in which human and animal life may exist and prosper.

Finally apothecaries belong to the first pioneers of modern aeronautics. An apothecary, the Frenchman Pilâtre de Rozier, was the first human being who dared a balloon ascension in 1783. Furthermore, he invented a new type of balloon, the so-called "rozière" replacing the "montgolfière." De Rozier was killed on June 1, 1785, in a flight over the English channel.[51] Thus the first flyer as well as the first victim of aeronautics was an apothecary.

One of the first if not the first scientist who tried to examine experimentally the physical phenomena connected with aeronautics was likewise an apothecary. On October 16, 1784, i.e., only one year after Pilâtre de Rozier's first flight, the apothecary M. H. Klaproth, then a young man, ventured a flight in a montgolfière balloon, armed with instruments for the determination of air pressure, etc. The balloon was torn and rose only to a height of ten meters and thus the flight was without scientific results.[52]

6. Conclusion

In many cases both contemporaries and posterity have shown their appreciation and gratitude toward the men mentioned in this chapter. Monuments have been erected and medals have been coined in honor of many of the great apothecaries. In Stockholm and in Köping statues

of Scheele commemorate the modest pharmacist who passed his life in his profession while serving the world in his laboratory. In Paris one monument unites Caventou and Pelletier, the two apothecaries whose joint work presented the world with so many important alkaloids including quinine. Sertürner is commemorated by tablets in Paderborn, in Einbeck, and in Hameln, the places where the apothecary practiced his profession, in Neuhaus where he was born, and within the University of Münster. The bust of Klaproth adorns the peristyle of the University of Berlin, close to the busts of the brothers Alexander and Wilhelm v. Humboldt. From the wall of the house in Berlin which once housed the laboratory of the Royal Prussian Academy of Science the bust of the apothecary A. S. Marggraf bears witness to the work done by him at this place for the benefit of humanity. In Melbourne, Australia the statue of the apothecary-botanist F. v. Müller looks down rows of eucalyptus, *his* tree.

All gratitude and honors naturally are given to the individuals rather than to the profession which these men practiced or in which they were trained. And yet this profession has some part in the special efforts and the values of the work of its sons.

This survey of the contributions of pharmacists to science and industry has necessarily been restricted to facts, findings, and experimental work of immediate and significant importance, and no person has been admitted on the basis of merely literary work. Even with this restriction there is an obvious abundance of individuals and scientific deeds to which to refer.

Such an abundance can scarcely be accidental. It must have some basis. Perhaps this basis can be found in the fact that there is scarcely another profession committed like pharmacy to the knowledge and utilization of a number of sciences and at the same time closely connected with the daily life of society, its wants and needs. From this arises the incentive to perfection in the sciences, and the commitment to work for the benefit of mankind.

The members of the profession may derive pride and confidence from the deeds of their great colleagues. The young generation to come may take these deeds and these men as models and as evidence of the existence of opportunities open to every one who attempts to fulfil his profession and himself in it. The world at large and finally legislation and public opinion, should take cognizance of what pharmacy really means. It is up to them to recognize and protect pharmacy in order to make possible the maintainance and security of the professional spirit.

If we do not wish to lose the great men and deeds emerging from pharmacy we must cultivate the ground from which they spring.

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Jan. 1878 (which see, page 66). This, however, gives the date correctly as 1736." The mistake of Wickes, obviously a mere slip of writing or printing, in this way became perpetuated.

Cowen corrects also the reference to a New Jersey act of 1664, as being the "earliest law regulating apothecaries in the new world" (LaWall, 4000 Years of Pharmacy, p. 572) as unbased. The first assembly ever convened in New Jersey met May 26-30, 1668.

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CHRONOLOGY

Dates of pharmaceutical interest are set in bold-face. Single dates are usually given for individuals supplemented by birth and death dates when known. Approximate dates are not indicated since these should be obvious.

B. C.

5000- Beginnings of Sumerian, Egyptian, and Minoan civilizations.
4000.

3000- Time of the Building of the Pyramids.
2500.

2500. Approximate date of the depicting of a surgical operation. (Tomb at Saqquarah in Egypt)

2250. Code of Hammurabi in Babylon.

2000- Approximate period of the Bronze Age in Europe.
1000.

1500. Ebers Papyrus dealing chiefly with pharmacy.

1300. Berlin Papyrus some parts of which duplicate the Ebers Papyrus.

1000- Early Iron Age in Europe.
500.

950. Time of Homer.

776. The first Olympiad—beginning of the formal reckoning of time in the Greek world.

753. Traditional date of the Founding of Rome.

600. Time of Thales of Miletus (639-544), the first Greek philosopher.
Lex Regia in Rome, permitting post-mortem Caesarian section.
Asklepios, the mythical "Father of Medicine."

590. Tarquinius Priscus begins the sewage disposal system of Rome with the Cloaca Maxima.

585. An eclipse of the sun predicted by Thales of Miletus.

522. A medical school founded at Athens by Democedes.

494. Romans institute Aediles (sanitary police).

490. Battle of Marathon between the Persians and Greeks: one of the decisive battles of the world since together with the Battles of Thermopylae and Salamis in 480, it determined that European culture was to be free of domination from western Asia.

460- Age of Pericles, the peak of Greek culture.
425.

431- The Peloponnesian War which resulted in the victory of Sparta over Athens.
404.

430- Plague at Athens.
425.

425. Hippocrates of Kos (460-377).

420. Democritus (460-370), author of the atomic theory of matter.

375. Plato (429-347).

350. Approximate period of Diocles of Karystos, one of the most important of the "rhizotomoi." He wrote an important pharmacologic treatise.

335. Aristotle (384-322). He codified the knowledge of the Greeks and added greatly to it.

323. Death of Alexander the Great.

312. The first Roman Aqueduct (Aqua Appia). It was eleven miles in length.

300. Theophrastus (372-285), the "Father of Botany."
Beginning of the famous school in Alexandria in Egypt.
212. Archimedes killed at the Roman capture of the city of Syracuse.
146. Fall of Corinth. Destruction of Carthage by the Romans at the end of the Third Punic War.
80. Mithridates, the first student of toxicology. The most famous theriac of later times was named after him.
44. Julius Caesar assassinated.

A. D.

43. Scribonius Largus, physician to the Emperor Tiberius and compiler of a famous dispensatory, the first to come down to us. Date uncertain.
60. Dioscorides, earliest authority on materia medica. Date uncertain.
70. Pliny, (23-79) author of the first known encyclopaedic natural history.
170. Galen (131-201), Rome's most celebrated pharmacist and physician.
350. Approximate time of Saints Cosmas and Damian, semi-mythical patrons of pharmacy and medicine.
400. Oribasius, Greek physician to the Emperor Julian.
476. Fall of the Western Roman Empire.
500. Theodoric the Ostrogoth passes laws drastically affecting medical practice.
539. St. Benedict founds the Benedictine Order at Monte Cassino in Italy.
550. Alexander Trallianus, who used rhubarb, cantharides, and colchicum in medicine.
Marcus Aurelius Cassiodorus (490-585), Chancellor of King Theodoric. His "Institutiones" was a fundamental book of mediaeval science.
600. Isidore of Seville, bishop and author of a famous encyclopaedia partly devoted to medicine.
632. Death of Mohammed (571-632).
800. Charlemagne crowned emperor of the Holy Roman Empire.
Time of Johann Mesuë Senior, or Jûhannâ Ibn Mâsswaihi (777-857), a Nestorian Christian who wrote in Arabic.
825. Abbot Walahfried writes his "Hortulus" at Reichenau.
878. The city of Syracuse in Sicily, conquered by Arabs, becomes a seat of Arabic culture.
900. Rhazes, the Persian Abu Bekr-el Razi (865-925), whose work was of great influence on European pharmacy and medicine.
950. Albucasis (+1013), author of a noted pharmaceutical and medical work.
Approximate time of the "Leech Book of Bald," a Saxon recipe book.
962. Hospice of St. Bernard founded.
1000. Avicenna (980-1035), noted philosopher, physician, and pharmacist.
1050. Serapion Junior, noted pharmaceutical authority. Dates very uncertain. Possibly even 13th century.
1060. Approximate date of "Causae et Curae," written by the Abbess Hildegard of Bingen (1098-1179).
1066. Battle of Hastings. Norman Conquest of England.
1075. Johannes Afflatus, pupil of Constantinus Africanus, author of an encyclopedia of drugs and medicine.
1096. First Crusade. The Crusades extended from 1096 to 1272.
1100. Constantinus Africanus, the greatest pharmaceutical and medical translator of his time.
Mesuë Junior, reputed author of an apothecaries' manual used as late as 1700. He is now assumed to be an entirely mythical personage.
1131. Council of Rheims forbids clerics to practice medicine.

1137. St. Bartholomew's Hospital founded in London.
1140. Antidotary of Nicholas of Salerno.
1160. About this time hospitals of great completeness and efficiency were instituted by the Saracens.
1163. Edict of Tours, restricting surgery to barbers and traveling mountebanks.
1178. Apothecaries first mentioned in French records.
1180. Guild of Pepperers in London, which included the dealers in drugs. Guild of physicians and apothecaries in Florence.
1187. Death of Gerard of Cremona, a famous translator of medical and pharmaceutical works.
1187. The Saracen emperor Saladin captures Jerusalem.
1215. King John of England forced to sign the Magna Charta.
1225. First recorded apothecary shop in Germany (Cologne).
1240. Frederick of Sicily, Emperor of the Holy Roman Empire, issues a decree regulating the practice of pharmacy as a profession separated from medicine.
1270. Antidotary of Nicholas Myrepsus.
1271. Herborists and Apothecaries forbidden to practice medicine in Paris.
1297. Guild of Pharmacists organized in Bruges.
1311. Death of Arnald of Villanova, who promoted the use of the process of distillation in pharmacy.
1314. Formulary of John Gaddesden.
1330. Gunpowder first used in warfare.
1345. First recorded apothecary shop in London.
1348. Great Plague throughout Europe—the "Black Death."
1353. Mention of "Master" apothecaries in a Parisian ordinance concerning the inspection of the apothecary shops.
1428. Charter granted to Guild of Grocers in England. (This guild included the apothecaries.)
1440-50. Invention of printing.
1450. The physician Saladin de Asculo, writes his "Compendium Aromatariorum."
1453. Fall of the Eastern Roman Empire (Byzantium). This greatly affected the drug and spice trade with the East since it closed the land route between Europe and the Orient.
1478. Epidemic of the Plague in London. Other epidemics in 1508, 1531, 1535-36, 1543, 1547, 1563, 1580-84, 1592-93, 1629-31, 1636, 1663-65. The plague at Nottingham in 1667 was the last incidence of plague in England.
1480. First "poison law" issued by James I of Scotland.
Latin text of "Regimen Sanitatis" printed for first time.
1484. Pope Innocent VIII authorizes burning of witches.
1492. Columbus discovers America.
1496-1500. Rapid spread of syphilis in Europe.
1498. Vasco da Gama finds an all-water route to the East Indies by sailing around Africa.
First edition of the "Ricettario Fiorentino." Published in Florence, its use was obligatory and hence it was the first official pharmacopoeia of Europe.
1515. Vesalius the anatomist.
1517. Martin Luther starts the Reformation.

1519-22. Magellan's expedition circumnavigates the globe. Sailors suffer greatly from scurvy.

1529. The first treatise of Paracelsus (1493-1541) is published.

Senate of Nuremberg authorizes apothecaries to follow formulas in "Luminare Maius."

1530. Otto Brunfels' Atlas of Plants published.

Sarsaparilla introduced.

1540. English Barbers and Surgeons unite under the name "Commonalty of the Barbers and Surgeons."

Sulphuric ether discovered by Valerius Cordus (1515-44).

1545. Botanic Garden established at Padua in Italy.

1546. Dispensatory of Valerius Cordus printed by direct order of the Senate of Nuremburg.

1547. Botanic garden established at University of Pisa in Italy.

1548. Charles V issues decree regulating pharmacy and requiring at least one inspection annually.

1548. The first formulary to be called "Pharmacopoea" published by the French physician Jacques DuBois (Jacobus Sylvius) in Lyon.

1559. Pharmacopoeia of Mantua issued.

1560. Monardes introduces balsam of Peru.

1564. Pharmacopoeia of Augsburg issued.

Shakespeare born (1564-1616).

1565. Tobacco plant introduced in France by Jean Nicot, from whose name is derived our word "nicotine."

Pharmacopeia of Cologne issued.

1571. Battle of Lepanto.

End of the Turkish sea-power.

1580. Drake's voyage around the world.

Severe scurvy among sailors.

Jardin des Apothicaires founded in Paris.

1584. Sir Walter Raleigh brings the potato to Europe.

1588. Defeat of the Spanish Armada.

1589. Galileo demonstrates the law of falling bodies and thus repudiates the authority of Aristotle.

1598. Botanical garden founded at Montpellier.

1601. Chair of surgery and pharmacy established at Montpellier.

1602. First pharmacy established in Russia.

1603. Death of Queen Elizabeth of England.

1607. English settlement at Jamestown, Virginia.

1609. Oswald Crollius publishes "Basilica Chemica" containing the earliest recorded method of making calomel.

1610. Potassium acetate first made; called "Terra Folia Tartrata."

1617. Society of Apothecaries of London created by charter of King James I. as an independent corporation.

1618. First London Pharmacopoeia published.

1620. Plymouth, Massachusetts, settled by the Pilgrims: Salem in 1628; Boston in 1630.

1621. Raymond Minderer publishes "Military Pharmacy and Medicine."

1628. Harvey publishes his famous book on the circulation of the blood (De Motu Cordis et sanguinis in animalibus).
1631. Tartar emetic introduced by Adrian van Mynsicht.
1635. Louis XIII establishes Jardin des Plantes.
1642. Beriberi described by Jacob Bontius.
1642-49. Civil War in England ending with the beheading of Charles I.
1643. First European reference to cinchona published by H. van der Heyden at Gand (Ghent), Belgium.
1658. Red blood corpuscles discovered by Swammerdam.
1662. The "Nuovo et Universale Theatro Farmaceutico" by Antonio de Sgobbis da Montagnana is published.
1664. English capture New Netherlands from the Dutch, renaming it New York.
1665. Sir Isaac Newton discovers law of gravitation.
1666. The Great Fire of London.
1669. Phosphorus discovered by Brand.
Sydenham publishes formula for laudanum.
1675. Charas publishes "Pharmacopoeia Royale et Galenique."
1680. Leeuwenhoek discovers yeast plant.
1681. Pennsylvania founded by the Quakers.
1691. Yellow fever epidemic in Boston.
1692. Persecutions for Witchcraft in Salem, Massachusetts.
1695. Magnesium sulphate (Epsom salts) discovered by Nehemiah Grew in the waters from springs at Epsom, England. The discoverer received a patent for this medicament. This patent (1698, No. 354) was the first medicinal patent granted in England.
1699. First edition of the Edinburgh Pharmacopoeia issued.
1703. English House of Lords authorizes apothecaries to prescribe as well as to dispense medicines.
1712. Compound tincture of gentian first appears under the name of "Stoughton's Elixir," a patent medicine.
1715. Bartram's botanical garden established in Philadelphia.
1718. The French apothecary E. Fr. Geoffroy makes the first successful attempt at defining the relationship between chemical elements.
1719. Thymol isolated by Kaspar Neumann, a German apothecary.
1731. Philadelphia Hospital founded.
1736. Virginia issues the first law in North America having a concrete bearing on the practice of pharmacy.
1740. Thomas Dover invents "Dover's Powder."
1741. Formulary of St. Bartholomew's Hospital issued.
1746. Compound tincture of benzoin first recognized by the London Pharmacopoeia issued in this year.
1752. First dispensary in America opened in Pennsylvania Hospital in Philadelphia; Jonathan Roberts being the first apothecary.
1754. Carbon dioxide discovered by Black.
1758. Halley's Comet returns (as had been predicted) and thus ends the "comet theory of disease causation."
1762. Antoine Baumé, France's most famous pharmacist of the 18th century, publishes his "Elements of Pharmacy."

1765. John Morgan teaches pharmacy in the University of Pennsylvania and introduces prescription writing into the United States.
First Medical School in the United States opens at the University of Pennsylvania.
1770-71. Three million people die of small-pox in West Indies.
1771-74. Oxygen observed in 1771 by Priestley and isolated in 1774 by him as well as by Scheele.
1772. Nitrogen discovered by Rutherford.
1774. Chlorine discovered by Scheele.
1775. Oxygen defined by Lavoisier who recognized its theoretical and experimental importance.
1776. Declaration of Independence (July 4) by the Continental Congress.
Christopher Marshall, famous American pharmacist, appointed by the Continental Congress to provide for the needs of wounded soldiers in Philadelphia.
1777. Royal decree separates the Parisian apothecaries and spicers and establishes a "College de Pharmacie"
1783. Pilâtre de Rozier, the apothecary, makes a balloon ascension. This was the first flight made by a human being.
1785. Fowler introduces potassium arsenate (Fowler's Solution).
Cod-liver oil first used in England.
Withering's treatise on digitalis published.
1787. The Northwest Ordinance providing for the government of the Northwest Territory.
College of Physicians of Philadelphia established.
Use of ergot introduced in obstetrics by Paullitzsky.
1789-99. French Revolution.
1789. George Washington becomes first president of the United States.
1790. First United States Patent Law. First medical patent granted to Elisha Perkins in 1796.
1793. Five thousand die of the plague in Philadelphia.
1798. Jenner publishes his work on vaccination.
1799-1800. Sir Humphry Davy discovers the anesthetic properties of laughing gas (nitrous oxide).
1803. Société de pharmacie de Paris founded.
1804. Atomic theory formulated by Dalton.
Napoleon becomes Emperor of the French. The Napoleonic Wars ended in 1815 with the Battle of Waterloo.
1805. Morphine isolated by Sertürner.
1807. First edition of the Dublin Pharmacopoeia.
Act of the British Parliament abolishes slave-trade in English vessels.
1808. Pharmacopoeia of Massachusetts Medical Society issued.
1809. French "Bulletin de Pharmacie" first published oldest pharmaceutical journal in the world, now published as "Journal de Pharmacie et de Chemie."
1811. Iodine discovered by Courtois in sea-weed ashes.
1812. Farr and Kunzi begin manufacture of pharmaceutical chemicals in Philadelphia.
1816. Pharmacopoeia of New York Hospital issued.
1818. Strychnine isolated by Caventou and Pelletier.

1818. First pharmacopoeia official for the whole of France.
1819. First steamship crosses the Atlantic.
1820. First edition of the "United States Pharmacopoeia" issued.
1821. Philadelphia College of Pharmacy founded.
1823. Massachusetts College of Pharmacy founded.
Process of catalysis discovered by the apothecary Döbereiner.
1824. Philadelphia College of Pharmacy publishes book exposing patent medicines.
1826. A. J. Balard, French pharmacist, discovers bromine and prepares the bromides of sodium and potassium.
1827. Aluminum isolated by Wöhler.
1828. Wöhler synthesizes urea from ammonium cyanate thus bridging the gulf between organic and inorganic chemistry.
1829. New York College of Pharmacy founded.
Louis Braille introduces raised printing for the blind.
Daguerre introduces photography.
1831. Chloroform prepared at the same time by Liebig and Soubeiran and recognized as a new compound.
1832. Codein isolated by Robiquet.
1834. Carbolic acid and aniline isolated from coal-tar by Runge.
Pure chloroform isolated and named by Dumas.
1836. Royal Pharmaceutic Institute founded at Stockholm, Sweden.
1838. Schleiden describes plant cells. This was followed in 1839 by Schwann's book on the cell theory, one of the epochal events in the history of biology.
1840. Drug milling started by Hagner in Philadelphia.
1842. Long performs first operation under ether anesthesia.
1843. Oliver Wendell Holmes points out the contagiousness of puerperal fever.
1844. A. J. Balard, French pharmacist, discovers amyl nitrite.
1846. Morton introduces ether anesthesia into general use.
American Medical Association organized. Its first meeting was held in Philadelphia the following year.
1848. First comprehensive code of pharmaceutical ethics adopted by the Philadelphia College of Pharmacy.
1850. Chatin first employs iodine in goitre prophylaxis.
1852. American Pharmaceutical Association founded and adopts Code of Pharmaceutical Ethics.
First Pharmacy Act in Great Britain.
1853. The Crimean War during which Florence Nightingale laid the foundation of professional nursing. She published her "Notes on Nursing" in 1859. In 1862 she established a training school for nurses.
1856. W. H. Perkin accidentally discovers a new coal-tar color while attempting the synthesis of quinine. Perkin received a patent on the process. (1856, No. 1984).
1858. Cocain isolated by Niemann in Wöhler's laboratory.
1859. Charles Darwin's Origin of Species published. This book, with Darwin's Descent of Man (1871), laid the foundation for our modern conception of organic evolution.
1860. Louis Pasteur demonstrates presence of bacteria in air.
1861. The Civil War.
1864. First edition of the British Pharmacopoeia which replaced the London, Edinburgh, and Dublin pharmacopoeias.

1864. St. Louis College of Pharmacy founded.

1865. First International Pharmaceutical Conference held in Brunswick, in Germany. There have been twelve such congresses in all, the twelfth being held in Brussels in 1935.

Gregor Mendel publishes his memoir on the inheritance of characteristics in plants. His work was not recognized until after 1900.

1867. Lister introduces antisepsis into surgery.

Formaldehyde discovered by A. W. von Hoffman.

1868. English Pharmacy Act requiring qualification and registration of all English pharmacists.

University of Michigan establishes Department of Pharmacy.

1872. First edition of the "Pharmacopoeia Germanica." This followed the unification of the German Empire in 1871.

1876. Bell introduces the telephone.

1883. University of Wisconsin establishes Department of Pharmacy.

1884. Mergenthaler invents first successful machine for setting type.

1888. National Formulary first issued by American Pharmaceutical Association.

Pasteur Institute founded.

1889. Missouri Botanical Garden established at St. Louis.

1890. German Pharmaceutical Society founded at Berlin.

Serum therapy introduced by Behring and Kitasato.

1892. First national Italian pharmacopoeia issued.

World's Columbian Exposition opens in Chicago.

1893. Aspirin introduced by Dreser.

1895. Discovery of X-rays by Röntgen.

1898. National Association of Retail Druggists founded in the United States.

Discovery of radium by P. and M. Curie.

1899. Transmission of yellow fever by mosquitoes demonstrated by a group working under Dr. Walter Reed.

1905. Wright Brothers make first successful flight in airplane.

1906. National Food and Drugs Act passed in the United States.

1910. Ehrlich and Hata introduce Salvarsan (606).

1912. The first assembly of the International Pharmaceutical Federation (Federation Pharmaceutique Internationale) held at the Hague, in Holland, in September. The tenth meeting was held in Copenhagen in 1937. Because of the war the 1939 meeting was postponed.

Word "vitamin" introduced by Funk. Since then vitamin research has progressed rapidly.

1914-18. First World War.

1922. Banting and Best isolate insulin.

1935. Prontosil, the first drug containing sulfanilamide introduced into therapy by Domagk.

1937-45. Sulfanilamide and other so-called "sulfa"-drugs demonstrated to be specifics against most bacterial diseases.

1943. Creation of a Pharmacy-Corps of the United States Army.

GLOSSARY

A

Abbott, Joel (1790-1826), physician in Washington, Georgia, four times representative to Congress. See Biographical Congressional Directory, p. 351.

Abbott, Wallace Calvin (1857-1921), physician and founder of the Abbott Laboratories. See Journ. Amer. Pharm. Asso., 10:559, 1921.

Accademia della Crusca, literally academy of the brain, alluding to its professed object of sifting the Italian language. Its dictionary, first published in 1612, was long the standard.

Adjunkt. See Personnel.

Administration. See Modes of administration.

Aesclepias. A Greco-Roman physician, born in Bithynia, practising at Rome in the first century A.D.

Aesculapius, Aesculopius. See Asklepios.

Albertus Magnus (1193-1280), or Albert count of Bollstaedt, a German aristocrat who became a priest and later Bishop of Regensburg. He was one of the earliest and most important medieval writers on natural history. See Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910, I, Part 2, p. 672; Louis Figuier: Vies des Savants Illustres Du Moyen Age, Paris, 1867, p. 112; Franz Strurnz: Albertus Magnus, Wien, 1926.

Alexander Trallianus (525-605), the cognomen Trallianus refers to his native town of Tralles in Lydia. Living at Rome as a physician he wrote in Greek a Materia Medica in 12 volumes.

Allen, William (1770-1843), English apothecary. He was not only a well-known chemist, but one of the leading English Quakers and a philanthropist of international importance. Bibliography: See E. C. Cripps: Plough Court, London, 1927, p. 25.

Almanach oder Taschenbuch für Scheidekuenstler und Apotheker (1780-1829). In 1820 the title was changed to "Trommsdorff's Almanach oder Taschenbuch für Chemiker und Apotheker," in 1822 to "Taschenbuch für Scheidekuenstler und Apotheker."

Amory, Robert (1842-1910), physician in Brookline, Mass., professor of physiology at Bowdoin College Medical School in Brunswick, Me., president of the pharmacopoeia convention in 1880. See Kelly and Burrage, American Medical Biographies, 1920, p. 24.

Anderson, John F. (1873-), physician, since 1915 director of the research and biological laboratories of E. R. Squibb's Sons. See Who's Who in America, 20: p. 177.

Anepu, the apothecary of the Egyptian gods. He was considered the son of Isis and Osiris.

Animal drugs, Animals, parts thereof, excrements, and animal preparations have always been used for medicinal purposes. Their use reached its climax in Joh. Jacob Wecker's Antidotarium generale, the first edition of which was published in Basle in 1553, and in the "Neuvermehrte heylsame Dreckapotheke," i.e., the newly augmented salutary dung pharmacy, published by the German physician Franz Christian Paullini in 1689 and reissued several times up to the end of the 19th Century. Hormones prepared from urine are the most recent phase of animal therapy.

Annalen der Chemie und Pharmacie (1840-1874). See also Annalen der Pharmacie. In 1874 the name was changed to Justus Liebigs Annalen der Chemie.

Annalen der Pharmacie (1832-1840). This journal represents not only a consolidation of several pharmaceutical journals, but also a substantial journal contribution made by pharmacy to chemistry. Under its later title "Liebig's Annalen" it has acquired international significance.

Antidotarium. See Pharmacopoeia.

Antidotarium Nicolai Myrepsi or Alexandrini, called also antidotarium magnum (large formulary). This formulary, composed in the 13th century, gained widest distribution in the edition prepared by Leonhard Fuchs, q.v., and published in Basle in 1549.

Antidotarium Nicolai Salernitani, called also antidotarium parvum (small formulary), was compiled around 1100, annotated and enlarged by Matthaeus Platearius, q.v., about 50 years later and was probably the official formulary in the Kingdom of the Two Sicilies of Frederick II of Hohenstauffen, q.v.

Apollo. God of healing as well as of youth and beauty, of poetry and music and of the wisdom of oracles. Gradually he became identified with the sun god Helios and was considered the son of Zeus. Apollo was the first Greek deity to find a place in Roman religion, worshipped chiefly as a god of healing.

Apotheca. Latinized form of Apothēkē, q.v. During Roman antiquity it was commonly applied to the storage room for wine. Galen differentiated between his apotheca or store room and his iatron, q.v., the room in which he prepared his medicaments. The Roman apotheca librorum corresponds to our library or storage room for books. In the Middle Ages the term was more or less restricted to store rooms for spices and drugs and thus the German Apotheke, q.v., and French apothicairerie, q.v., came into general use. The French equivalent was replaced by pharmacie, q.v., toward the close of the 18th century.

Apothecarius, from Latin apotheca, q.v., storage room and -arius, pertaining to, literally the person in charge of a storage room. So far as pharmacy is concerned, it refers to the dealer in spices and drugs. See French apothicaire, English apothecary, German apotheker (spelled variously in different Germanic countries and at different times).

Apothecary, anglicized form of apothecarius, q.v. In England the designation became restricted to a medico-pharmaceutical practitioner after the middle of the 18th century.

Apotheke, the Germanized form of the Latin apotheca, q.v. During the Middle Ages the name was applied to the German apothecary's place of business. French apothicairerie, q.v. and boutique, q.v., Italian botica, q.v., Spanish botega, etc., English apothecary shop, q.v., and pharmacy, q.v. The word also occurs in several book titles and in various combinations, e.g. Hausapotheke (medicine chest), Militair-apotheke (regimental medicine chest), etc., and figuratively in Seelenapotheke (medicine chest for the soul).

Apotheker. German form of apothecarius, q.v. In Germany it is still the official designation of the pharmaceutical practitioner as opposed to the Drogist, q.v.

Apothekerzeitung (1886-1933). The volume for 1933-34 was called Standeszeitung Deutscher Apotheker, since 1934 it has been known as Deutsche Apothekerzeitung.

Apothicaire. French form of apothecarius, q.v. At the close of the 18th century the word was replaced officially by pharmacien, q.v.

Apothicairerie. Old French form for pharmacy. See Apotheca.

Apotteck. See Pharmacopoeia.

Apprentice. See Personnel.

Apuleius, Lucius or Pseudo-Apuleius, a late Roman medical author of uncertain identity (4th or 5th century A.D.).

Aquae aromaticae. In contrast to aquae minerales and other aqueous solutions such as Aqua Goulardi, etc., aromatic waters (Compare Aromatic Spirits) were aqueous distillates of aromatic plants. Compare Eaux des plantes odorantes with Eaux des plantes inodorantes

(Baumé, Elémens de Pharmacie). Rose water played an important role in Persian commerce as early as the ninth century. It was used not only as a perfume but also in the preparation of medicaments. Arnaldus de Villanova (1235-1312) developed the art of distillation as a method of pharmaceutical technique. So important was this method and the products obtained thereby that a new type of medico-pharmaceutical treatises, the Destillirbücher (books on distillation) made its appearance. For details

FIGURE 26. Representative American Pharmacists of the Nineteenth Century.
(*From LaWall: Four Thousand Years of Pharmacy.*)

see Gildemeister - Hoffmann - Kremers: The Volatile Oils, (1900) I, p. 13. In modern pharmaceutical practice aromatic waters are, for the most part, no longer made by distillation, but by the solution of volatile oils in water. For perfumery purposes, however, such aromatic waters as rose water and orange flower water are still made by distillation.

Archaic, from the Greek archē (beginning), meaning the earliest times of the development of mankind until the predominance of human reasoning over the blind belief in magic forces.

Archiv der Pharmacie (1835-), founded in 1822 as Archiv des Apothekervereins im noerdlichen Teutschland, combined with Annalen der Pharmacie from 1832-1835. In 1924 the Archiv became merged with the Berichte der Deutschen Pharmazeutischen Gesellschaft. The combined journals appear under the title Archiv der Pharmazie und Berichte der Deutschen Pharmazeutischen Gesellschaft.

Aristotle (384-322 B.C.), one of the greatest philosophers of all times, called the Stagirite because of his birth in the Greek town Stagira. In the Middle Ages he was recognized as the highest authority in science.

Arny, Henry V. (1868-1943), one of the American teachers of pharmacy who completed their scientific education in Germany, editor, author, professor and dean at the New York College of Pharmacy, 1911-1936. See New York State Pharmacist, 10:9, 1936.

Aromatarius, pl. **-i,** from Latin aroma (spice), and -arius, pertaining to, i.e., dealer in spices.

Aromatic waters. See Aquae aromaticae.

Asklepios, whose Egyptian antecedent was Imhotep, q.v. He is considered to have been a physician and is mentioned as such by Homer. Later he became the Greek god of medicine and healing, the chief seat of his worship being Epidauros. In Greek mythology Asklepios is the son of Apollo. His sanctuaries were not only places of worship but also centers of medical treatment. The Romans who also worshiped him, frequently with his daughter Hygieia as the god of health, called him Aesculapius.

Assistant. See Personnel.

Assistant Pharmacist. See Titles.

Assyria. During the era of its greatest expanse ancient Assyria comprised the territory between the Euphrates and the mountain slopes east of the Tigris. At one time, i.e., during the reign of Ashurbanipal (668-626 B.C.) it extended to the Nile. Its history can be traced back to about 2300 B.C. Its civilization was borrowed almost wholly from Babylonia.

Atkins, Henry (1658-1635), physician in ordinary to the English King James I, q.v. It was under the presidency of Dr. Atkins that the London College of Physicians issued the first London Pharmacopoeia. See Dictionary (English) National Biography, II, p. 220.

Attfield, John (1835-1911), English pharmacist, professor at the Pharmacy School of the Pharmaceutical Society of Great Britain. See Amer. Journ. Pharm., 78:102, 1906; Jos. P. Remington: Journ. Amer. Pharm. Asso., 1:490, 1912.

Avenzoar, or Abŭ Marvan Ibn Fuhr (1113-1162). A Spanish-Arabic medical author. See George Sarton: Introduction to the History of Science, Bruges, 1931, II, p. 233.

Avicenna, or Abdallâh Ibn' Ali-Hosain Ibn' Ali Aš-Saib Ar-Rais Ibn Sinâ (980-1033), the most famous and most influential Persian-Arabic physician of the classical period of Arabian, or Greco-Arabic medicine. See Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910, I, Part 2, p. 602.

Avogadro, Amadeo, Count of Quaregna (1776-1856), Italian physicist. The so-called Avogadro's law, announced in 1811 and stating that equal volumes of all gases at the same temperature and under the same pressure contain equal numbers of molecules, is one of the fundamental concepts of modern chemistry. See Chemistry, History of.

B

Babylonia. In the time of her highest glory (6th century B.C.) ancient Babylonia with its capital Babylon in the Euphrates valley extended into Asia Minor and Egypt. It was a center of the world's commerce and of the arts and sciences. Its language can be traced back to about 3500 B.C.

Bache, Franklin (1792-1864), physician, professor of chemistry at the Philadelphia College of Pharmacy and later at Jefferson Medical College, co-author of the U. S. Dispensatory. See J. W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 399.

Bacon, Roger (1214-1294), an English Franciscan Friar, while a follower of

Aristotle, he insisted upon the value of experiment in scientific investigation. See Louis Figuier: Vies des Savants Illustres Du Moyen Age, Paris, 1867, p. 174.

Baitâr, Ibn al (1197-1248), Spanish-Arabic medical author, physician in ordinary to the ruler of Egypt. See Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910, I, Part 2, p. 600.

Balard, Antoine Jérome (1802-1876), French apothecary. He discovered bromine (from the Greek bromos = stench) in the salt brine of the Mediterranean in 1826. Of his further discoveries that of amyl nitrite (1834) is noteworthy. See Amer. Journ. Pharm., 48:287, 1876. See Chemistry, History of.

Bard, Samuel (1742-1821), American physician and writer. See Dictionary of American Biography, I, p. 598.

Barthet (Barthez), Paul-Joseph (1734-1806). Physician, theologian, lawyer and philosopher. See Garrison: History of Medicine, Philadelphia, 1929, p. 364.

Barton, Benjamin Smith (1776-1815), American botanist, professor at the University of Pennsylvania. See Bull. Lloyd Lib., Vol. I, 1900.

Bartram, John (1699-1777), American botanist. At Kingsessing he founded the first botanical garden in America. Linné termed him "the greatest natural botanist in the world." See Amer. Journ. Pharm., 80:416, 1908; Dictionary of American Biography, II, p. 26.

Bartram, Moses (1732-1809), son of the famous botanist Bartram, q.v., and druggist in Philadelphia. See Edward Kremers: Two Invoices of 1785, Journ. Amer. Pharm. Asso., 20:691, 1931.

Bastedo, Walter A. (1874-), pharmacist, physician, professor of clinical medicine at Columbia University, president of the pharmacopoeia convention, 1930. See Journ. Amer. Pharm. Asso., 20:199, 1931.

Bastin, Edson T. (1843-1897). Bastin started his career as a druggist owning a store in Chicago. Later he became a teacher of botany and materia medica first at the Northwestern College of Pharmacy and later at the Philadelphia College of Pharmacy. See Proc. Amer. Pharm. Asso., 45:32, 1897; England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 413.

Bate, George (1608-1669), physician in ordinary to the English Kings Charles I and Charles II and to the Lord Protector Cromwell. His formulae were published by the London apothecary Shipton, q.v., under the title Bate's Dispensatory or Pharmacopoeia Bateana. See Dictionary (English) National Biography, III, p. 390.

Bateman's Elixir. Bateman's elixir or pectoral drops was, according to a formula published by the Philadelphia College of Pharmacy in 1833, a tincture of opium, red sanders and catechu with camphor and oil of anise. See Journ. Phil. Coll. Pharm. 5:25, 1833.

Bauhin, Caspar, professor of anatomy and botany at the University of Basle, Switzerland (1560-1624), one of the most learned botanists of all time. His book Prodromus theatri botanici, in which he describes about 6,000 plants arranging them according to a kind of natural system, represents the best dictionary of botanical nomenclature of his period.

Baumé, Antoine (1728-1804). Baumé belongs to the important French apothecary-chemists of the 18th century who simultaneously enriched pharmacy and chemistry. He introduced the hydrometer (Baumé's degrees), improved the process of distillation and gave in his Élémens de Pharmacie théorique et pratique, a comprehensive description of pharmaceutical apparatus and manipulation. He established the first laboratory for the manufacture of ammonium chloride and manufactured many other chemicals and galenicals on a large scale.

Bayen, Pierre (1725-1798), French apothecary. In 1775 Bayen published his observations on the "escape" of "Un fluide élastique", i.e., an air, when heating mercuric oxide. He is, therefore, supposed to have discovered oxygen before Priestley.

Beach, Wooster (1794-1868). He was the founder of the American reformed school of medicine, which later on was merged in the eclectic school. Beach's book, The American Practice of Medicine, the standard work of the new movement, was recognized all over the world. See A. Wilder: History of Medicine, New Sharon, 1901, p. 437; Dictionary of American Biography, II, p. 85.

Beal, James Hartley (1861-), pharmacist, lawyer, educator and writer. See J. A. Koch, American Contemporaries, Industrial and Engineering Chemistry, News Edition, 13:352, 1935.

Beck, John B. (1794-1851), physician in New York, professor of materia medica and botany in the N. Y. College of Phy-

sicians and Surgeons and one of the earliest American historians of medicine.

Becher, Johann Joachim (1635-1682), chemist, polyhistorian, author and for some time physician in ordinary to the elector of Bavaria. He was the first to determine the increase in weight after oxidation (calcination of lead). His mentioning of a principle of combustion adherent to all combustible substances laid the foundation of the phlogiston theory of Stahl, q.v.

Beckmann, Ernst Otto (1853-1923), apothecary and professor of pharmaceutical chemistry at the University of Leipzig. His main work and merit lay in the field of physical chemistry. His apparatus for the determination of lowering of the freezing point and raising of the boiling point have become indispensable tools in chemistry.

Bedford, Peter W. (1836-1892), New York druggist and from 1873 professor at the New York College of Pharmacy, also editor of the Pharm. Record. See Drug. Circ., 51:82, 1907.

Behring, Emil von (1854-1917), German physician and academic teacher of hygiene in Marburg, inaugurator of the serum therapy. See Sigerist: The Great Doctors, New York, 1933, p. 372; Garrison: History of Medicine, Philadelphia, 1929, p. 584.

Beissenhirtz, Friedrich Wilhelm (1779-1831), German apothecary. He was one of the founders of the "Apothekerverein im noerdlichen Teutschland," and contributed many papers to the Archiv and to Trommsdorff's Journal der Pharmacie.

Bendiner, Samuel J., Hungarian-born druggist in New York (1839-1897). See Proc. Amer. Pharm. Asso., 45:33, 1897.

Benger, Frederick Baden (1840-1903), English pharmacist and manufacturer. See Pharmaceutical Journal, 70:145, 179, 1903.

Berendes, J. German apothecary and pharmaceutical historian (1836-1914). Berendes' most important books are Das Apothekenwesen, especially devoted to German pharmacy, and Die Pharmacie bei den alten Kulturvölkern (Pharmacy during antiquity). He also translated the materia medica of Dioscorides and the Seven Books of Paulus Aegineta from the Latin and Greek texts into German. See Haefliger: Biographicon in Tschirch's Handbuch der Pharmakognosie, Leipzig, 1932; Adlung and Urdang: Grundriss der Geschichte der deutschen Pharmazie, Berlin, 1935.

Berlinisches Jahrbuch der Pharmacie (1795-1840). In 1803 the title was changed to Neues Berlinisches Jahrbuch der Pharmazie and in 1815 to Deutsches Jahrbuch für die Pharmacie.

Berlinisches Jahrbuch für die Pharmacie (1795-1840). In 1803 the title of this annual periodical was changed to Neues Jahrbuch der Pharmacie, in 1815 to Deutsches Jahrbuch der Pharmacie and again in 1837 to Berlinisches Jahrbuch für Pharmacie.

Berthollet, Claude Louis (1748-1822), eminent French chemist. He prepared for the first time potassium chlorate and the pure hydrates of potassium and sodium. See Encyclopaedia Britannica, 1910, 3: 812; Philippe and Ludwig, Geschichte der Apotheken, Jena, 1855, p. 707.

Berzelius, Johann (Joens) Jacob (1779-1848), Swedish physician and one of the greatest of chemists. He is the founder of the modern chemical nomenclature and was the first to observe and to describe isomorphism, polymorphism, and allotrophy. A very interesting controversy respecting nomenclature between Robert Hare, professor of chemistry in the University of Pennsylvania and Berzelius may be found in the Amer. Journ. Pharm. 9:1, 1837. See Soederbaum: Joens Jacob Berzelius; biographical notes, translated into English by O. Larsell, Baltimore, 1934.

Besler, Basilius, German apothecary, and botanist (1561-1629). His Hortus Eystettensis was the first botanical work to make use of copper etchings rather than woodcuts.

Beven, Silvanus and Timothy, London wholesale and retail druggists. Silvanus Beven (1691-1765) founded the business in 1715 and the partnership with his brother Timothy (1704-1786) started between 1731-1736. It was this firm which later on became Allen & Howard, Allen, Hanburys and Barry, and finally Allen & Hanburys, Ltd., London. See E. C. Cripps, Plough Court, London, 1927.

Bibliography. While the attempt has been made to supply the reader with as many bibliographic references, as possible, the limitations of space make it impossible to go into greater detail. For other references the reader is referred to standard treatises, such as H. C. Bolton, Chemical Bibliography, published by the Smithsonian Institute; J. C. Poggendorff, Biographisch-literarisches Handwörterbuch zur Geschichte der exakten Wissenschaften, Leipzig, 1863; H. Schelenz; Geschichte der Phar-

mazie, Berlin, 1904, John Ferguson; Bibliotheca Chemica, 1906; J. A. Haefliger: Biographikon, in Tschirch's Handbuch der Pharmakognosie, Leipzig, 1932; Adlung and Urdang: Grundriss der Geschichte der deutschen Pharmazie, Berlin, 1935; F. Ferchl; Bio-und Bibliographikon, Mittenwald, 1937.

Bigelow, Jacob (1787-1879), physician in Boston, professor of materia medica at Harvard, a great educational reformer and one of America's most learned botanists. See Kelly and Burrage; American Medical Biographies, New York, 1920, p. 100.

Biroth, Henry (1857-1912), German-born Chicago pharmacist, who was considered one of the leading apothecaries and chemists of the Northwest in early days. Biroth wrote on pharmaceutical and general subjects. See Journ. Amer. Pharm. Asso., 1:776, 1912.

Black, Joseph (1728-1799), eminent English chemist and physicist. He recognized carbonic acid as a product of fermentation, of combustion of substances containing carbon, and of breathing. See E. W. J. Neave: Joseph Black's lectures on the elements of chemistry, Isis, 25:372 ff, 1936.

Bock, Hieronymus (1498-1554), German cleric, physician, and botanist. His New Kreuterbuch (1539) became well known especially for its excellent illustrations.

Boe, Franz de le. See Sylvius.

Boerhave, Hermann (1668-1738). Dutch physician and academic teacher of medicine and chemistry in Leyden. His medical writings were read all over the world and his Elementa Chemiae (Leyden, 1732) is considered the best book on the subject in the first half of the 18th century. He was called the "Batavian Hippocrates." Bibliography: See Garrison: History of Medicine, Philadelphia, 1929, p. 261; Sigerist: The Great Doctors, New York, 1933, p. 185.

Boettger, Johann Friedrich (1682-1719), apothecary and alchemist. In connection with Tschirnhaus, q.v., or at least assisted by the latter, he invented the process of production of European porcelain.

Bois, Jacques du, Latinized Silvius or Sylvius (1492-1552), French physician and academic teacher at the University of Paris. It was he in his "Pharmacopoeae, libri tres (1548) who first used the term "Pharmacopoe[i]a" as the title for a formulary.

Bollstaedt, Count Albert of. See Albertus Mangus.

Bolton, H. C. American chemist interested in the history of chemistry, (1843-1903). Author of the chemical bibliography published by the Smithsonian Institution and of The Follies of Science.

Bond, Thomas (1712-1784), Philadelphia physician and one of the founders of the Pennsylvania Hospital. See Dictionary of American Biography, II, p. 433.

Boogaerdt, Bogart Herman Meynders (or Myndertz) van den (1612-1648), Dutch-American surgeon. See John Shrady: N. Y. Med. Register 25:231, 1887.

Botega. Spanish form of the Latin apotheca, q. v. See Apotheke.

Botica. Italian form of the Latin apotheca, q. v. See Apotheke.

Bourbon. French ducal and royal family. The first representative of this family to be known in history was Baron Aimar (9th Century). His descendants founded dynasties in France (Henry IV, 1589), Spain (Philip V, 1700), and Naples (Charles III, 1735).

Burroughs, Silas Maineville (1850-1895), American pharmacist and, together with Henry Wellcome, founder of the English pharmaceutical firm of Burroughs, Wellcome & Co. See Amer. Journ. Pharm. 67:433, 1895.

Boutique. French form of the Latin apotheca, q. v. See Apotheke and Apothicairerie.

Bowditch, Henry I. (1808-1892), physician, author and one of the leading spirits of the antislavery movement before the Civil War. See Dictionary of American Biography, 2, 1929, p. 492.

Boyle, Robert (1627-1687), Irish-English aristocrat, one of the earliest eminent English chemists, one of the founders of the Royal Society of Great Britain and director of the East India Company. Boyle is one of the originators of analysis by precipitation. His general chemical knowledge was far ahead of his time. He introduced the terms analysis, reaction, and reagent into chemical language and formulated Boyle's law, which states that when a gas is subjected to compression at a constant temperature the volume is inversely proportional to the pressure. See Encyclopaedia Britannica, IV, 1910, p. 354.

Boylston, Zabdiel (1679-1766), American-born medical practitioner, taught by his father who likewise practised medicine. Without academic study or a medical degree he achieved a high reputation in

his profession. See Dictionary of American Biography, **II**, p. 535.

Braillier, Pierre (16th century), French apothecary. See L. André-Pontier: Histoire de la Pharmacie, Paris, 1900, p. 210.

Brandes, Rudolph (1795-1842), German apothecary. It was he who initiated the Apothekerverein im Noerdlichen Teutschland. He discovered delphinine and hyoscyamine, both in 1819, and wrote many books and essays on pharmaceutical, chemical, and meteorological subjects.

Breasted, James Henry (1865-1935), the first American to specialize in ancient, especially Egyptian History. He became an international authority in this field. His importance for pharmacy was twofold. Firstly he started his career, as a pharmacist, graduating from the Chicago College of Pharmacy in 1886; and secondly he translated, annotated, and published the Edwin Smith Papyrus. See John A. Wilson; James H. Breasted, National Academy of Sciences of the U. S. A., Biograph. Mem. Vol. XVIII, 1938, p. 95; Alumni Rec., University of Illinois, 1921, p. 346.

Bridges, Robert (1806-1882), physician and professor at the Philadelphia College of Pharmacy from 1842-1879. See J. W. England; First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 401.

British Oil. The most efficient ingredient was crude petroleum. The formula, published by the Philadelphia College of Pharmacy in 1833 called for oils of turpentine, of linseed, amber, juniper, and petroleum. See Journ. Phil. Col. Pharm., **5**: p. 29, 1833.

Brockedon (19th century), inventor of compressed tablets. See L. F. Kebler: The Tablet Industry, Journ. Amer. Pharm. Asso., **3**: 820, 1914.

Brooks, John (1752-1825), American physician, serving in the Revolutionary Army first as a captain and advancing rapidly until he became brigadier general. After the war while practising medicine in Medford he was elected governor of Massachusetts in 1816: See Dictionary of American Biography, **III**, p. 79.

Brown, John (1735-1788), Scotch physician. Bibliography: See Garrison: History of Medicine, Philadelphia, 1929, p. 314; Sigerist: New York, 1932. Man and Medicine, p. 43.

Brown, William (1752-1792), Scotch-born American physician of high professional and social standing, author of the so-called Lititz Pharmacopoeia. See L. C. Duncan: Medical Men in the American Revolution, Carlisle, 1931, p. 240; John Kebler: Journ. Amer. Pharm. Asso., **16**:1090, 1927; Badger Pharmacist, Nos. 22-25, 1938; Dictionary of American Biography, **III**, p. 157.

Brown-Séquard, Charles-Edouard (1817-1894). A native of Mauritius, the son of an American father and a French mother, Brown-Séquard was chiefly associated with French medicine. He was professor of experimental medicine in the Collège de France (1878) and successively a professor in the Harvard and Paris medical faculties. Bibliography: See Garrison: History of Medicine, Philadelphia, 1929, p. 553.

Brunfels, Otto (1500-1534), German cleric, physician, and botanist. He not only wrote his famous botanical work, first in Latin as a Herbarium, then in German as a Kreuterbuch, but also many other treatises, among them a dictionary of synonyms and his Reformation der Apotecken, published after his death in 1536. This reformation presents an account of the various pharmaceutical duties and served as a guide to both pharmacist and government.

Brunschwygk, Hieronymus, spelled also Brunschwig, Brunschwyk, etc., (1430-1512), German surgeon. His books on the art of distillation initiated a new period of pharmaceutical art. Besides Brunschwygk wrote a "thesaurus pauperum" (literally—treasury of the poor) i. e., a popular medicine book designed for self-treatment.

Buchner, Johannes Andreas (1783-1852), German apothecary and professor of pharmacy first at the University of Landshut, later of Munich. He discovered salicine in the willowbark, solanine in the potato plant, berberine in Berberis, aesculin in the ashtree bark, nicotine in tobacco, and also acrolein. From 1815-1852 Buchner edited the Repertorium der Pharmacie, q. v.

Bulleyn, (also Bullein) William (died 1576), English physician, botanist and rector of Blaxhall, Suffolk. See Dictionary (English) National Biography, **VII**, p. 244.

Bullock, Charles (1826-1900), Philadelphia druggist. See Drug. Circ. **51**:82, 1907; Proc. Amer. Pharm. Osso., **48**:38, 1900.

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Cadet de Gassicourt, Charles Louis (1769-1821), French apothecary. Of his books his La chimie domestique (8 volumes), his Pharmacie domestique and his Formulaire magistral et mémorial pharmaceutique are noteworthy.

Caille, André, French physician (16th century). His translation of the "Methodus Medicamenta Componendi ex Simplicibus," of Jacques du Bois, q. v., which he published under the title La Pharmacopée, qui est la manière de bien choisir et préparer les simples, et de bien faire les composées (The Pharmacopoeia, i. e. the manner in which to choose and prepare well the simple drugs and to manufacture well the compound remedies) lived to see several editions.

Camerarius, Elias (1665-1721), German physician and professor of medicine and botany at the University of Tuebingen. Among his medico-chemical researches those on ammonium sulfate are noteworthy. He wrote about the use and abuse of tea and coffee as beverages.

Cannizzaro, Stanislao (1826-1910), Italian chemist. Of his many achievements his explanation of the atomic theory, and the so-called Cannizzaro's Reaction, based on the formation of R CH_2OH and R COOH by the treatment of aldehydes with alkalis may be mentioned.

Carney, Charles T. (1832-1862), Boston druggist and teacher at the Massachusetts College of Pharmacy. See Drug. Circ., 51:157, 1907.

Carpenter, Philo, Chicago's first druggist (about 1800-1850). See Bull. Pharm. 16:100, 1902.

Cartesius, Renatus, the Latinized form of René Descartes (1596-1650), French philosopher, who tried to achieve mathematical certitude in metaphysical demonstrations and whose philosophy was a reaction from scholastic subtleties.

Caspary, Charles J. (1850-1917), American druggist, professor at the Maryland College of Pharmacy and for 15 years general secretary of the Amer. Pharm. Asso. See E. F. Kelly: Amer. Journ. Pharm. 89:565, 1917.

Cassebeer, George A. (1817-1895), German-born and educated druggist of New York. See Amer. Drug. and Pharm. Rec. 27:124, 1895.

Cassiodorus, Marcus Aurelius (490-585), a learned Roman who in his capacity as chancellor of the Ostrogothic King Theodoric, q. v., in Ravenna tried to protect the remnants of Greco-Roman culture from being destroyed or lost.

Castle, Frederick A. (died 1884), New York physician, editor, and lecturer on pharmacology in Bellevue Hospital Medical College.

Cataplasna, Greek kataplassein, to spread over.

Catelan, Laurent, apothecary and lecturer at the University of Montpellier (16th and early 17th century). See J. A. Haefliger: Das Apothekenwesen Basels, Mittenwald, 1938, p. 52.

Catesby, Mark (1679-1749), English naturalist and artist, who after ten years of traveling in Southern North America and the Bahama Islands wrote the books: The Natural History of Carolina, Florida and the Bahama Islands and Hortus Britanniae Americanus. See Dictionary of American Biography, III, p. 571.

Cautery. A burning or searing, as of morbid flesh, with a hot iron or a caustic.

Caventou, Joseph Bienaimé (1795-1877), French pharmacist and one of the earliest and most successful investigators of alkaloids. In collaboration with Pelletier, q. v., he discovered strychnine in 1818, brucine and simultaneously with Meissner, veratrine in 1819, quinine and cinchonine in 1820. He coined the name chlorophyll (from Greek chloroś = light green and phyllon = leaf) for the green pigment of plants. Among his many publications there was a textbook on pharmacy (Traité élémentaire de pharmacie téorique). See Amer. Journ. Pharm. 49:384, 1877.

Chapman, William Barker (1813-1874), Ph. G. and M. D., druggist in Cincinnati and professor of pharmacy in the Cincinnati College of Pharmacy. See Amer. Journ. Pharm. 46:544, 1874; Drug. Circ. 51:82, 1907.

Chaptal, Jean Antoine Claude, Count of Chanteloup (1756-1832), French physician and chemist. His major field was chemical technology.

Charas, Moise, French apothecary (1618-1698). His Pharmacopée Royale Galenique et Chymique, was published in 1672. During a century it passed through several editions in French. It was also translated into English and Latin. Charas wrote several other treatises: two of them, one about treacle and the other about China bark and its

preparation and employment, received much attention.

Charon. The man who according to Greek mythology ferried the souls of the dead over the mythical river Styx which separated the earth from the underworld. He was said to know all mysteries, among them those of the art of healing.

Chaucer, Geoffrey (1340-1400). Chaucer is considered the creator of modern English and the father of English poetry.

Chemist. An individual versed in chemistry. The derivation is not undisputed. The word is assumed to have as its root either the Arabic Al-kimia, or the ancient name of the Egyptian country, Kemi, or the late Greek chymeia. The use of the word chemist as a designation for pharmaceutical practitioners is restricted primarily to the Anglo-Saxon world and in the combination chemist and druggist (see Druggist) has become general since the early 19th century. After the World War the chemists proper attempted to deprive the pharmaceutical practitioners of their legal title. Attempts to introduce the designation pharmacist in place of chemist were not altogether successful. The designation chemist's shop is common in England.

Chemist and Druggist. See Titles.

Chemistry, History of. The study of pharmaceutical chemistry cannot be separated from that of chemistry as a whole. When Paracelsus, (See Iatrochemical Period) taught that the work of the chemist was not to seek the transmutation of the baser metals into gold, but the preparation of medicaments, he expounded pharmaceutical chemistry as we now understand it. Moreover, the preparation of tinctures and extracts, of spirits and waters was supposed to involve chemical operations. These preparations were by him not placed in the same class with our galenicals (his powders, electuaries, ointments, etc.). It was toward the end of the 19th century that Ernst Schmidt in his Ausfuehrliches Lehrbuch der pharmaceutischen Chemie defined Pharmaceutical Chemistry as chemistry taught pharmacy students.

Chemical historians (See Gmelin, Kopp, E. v. Meyer, etc.) commonly classify the history of chemistry into four or five periods in the table appended.

The period of antiquity is commonly characterized by a tendency to speculate (See Elements, Four) and a disinclination to experiment. However, the ancients learned to make glass, to ferment grape juice to wine and the latter to vinegar, to make perfumes (oleum rosatum, q.v.), to tan leather, etc., etc.

During the middle ages, the general theory of transmutation, based on the four elements, was supplemented by a special theory of the transmutation of the metals. This supplementary theory, based on observations, gained dominance and assumed fanciful proportions particularly in the Christian Western World. This theory was regarded as the basis on which alchemy rested. However, al chemi means the chemistry and its Arabic devotees accomplished much that must be recorded to their credit. It is known that neither Rhazes, q.v., nor Avicenna, q.v., believed in the fanciful conceptions of the Christian alchemists. The Arabic alchemists developed the art of distillation which resulted in the preparation of medicinal waters and spirits and later in the manufacture of volatile oils. Although recent researches have demonstrated that the Latin manu-

General History			*History of Chemistry*	
Antiquity		From the dawn of history to the downfall of the West Roman Empire	Antiquity	
Middle or Dark Ages		From the downfall of the West Roman Empire to the Renaissance	Alchemistic Period	
Modern Period	"Neue Geschichte"	From the Renaissance to the French Revolution	Qualitative Period	Iatrochemical Period Phlogistic Period
	"Neueste Geschichte"	From the French Revolution to the present	Quantitative Period	

scripts, formerly attributed to Geber, q.v., a mysterious alchemist of the 9th century, were written during the 13th century, sufficient chemical accomplishments remain to their credit to justify the statement that the Arabic alchemists, unlike their Christian contemporaries, were true scientists.

When we delimit the alchemistic period of chemical history this should not be regarded as implying that alchemistic speculation was not indulged in both before and after the dates of its delimitation. The history of alchemy is practically co-extensive with that of chemistry.

As already indicated, Paracelsus, q.v., became the founder of what is commonly called iatrochemistry (iatros, physician) or medical chemistry, but which in part should be regarded as pharmaceutical chemistry. While he did not drop the older four elements nor disbelieve in transmutation based on those elements, he considered all substances "made up of the three chemical principles Mercury, Sulphur and Salt (See Elements, Three) and the processes in nature which effect changes in the forms of matter similar in character to changes which may be produced in the laboratory of the chemist." (T. M. Stillman, Paracelsus, p. 37.) This he held true of the reactions which take place within the human body. Thus disease came about through a disturbance in the body chemistry, hence remedies were applied to reestablish the equilibrium. Hence, also, the principal duty of the chemist was to prepare these chemical remedies. This revolutionary teaching, in the course of time, split the medical faculties into two camps: the older galenists and the newer iatrochemists, the school of which was founded by Fr. de le Boe Sylvius, q.v. This split in the medical camp is reflected in the early pharmacopoeias (See p. 34 of Husemann's introduction to the reprint of the Pharmacopoeia Augustana.) Gradually, however, the iatrochemists gained ground and it is, no doubt, because of this development that the pharmaceutical practitioner of Great Britain assumed the title chemist, q.v., or chemist and druggist, q.v.

According to Paracelsus, sulphur represented the principle of combustion: "Was da brennt ist der Sulfur, nichts brennt es sei den Sulfur." The chemical similarity between combustion and respiration having been recognized, this led to an intensification of the study of the phenomenon of combustion during the second half of the qualitative period. The phlogiston of Becher, q.v. and Stahl, q.v., was not only that which was combustible (charcoal was rich in phlogiston, sulphur came even nearer being pure phlogiston and when hydrogen was isolated it was regarded as the purest manifestation of phlogiston. Both volatile and fatty oils, also resins, were regarded as being rich in phlogiston) but also that which gave to metals their metallic lustre and other metallic properties. As a result mercury was regarded as mercury calx plus phlogiston. Iron ore (the oxide) was regarded as simpler than iron which was produced from the ore by adding phlogiston when the ore was heated with coal which was rich in phlogiston. Chlorine was named by Scheele dephlogisticated marine acid air, our HCl minus H which was the purest phlogiston attainable. The isolation and study of oxygen, the life air of Priestley, q.v., the fire air of Scheele, q.v., at the close of the 18th century led to the overthrow of the phlogistic theory yet both Priestley and Scheele died still believing in phlogiston.

It was Lavoisier, q.v., who repeated the experiments of his phlogistonist predecessors, and who demonstrated the fallacy of the phlogistic theory. Making use of the balance he demonstrated in a classic experiment that mercury calx, i.e., the oxide, was the more complex body consisting of mercury and oxygen, the elementary substances. Hence, the last period of chemical history began with this chemical revolution, contemporary with the French Revolution, and became known as the Quantitative Period.

The chemistry of Lavoisier became the chemistry of oxygen: the oxides of the non-metals were the acids (P_2O_5 and P_2O_3, SO_2 and SO_3, CO_2, etc.) hence the name oxygen or acid former; the oxides of the metals were the bases, the former calxes (calx or CaO, mercury calx or HgO, etc.) Thus it became apparent at once how unfortunate was the coining of the word oxygen since it was not only the acid former, but the base former as well. According to Rouelle, q.v., the teacher of Lavoisier, a salt was the product of the union of an acid with a base. Thus gypsum became regarded as CaO, SO_3, i.e., sulphate of lime, not sulphate of calcium as now designated.

How the discovery of chlorine in 1774 by Scheele, of iodine in 1812 by Courtois, q.v., and of bromine in 1826 by

Balard, q.v., and the recognition of their elemental character led Berzelius to coin the word halogen (salt former), and how the hydrogen theory of acids developed may be read in greater detail in any history of chemistry.

Likewise, how organic chemistry, leaning on inorganic chemistry, developed its theory of organic acids (citric, tartaric, etc., i.e., oxides of negative radicals); organic bases (first Sertürner's, q.v., plant bases, see alkaloids, later Liebig's oxides of positive radicals, the hydrates of which were our alcohols); and ethereal salts, our esters, is given detailed treatment in all historical chemical texts (E. v. Meyer, etc.).

For the overthrow of the equivalent theory and the general adoption of Dalton's atomic theory as applied to carbon compounds by Cannizaro's revival of Avogadro's hypothesis the reader will also have to be referred to historical texts. This also holds true of Kekule's structural theories and the revolution they brought about in organic chemistry.

The remarkable development of physical chemistry is so recent as to bring its history into our own time.

China. A country in Eastern Asia with an old and very early highly developed culture. The Chinese Era dates from 2697 B. C., when, according to tradition, the present system of sixty-year cycles was established. As to ancient Chinese medicine and pharmacy see the chapters China or Chinese in H. Schelenz: Geschichte der Pharmazie, Berlin, 1904; I. Berendes: Die Pharmazie bei den alten Kulturvölkern, Halle, 1891; Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910, 1, Part 2. Furthermore see W. R. Morse, Chinese Medicine, New York, 1934; Wong Ch. and Wu, L.: History of Chinese Medicine, Chicago, 1936; K. L. Kaufman, A Chronology of Some Events of Pharmaceutical Interest in Ancient China and Japan, Journ. Amer. Pharm. Asso., **28**:544, 1939. I. Cameron and K. K. Chen, The Old and the New Pharmacy in China, Pharm. Journ. **114**:633, 1925.

Chovet, Abraham (1704-1790), English-born physician, who practised medicine and lectured on anatomy in Philadelphia. See Amer. Journ. Pharm., **76**:8, 1904; Dictionary Amer. Biography, **IV**, p. 95.

Christensen, H. C. (1865-). See Journ. Amer. Pharm. Asso., **19**:315, 1930.

Christian Saints as Patrons of Pharmacy. In the early Middle Ages the pagan deities to whom medicine and pharmacy, etc., were attributed, were gradually replaced within the Christian countries by Christian Saints, chosen as patrons by the local guilds of physicians and, in the 13th century, of apothecaries, spicers. etc. Most frequently we meet Cosmas, q.v., and Damian, q.v., as Saint patrons of the healing arts. Then follow in frequency the Holy Virgin and Mary Magdalene, the latter because she oiled the feet of the Savior with fragrant oil (a pharmaceutical preparation!). We know that in 1345 the English apothecaries were joined with the pepperers in the Fraternity of St. Anthony. Naturally the custom of Saint Patrons remained after the time of the reformation primarily with the Catholic countries. M. Bouvet gives a comprehensive list of such patrons chosen by the apothecaries in the various parts of France. He names the Saints Nicolas, Luke, Michael, Marcus, Rochus, besides naturally Cosmas, Damian, the Holy Virgin and Mary Magdalene. (M. Bouvet, Histoire de la Pharmacie en France, Paris 1937, p. 259-261.)

Christison, Sir Robert (1797-1882), English physician. Besides his Dispensatory, which he wrote to replace the antiquated Duncan's New Edinburgh Dispensatory, he published a Treatise on Poisons which was well received. See Pharm. Journ., **41**:659, 1882; Dictionary of National (English) Biography, **X**, p. 290.

Church, Benjamin (1734-1776), prominent American practitioner and the first medical director of the Revolutionary Army in 1775. He was found to be guilty of holding criminal correspondence with the enemy, was first imprisoned and in 1776 given permission to visit the West Indies. The vessel was never heard from. See L. C. Duncan: Medical Men in the American Revolution, Carlisle, 1931, p. 61; Dictionary of American Biography, **IV**, p. 100.

Circumforaneus, pl.-i. See **pharmacopolae circumforaneae.**

Clayton, John (1685-1774), English-born physician and botanist, living in Virginia. See Amer. Journ. Pharm., **80**:417, 1908; Dictionary of American Biography, **IV**, p. 184.

Clyster (also ibis or enema). A liquid injected into the lower intestine (from the Greek word Klyzein=wash off or out). According to Pliny the Egyptians

learned the use of clysters from the bird Ibis which was said to inject water into the bowel with its beak. Clysters have been generally used during antiquity as well as in modern times. See Friedenwald and Morrison: The History of Enema, in Bull. Hist. Med., **8**:68, 1940. Of special interest to modern pharmacy is the clyster episode in France immortalized by Molière in his Le malade imaginaire. For a sarcastic account of this chapter of French pharmaceutical history see Phillipe: Histoire des apothicaires, Paris, 1853, pp. 99 ff., 328; or Phillipe and Ludwig: Geschichte der Apotheker, Jena, 1855, pp. 119 ff., 923.

Coblentz, Virgil (1862-1932) American druggist, later on professor at the New York College of Pharmacy and one of the American pharmaceutical teachers who supplemented their education at German universities. See Journ. Amer. Pharm. Asso., **21**:425, 1932.

Cochran, John (1731-1807), American physician of Scotch descent. He was the last medical Director General of the Revolutionary Army. See L. C. Duncan, Medical Men in the American Revolution, Carlisle, 1931, p. 345; Dictionary of American Biography, **IV**, p. 251.

Codex. See Pharmacopoeia.

Codigo. See Pharmacopoeia.

Coggeshall, George D. (1809-1891), druggist in New York and one of the original members of the New York College of Pharmacy as well as of the Amer. Pharm. Asso. See J. W. England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 127; Proc. Amer. Pharm. Asso., 40:18, 1892.

Colden, Cadwallader (1688-1776) Scotch-born physician and botanist, who practised medicine first in Philadelphia and later in New York. He collected some hundred American plants for Linné. See Amer. Journ. Pharm., **80**:419, 1908; Pharm. Rundsch., **4**:121, 1886; Dictionary of American Biography, **IV**, p. 286.

Colin, Sébastian. See Lisset-Benancio.

Collyria, Greek kollyrian, poultice or eye salve, used as designation for medicated applications for the eyes, usually eyewaters.

Colombo, Cristoforo. See Columbus.

Colón, Cristobal. See Columbus.

Columbus, Christopher or Colombo, Cristoforo (Italian) or Colón, Cristobal (Spanish), Genoese navigator who in the service of the crown of Spain in 1492 discovered America (1446-1506). Of the legion of books describing the life story of Columbus that of Charles Duff, The Truth about Columbus and the Discovery of America, New York, 1936, is one of the most recent and interesting.

Compendium Pharmaceuticum Le Coste. A formulary, compiled for the French forces in North America by Jean François Coste, chief physician of Rochambeau's French Expeditionary Forces in the American Revolution, printed in Newport in 1780. Republished in facsimile by John E. Lane in the Bulletin of the Society of Medical History of Chicago, **45**:214, 1930. For an account of Coste's life see the same author, Americana, **22**:51, 1928, reprinted in Military Surgeon, 63:219.

Composita, from the Latin compositus (made up of parts), i.e., composite substance. In the system of humoralpathology, q.v., in its Galenic form composita are drugs with compound or composite effect in contrast to simplicia exerting only the simple effects of warmth or cold or moisture or dryness. Pharmaceutically composita were preparations and simplicia, q.v., the generic term for simple drugs used unmixed or for making the composita. It became customary to divide the pharmacopoeias into two groups, the one giving directions for making the composita, the other a list of simplicia. In the first official German pharmacopoeia, the Dispensatorium Pharmacopolarum of Valerius Cordus (1546) the simplicia which the author thought required an explanation were explained in connection with the formula for the preparation in which they are used. There are however, separate indices, viz., an Index Compositorum and an Index Simplicium.

Concordantia. See Pharmacopoeia.

Concordia. See Pharmacopoeia.

Condict, Lewis (1773-1862), New Jersey physician and for 9 terms representative to Congress.

Confectionarius, pl.-i, from confectio, that which is prepared (con and facere, to make) and -arius, pertaining to, i.e., a maker, in this case, of remedies or medicaments. The term appears in the edict of Frederick II of 1240, q.v., compare pharmakopoeos and medicamentarius.

Confectio(nes). Lat. conficio, -ere, -feci, -fectum, literally anything that is made.

(Our word factory, derived from facio, facere, feci, factum, implies a place where things are made.) In a more restricted sense the term confection was used to designate certain preparations made by the apothecary in his "officin" (from opus, work, and facere, to make) more particularly to Confectiones proper, q.v.; to Conservae, q.v.; to Species and Pulveres, q.v.; and to Morsuli, Tabulae, and Rotulae, q.v. According to modern English usage, the use of the word confection is still more restricted to what are commonly called candies and similar wares sold in a confectionery. (Compare Confectionarius.) See L. Winkler, Dispensatorium des Valerius Cordus Mittenwald, 1934, p. 13. For Confectiones proper see Electuaries.

Conservae. From Latin con-servo, avi, atum., to keep in existence, to preserve. One of the oldest modes of administration. Trommsdorff (See Konserven in Wörterbuch) points out that they were subject to deterioration—the very opposite of the property implied in the name and hence were discontinued. Compare Confectiones.

Constantinus Africanus, (1020-1087), the first to translate on a large scale Greco-Arabic works, particularly Arabic works, based on Galen or the Hippocratean Corpus into Latin. He is said to have been a North African Christian monk before coming to Salerno. The last years of his life he resided in the cloister at Monte Cassino. See J. J. Walsh: Old-Time Makers of Medicine, New York, 1911, p. 163; Louis Figuier: Vies des Savants Illustres Du Moyen Age, Paris, 1867, p. 103.

Cook, E. Fullerton (1879-), professor at the Philadelphia College of Pharmacy. His name is closely associated with Remington's Practice of Pharmacy, the U. S. Dispensatory and the U. S. Pharmacopoeia revision work. See England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 491.

Cordus, Valerius (1515-1544), German physician. The Dispensatorium, which made his name famous, was compiled at the suggestion of the apothecary Johannes Ralla, his uncle. In the laboratory of the apothecary shop of Ralla, Cordus experimented with the distillation of etheral oils. The results of these studies are not published in the Dispensatorium Valerii Cordi but in the writings which Conrad Gessner, q.v., published after the death of the author. In one of these papers De Artificiosis Extractionibus the first known formula for the preparation of ether has been given. See Ludwig Winkler: Dispensatorium des Valerius Cordus, Gesellschaft für Geschichte der Pharmazie. Mittenwald, 1934.

Corvisat, Jean-Nicholas (1755-1821). Physician in ordinary to the French Emperor Napoleon I and academic teacher in Paris. See Garrison: History of Medicine, Philadelphia, 1929, p. 414; Sigerist: The Great Doctors, New York, 1933, p. 272.

Cosmas. (died 303 A.D.), Arabic-Christian martyr, who together with his twin brother Damian is said to have given medical and medicinal help gratuitously to all people who needed it. After their martyrdom in 303 A.D. both brothers became the favorite patron saints of medicine and pharmacy in all Christian countries.

Courtois, Bernard (1777-1838), French pharmacist. In 1811 discovered iodine in the ashes of seaweeds. See Chemistry, History of. The name iodine (from the Greek iodes=violet color, ion=a violet) was given to the new element by Davy because of its violet vapor.

Coxe, John Redman (1773-1864), American physician, professor at the University of Pennsylvania and author of the first dispensatory to be published in the United States. Bibliography: See Amer. Journ. Pharm., 36:275, 1864; J. W. England; First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, pp. 44, 60.

Craanen, Theodor (1620-1690), of Dutch birth and pupil of Franz de le Boe Sylvius, q.v. He lived as physician in ordinary to the elector of Brandenburg in Berlin.

Craigie, Andrew (1743-1819). Apothecary general and chief apothecary during the Revolutionary War and wholesale druggist afterwards. See L. F. Kebler: Journ. Amer. Pharm. Asso., 17:63, 167, 1928; Dictionary of American Biography, IV, p. 497.

Croll, Oswald (1560-1609), German physician and one of the foremost followers of Paracelsus, q.v. His principal work Basilica Chymica contains numerous formulas for inorganic chemical remedies.

Cullen, William (1710-1790), Scotch physician and academic teacher of medicine and chemistry in Glasgow and Edinburgh. He introduced hydrotherapy with rapid changes of tempera-

ture into medical practice. See Garrison: History of medicine, Philadelphia, 1929, p. 357; Sigerist: The Great Doctors, New York, 1933, p. 199.

Cuming, Fortescue (1762-1828), Irish traveler, naturalist, and writer. See Dictionary of American Biography, **IV,** p. 592; Thwaites: Early Western Travels, Cleveland, 1904-1907, vol. 4. Cuming's Tour to the Western Country.

Curtman, Charles O. (1829-1896), German-born American pharmacist, during the Civil War director of the laboratories for manufacturing gun powder and other products for the Confederate Army, professor of chemistry in the St. Louis College of Pharmacy, author of textbooks on analytical chemistry. See Amer. Journ. Pharm, **68**:351, 1896.

Cutbush, Edward (1772-1843), physician, chief surgeon of the U. S. Navy, after 1829 professor of chemistry at Geneva College, Geneva, N. Y. See Kelly and Burrage: American Medical Biographies, 1920, p. 272.

Cutbush, James (1788-1823), Philadelphia apothecary and chemist. He was the first president of the Columbian Chemical Society, founded in 1811, professor of chemistry in St. John's College, Philadelphia, and later at West Point. See Dictionary of American Biography, **V,** p. 10.

Cutler, Manasseh (1742-1823), American clergyman and botanist. See Lloyd Libr., Reprod. Ser. No. 4, 1903; Dictionary of American Biography, **V,** p. 12.

D

Dalton, John (1766-1844), English physicist. He enunciated the law of definite and multiple proportions, commonly called Dalton's Law (1807) and formulated the old philosophical concept of atomism into a scientific theory (1803-1807). See Chemistry, History of. See Encyclopedia Britannica, **VII,** 1910, p. 777.

Damian (died 303 A.D.), Arabic-Christian martyr and patron saint of medicine and pharmacy. See Cosmas.

Davis, William (17 Century), Apothecary in Boston. See Bull. Mass. Coll. Pharm., **III,** p. 39, No. 4, 1914.

Davy, Sir Humphry (1778-1829), one of the greatest English chemists. He was the founder of electrochemistry. It was by "the electrochemical decomposition of the fixed alkalies" that Davy isolated potassium and sodium in 1807 and calcium, barium, strontium, magnesium in 1808. See Encyclopedia Britannica, **VII,** 1910, p. 871.

Dealers in drugs. During antiquity and up to the European Middle Ages the following designations of dealers in drugs were in use:—

Urma, the priest-apothecary of Egypt.

In Greek literature the following terms are found: migmatopolos, myropoeoi, myrepsoi, pharmacopoeoi, pharmacopoloi and rhizotomoi.

In Rome the following terms were used: circumforaneae, pharmacopoei, pharmacotribae, pharmacotritae, pharmacopolae, pigmentarii, sellularii, seplasiarii and unguentarii.

During the Middle Ages the following terms were coined:—apothecarius, aromatarius, herbarius and its modifications, speciarius and its modifications, and stationarius.

Most of the modern designations are derived from two Greek words, pharmakon or apotheke. From the former the French pharmacien, the English pharmacist and pharmaceutist, and the German pharmaceut and pharmazeut are derived. From the latter the French apothicaire, the English apothecary and the German apotheker, also the corresponding terms with slightly modified spelling in other Germanic languages. With the advent of the iatrochemical school, the terms chemist and later pharmaceutical chemist came into use. Lastly, the terms druggist, French droguiste, German Droguist and Drogist should be mentioned. Possibly the laboranten and olitätenhändler, peddlers of medicaments should not be omitted in this connection.

For details look up each term.

DeButts, Elisha (1773-1831), Irish-born physician, physiologist, a founder of the University of Maryland School of Medicine and professor of chemistry at the Maryland College of Medicine. See Kelly and Burrage, American Medical Biographies, 1920, p. 301.

Decoction. From Latin decoctus, boiled down; one of the earliest modes of administration.

Defectar. See Personnel.

Defectarius. See Personnel.

Defectuar. See Personnel.

Degrees in American Pharmacy. Bachelor of Pharmacy; Bachelor of Science (in Pharmacy, Pharmacy Course); Doctor of Pharmacy; Doctor of Philosophy (with Pharmacy, Pharmacognosy, Pharmaceutical Chemistry, etc., as major); Graduate in Pharmacy; Master of

Pharmacy; Master of Science (Pharmacy, etc.); Pharmaceutical Chemist.

Deities or deified persons to whom medicine, etc., is attributed.

1. Egyptian: Thoth, Osiris, Isis, Horus, Imhotep, Anepu (Anubis).

2. Greek: Apollo, Hephaistos, Herakles, Prometheus, Asklepios, Hygeia, Charon.

For replacement of these pagan deities by Christian saints see Christian Saints as Patrons of Pharmacy.

Demachy, Jean François (1728-1803), French apothecary. Besides his Manuel de pharmacien he wrote several books about industrial pharmaceutical and chemical technique, among them one concerning the preparation of liquors.

Derosne, Charles Louis (1780-1846), French pharmacist. As early as 1803, Derosne prepared opium alkaloids without, however, isolating the individual ones and recognizing their alkaline nature.

Descartes, René. See Cartesius.

Dia-preparations, i.e., preparations designated by putting the word dia before the main constituent of the compounded medicine or "confectio," q.v., concerned. Thus the most important constituent of Diasenna Nicolai was senna.

Diehl, C. Lewis (1840-1917), German-born American pharmacist. Diehl was active in almost all branches of pharmacy, as owner of a drugstore in Louisville, as professor of pharmacy at the Louisville College of Pharmacy, in pharmaceutical industry and as a contributor to pharmaceutical literature. His reports on the progress of pharmacy in the Proceedings of the Amer. Pharm. Asso. offered an all-around survey of great value. See England, First Century Philadelphia College of Pharmacy, Philadelphia, 1922, p. 217; Journ. Amer. Pharm. Asso., 6:423, 1917.

Digby (Digbi), Sir Kenelm (1603-1665). He was secretary of the navy under the English Kings Charles I and II and left comprehensive collections of secret formulas which were published after his death. See Wootton, Chronicles of Pharmacy, London, 1910, I, p. 193; Dictionary (English) National Biography, XV, p. 60.

Diocletian (about 300 A.D.), Roman Emperor, who tried to extinguish Christian faith by brutal persecution of the Christians.

Dioscorides, Greek physician and botanist (1st century, A.D.), author of "peri hylé," latinized materia medica, which for 1500 years was one of the standard works on medicine, pharmacy, and botany. See Berendes: Des Pedanios Dioskurides aus Anazarbos Arzneimittellehre, Stuttgart, 1902; Louis Figuier: Vie des savants illustres, Paris, 1866, I, p. 347; Wootton Chronicles of Pharmacy, London, 1910, I, p. 206; C. J. S. Thompson: The Mystery and Art of the apothecary, London, 1929, p. 130.

Dippel, Johann Conrad (1673-1734), German chemist, physician, and mystic. He introduced the so-called Dippel's Oil or Oleum empyreumaticum animale, i.e., an oil obtained by the distillation of bones and other animal matter, into therapy. He also discovered Berlin or Prussian blue (Ferric Ferro-cyanide) in 1710.

Dispensary. The room or place where articles are dispensed. In pharmaceutical practice we refer to the dispensary of a hospital, of a physician, or a factory, etc. Contrast with Medicine Chest, q.v., or Medicine Cabinet. However, it also finds non-pharmaceutical application, e.g., Milk Dispensary, etc.

Dispensatorium. From dispensare, to dispense. As a title for a book of formulas, etc. (directions for the making of preparations) it was employed before the designation pharmacopoeia had come into use. Thus we refer to the dispensatory of Valerius Cordus, q. v., or the Nürnberg Pharmacopoeia. The English dispensatories of the 17th century and later were for the most part commentaries on the London, etc., pharmacopoeias and expanded to more or less comprehensive reference books. This usage has become common in the U. S. See e.g., Coxe's Dispensatory, the U. S. Dispensatory, the American Dispensatory, the National Dispensatory. Compare Pharmacopoeia.

Dispensatory. See Dispensatorium.

Dispensing Lady. See Personnel.

Dispensor. See Personnel.

Distillation Apparatus. See Gildemeister-Hoffmann-Kremers: The Volatile Oils, Milwaukee, 1900, p. 51-82; H. Schelenz; Zur Geschichte der Pharmazeutisch chemischen Destilliergeräte, 1911.

Doctor of Pharmacy. See Degrees.

Doctor of Philosophy (Pharmacy). See Degrees.

Döbereiner, Johann Wolfgang (1780-1849), German apothecary and professor of chemistry at Jena. He discovered the

catalytic effect of platinum and used it in converting alcohol into acetic acid (1821) and into acetaldehyde (1832) previously discovered by him in 1821. Finally he converted by the same means H_2SO_3 into H_2SO_4. He produced formic acid by treating manganese with acetic acid and prepared synthetically methyl-alcohol. By his so-called theory of triads (1829), based on his discovery that there are groups of three elements in which the atomic weight of the one is the mean of those of the other two, Döbereiner became one of the forerunners of the periodic system.

Dohme, A. R. L. (1867-). Son of Charles Dohme, a graduate of Johns Hopkins University and a student at Berlin and Strassburg Universities and finally with Fresenius of Wiesbaden. He succeeded his uncle, Louis, as president of Sharp & Dohme until this firm and that of Mulford & Co. were merged (1911-1929). Author of numerous papers on pharmaceutical subjects. See Who's Who in America, **21**, p. 784.

Dohme, Charles E. (1843-1911), German-born American druggist and pharmaceutical manufacturer. See Pharmaceutical Era, **45**:40, 1912; Journ. Amer. Pharm. Asso., **1**:82, 1912.

Doliber, Ph. (1836-1912), druggist in Boston and president of the Mellin's Food Company. See Journ. Amer. Pharm. Asso., **1**:777, 1912.

Dônnolo, Italian cognomen of the Jewish physician Sabbaitai ben Abraham (913-970), meaning little lord.

Dorvault, François Laurent Marie (1815-1879), French apothecary and writer on pharmaceutical subjects. He not only organized the Pharmacie Centrale de France, q.v., but edited "L'Officine, Répertoire général de Pharmacie pratique" which has been published up to the present time in many editions and had become the French standard work on practical pharmacie.

Douglass, William (1691-1752), a Scotch-born and educated American physician, practising in Boston, with wide interests in natural history and economics. See George H. Weaver: The Life and Writings of William Douglass, Bull. Soc. Med. Hist., Chicago, **2**:229, 1921; Dictionary of American Biography, **V**, p. 407.

Dow, Cora M. (1871-), Cincinnati druggist. See Pharm. Era **43**:489, 1910.

Drogist, German for druggist (see also Droguist). A sort of second-class apothecary established in Germany in the second half of the 19th century. Also used as title for books and journals.

Drogistenverband. Name of a German organization, of "Drogisten" q.v.

Droguist, German for druggist. See also Drogist.

Droguiste, French for druggist, a sort of third-class pharmaceutical practitioner discontinued in the 20th century.

Drug. French drogue, German Droge. In its restricted sense the word has been used to designate so-called "crude" drugs of mineral, vegetable, or animal origin in contrast with galenical preparations or chemicals. In its wider sense as defined in state and national laws, the term has been made to include all of these and more. Its derivation is in doubt. Formerly it was regarded as being derived from the Dutch verb droog, to dry, i.e., a product of either vegetable or animal origin preserved by drying (German Pflanzendrogen, Medizinaldrogen as contrasted with vegetables dried for culinary purposes.) C. F. Seybold in Zeitschr. für Deutsche Wortforschung **10**:218, 1908 traces it back to the Arabic dowa, a remedy. According to W. V. Richtmann: Etymological derivation of the word drug, Hist. Sect. Amer. Pharm. Asso., 1918. (Manuscript in the Library of the School of Pharmacy, University of Wisconsin), "It would appear that the word has come to us from the Arabic, through the Romanic languages, rather than from some one of the more modern languages direct; and that it had a broad and general meaning, rather than a restricted one."

Drug Miller. Compare rhizotomos, the root cutter of the Greeks.

Druggist. Derived from drug, q. v., dealer in drugs. As Chemist and Druggist the word in 1868 became part of the official designation of the English pharmaceutical practitioners by an act of Parliament requiring all future "chemists and druggists" to pass examination and be registered.

Drugs, Designations of dealers in. See dealers in drugs.

Du Mênil, August Peter Julius (1777-1852), German apothecary, author of many treatises on pharmaceutical and analytical chemistry. He was one of the founders of the Apothekerverein für das Noerdliche Teutschland.

Du Mez, Andrew G. (1885-). He has been active in a series of official and teaching positions and since 1926 dean

of the School of Pharmacy, University of Maryland. Of his numerous publications the Year Book of the Amer. Pharm. Asso., edited by him 1921-1935, and since 1935 the "Pharmaceutical Abstracts" have made him especially well-known. See Journ. Amer. Pharm. Asso., **28**: p. 67, 1939.

Dumas, Jean Baptiste (1800-1884). French pharmacist who received the highest honors in science as well as in the political life of his country. His determinations of the vapor densities of iodine, sulphur, phosphorus, mercury, etc., were of the utmost importance for theoretical chemistry. He determined the chemical formula for methyl alcohol, chloroform, and iodoform and laid the ground for modern chemical structural formulas. He is considered one of the founders of physical chemistry and "one of those great chemical researchers . . . who served as landmarks" (A. W. v. Hofmann in the announcement of Dumas' death before the German Chemical Society). He held the positions of Secretary of Agriculture and Commerce in the French government from 1849 to 1851 and was subsequently a senator. Amer. Journ. Pharm., **56**:351, 1884.

Duncan, Andrew (1744-1828), physician and professor at Edinburgh University. Besides his New Dispensatory Duncan wrote several other books on medicine. Bibliography: See Dictionary of (English) National Biography, **XVI**, p. 161.

Dunning, Henry A. B. (1877-). One of the leaders of the pharmaceutical manufacturing firm Hynson, Westcott & Dunning in Baltimore. See Journ. Amer. Pharm. Asso., **13**:593, 1924; **18**:3, 1929; Who's Who in America, **21**, p. 819.

Durand, Elias (1794-1873), French-born Philadelphia pharmacist. See England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 357; Amer. Journ. Pharm., **45**:432, 509, 1873.

Dusseau, Michel, also called du Seau, French apothecary (16th century). His textbook for pharmaceutical apprentices was used in various editions for more than a century.

Dyott, J. W. (about 1775-1850), English-born druggist of Philadelphia. See Bull. Pharm., **18**:237, 1904.

E

Ebers, Georg. German Egyptologist and novelist (1837-1898). He discovered and described the medicinally important papyrus named after him. Among other historical novels he wrote An Egyptian Princess, mirroring ancient Egyptian life and culture. See Papyrus Ebers.

Ebert, Albert Ethelbert (1840-1906), German-born druggist in Chicago. Ebert belonged to the group of American druggists who studied at German universities and was for a number of years professor of pharmacy at the Chicago College of Pharmacy. He invented the sulphurous process for the manufacture of starch and glucose. His work is commemorated by the Ebert Prize for Scientific Research. Bibliography: See Proc. Amer. Pharm. Asso., **55**:iii, 1907; Drug Circ., **51**:84, 1907.

Eger, George, German-born and educated American pharmacist (1836-1900). See Proc. Amer. Pharm. Asso., **49**:40, 1901.

Egypt. Ancient Egypt is of highest importance in the history of civilization in general and to that of medicine and pharmacy in particular offering the most plentiful documentary evidences of early cultural life to come down to us. Its culture immediately influenced the Greeks and hence European civilization. Ancient Egyptian history is divided into periods as follows:

A. Native Dynasties:

I. The Old Empire: Dynasties 3 to 6: 2800 to 2500 B.C., with Memphis as capital. The Great Sphinx and the pyramids date back to this period.

II. The Middle Empire: Dynasties 11 to 13: 2400 to 1700 B.C.; with Thebes the principal upper Egyptian capital.

III. The New Empire: Dynasties 18 to 21: 1600 to 950 B.C., during which Egyptian power and splendor were at their height. Thebes was the capital of the empire. To this period belongs the reign of Rameses II who forced the Hebrews to labor at his extensive building enterprises.

B. Foreign Rule:

IV. The Lybian Epoch: Dynasty 22: 950 to 750 B.C.; The reign of the Ethiopians and Assyrians: Dynasties 23 to 25; 728 to 663 B.C., the beginning of the decay of Egyptian civilization.

V. The Later Period: Dynasties 26 to 31: 663 to 331 B.C., Egypt is conquered by the Persians. As a Persian province it fell into the hands of Alexander the Great in 332 B.C. Alexandria became the center of Greek civilization amidst Egyptian decay. After the battle of Actium (31 B.C.) and the down-fall of Cleopatra, Egypt became a Roman province.

Ehrlich, Paul (1854-1915), German physician and leader of the Institute for Experimental Therapy at Frankfurt on the Main founded especially as a means for his research. He was a pioneer in merging descriptive cellular pathology with experimental intracellular chemistry, and in testing and using the microchemical reaction of the tissues to dye-stuffs. His best known research was the production of Salvarsan (Arsphenamine) which he brought about in collaboration with Hata. See Sigerist: The Great Doctors, New York, 1933, p. 384; Garrison: History of Medicine, Philadelphia, 1929, p. 709.

Electuary. Latin electuarium and electarium, from ecligma (from Greek ek out and leichein to lick.) In classical Latin "a medicine that melts in the mouth." A soft preparation made by mixing powders and other ingredients with a sweet juice, honey, or a solution of sugar. Compare Confectiones. For details see Latwerge in Trommsdorff's Handwöarterbuch. Compare also Diapreparations.

Elements, Three. Paracelsus rejected the four elements of the ancient world as the determining constituent principles of all bodies and substituted therefor his three alchemical elements: Mercury, the principle of liquidity and volatility, Sulphur, the principle of combustibility, and Salt, that principle which is permanent and resists the action of fire. See J. M. Stillman: Paracelsus, p. 33. See also Chemistry, History of.

Elements, four. The four elements of the ancient world, i.e., earth, water, fire, and air, were considered to have a mysterious relation to the four humors of the human body (see humoralpathology), blood being moist and warm like earth, phlegm moist and cold like water, yellow bile warm and dry like fire, and black bile cold and dry like air. See Chemistry, History of.

Elève. See Personnel.

Ellis, Charles (1800-1874), original member of the Philadelphia College of Pharmacy as well as of the Amer. Pharm. Asso., druggist in Philadelphia. See Drug Circ., 51:84, 1907; J. W. England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 355; Proc. Amer. Pharm. Asso., 55:583, 1907.

Embalming. The art of embalming was practiced by several peoples during antiquity, but was carried to perfection by the Egyptians who embalmed not only the human dead, but animals as well. See Tschirch and Reutter: Über bei der Einbalsamierung der Leichen in Eegypten and Carthago benutzte Harze, Archiv der Pharm., 250:170, 1912; L. Reutter: De L'Embaumement chez les anciens, Bulletin de L'Institut National Genevois, Tome XLIII; also the same author, De L'Embaumement avant et après Jesus-Christ. Paris 1912.

Encheiridion. See Pharmacopoeia.

Endicott, John (1588-1665), Colonial governor of Massachusetts. See Dictionary of American Biography, VI, p. 155.

Enema, Greek enjénai, to send in. See Clyster.

Ergänzungsbuch. The German supplement to the Pharmacopoeia. Published by the Deutscher Apotheker Verein. It has semi-official character. Compare National Formulary and the British Extra-Pharmacopoeia.

Errand Boy. See Personnel.

Ether. A hypothetical substance thought to be the product of ferment action on blood and to be responsible for the life processes. See Sylvius, Franciscus de le Boe.

Extra-Pharmacopoeia. An English formulary supplementary to the British Pharmacopoeia. Compare National Formulary and Recipe Book; also the German Ergänzungsbuch.

F

Faraday, Michael, (1794-1867), one of the greatest English physicists. Faraday became famous especially by his discoveries in the field of electricity and magnetism. The terms ion, anion, kation, anode, and cathode were coined by him. He was, however, also an excellent chemist. In 1825 he discovered benzene in the liquid obtained upon compressing illuminating gas, and determined the composition of napthalin. See Amer. Pharm., 39:576, 1867.

Faragut. See Faraj Ibn Salim.

Faraj Ibn Salim, (13th century). Also called Fararius, Ferrarius or Faragut. Salernitan Jewish physician. Master translator of Greco-Arabic medical treatises into Latin. See J. J. Walsh: Old-Time Makers of Medicine, New York, 1911, p. 79.

Fararius. See Faraj Ibn Salim.

Farmacopoea. See Pharmacopoeia.

Farmacopen. See Pharmacopoeia.

Farmacopin. See Pharmacopoeia.

Farmakopo. See Pharmacopoeia.

Farr, John (1791-1847), English-born chemist and founder of the manufacturing firm later known as Powers and Weightman. See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 33.

Fée, Antoine Laurent Apollinaire (1789-1874), French apothecary. He became professor of botany at the University of Strasburg in 1833. Fée published his Cours d'histoire naturelle pharmaceutique in 1828, his famous Commentaires sur la botanique et la matière medicale de Pline comprehending about 1,000 plants mentioned by Pliny, in 1853.

Fehling, Hermann von (1812-1885), German apothecary and physiological chemist. He developed the method for the determination of sugar and starch by means of an alkaline copper sulfate solution in the presence of alkali tartrates, which has been named after him. His discovery of paraldehyde is also noteworthy. See Pharm. Journ., **45**:83, 153, 1885; Amer. Journ. Pharm., **57**:463, 1885.

Felter, H. Wickes (1865-1927), physician, professor at the Eclectic Medical College, author, historian. See Lloyd Libr., Bull. No. 19, 4 (1912), p. V.

Ferrand, Claude-Henry (1740-?), French pharmacien en chef with the French auxiliary corps in the American Revolutionary War. See A. Balland: Les Pharmaciens Militaires Français, Paris, 1913, p. 89.

Ferrarius, See Faraj Ibn Salim.

Firmin, Giles, Jr. (1614 or 1615-1697). Giles was born in England, came to Boston first for a brief visit in 1632 and returned 1637 after having studied medicine in England. He is said to have delivered the first anatomical lectures to students in this country. Later on he returned to England, where he entered the ministry.

Fischelis, Robert P. (1891-), pharmaceutical teacher, editor, writer and for a time executive secretary of the Board of Pharmacy of the State of New Jersey. See Journ. Amer. Pharm. Asso., **23**:85, 1934.

Flueckiger, Friedrich August (1828-1894). Swiss apothecary and professor of pharmacy at the University of Strasburg. He is the first of modern pharmacognosists and wrote fundamental books on this subject. He also contributed important articles on the history of pharmacy. See Haefliger: Fr. A. Flueckiger, Gesellschaft für Geschichte der Pharmazie; Mittenwald, 1928, N. Y. Pharm. Rundschau **10**:107, 1892; Fr. Hoffmann: Amer. Journ. Pharm., **67**:65, 1895; Pharm. Journ., **54**:538, 1894.

Foesius, Anutius (1528-1595), French physician living in Metz (Lorraine). His unlatinized name was Foès. His Pharmacopoeia Mediomatrica (pharmacopoeia of Metz) was widely used.

Forms of administration. See Modes of administration.

Formularium. See Pharmacopoeia.

Fourcroy, Antoine Francois, Count of (1755-1809), French physician and chemist. He was a pupil of Vauquelin, q. v., with him he worked intimately. He analyzed many medicinal chemicals and chemical medicines. See Encyclopaedia Britannica, **11**:751.

Fowler, Thomas (1736-1801), English apothecary and physician. See Wootton: Chronicles of Pharmacy, London, 1910, **II**, p. 133.

Fownes, George (1815-1849), English apothecary and chemist. His Manual of Elementary Chemistry (1845) was widely used. See Ferchl: Chemisch-Pharmazeutisches Bio-und Bibliographicon, Mittenwald, 1937, p. 162.

Frank, Adolf (1834-1916), German apothecary and one of the most versatile inventors and organizers in industrial chemistry and technology.

Franklin, Benjamin (1706-1790), American philosopher, physicist, and statesman. See Dictionary of American Biography, **VI**, p. 585.

Frederick II (The Great), King of Prussia, (1712-1786). The most talented prince of the House of Hohenzollern. He was considered the most learned and enlightened sovereign of his time.

Frederick II, the Hohenstaufen, German Emperor and King of Southern Italy and Sicily (1194-1250). See law of Frederick II, concerning the separation of medicine and pharmacy.

Fuchs, Leonhart (1501-1566), physician and botanist. He was the most learned of the contemporary authors of herbals and besides his New Kreuterbuch (1543) wrote many other treatises. His edition of the Antidotarium of the Byzantine physician Nicolaus Myrepsus, q. v., with notes is of special pharmaceutical interest. Bibliography: See Annual Report of the Smithsonian Institution, 1917; Eberhard Stübler; Leonhart Fuchs, Leben und Werk, Munich, 1928.

Fuller, Thomas (1654-1734), English physician and author of several books and pamphlets on medical subjects. See

Dictionary of National (English) Biography, **20**, p. 320.

G

Gale, Edwin Oscar (1832-1913), Chicago pharmacist, historian and poet. See Journ. Amer. Pharm. Asso., **2**:283, 1913.

Gardiner, Silvester (1708-1786), American-born physician who studied medicine in London and Paris. He and Douglass, q.v., were the first physicians to be adequately educated in England and then to practise in America, and both exerted a marked influence on American medicine. See Henry R. Viets: Some Features of the History of Medicine in Massachusetts, Isis, **23**: 389, 1935; Dictionary of American Biography, **VII**, p. 139.

Gehlen, Adolph Ferdinand (1775-1815), German apothecary and chemico-pharmaceutical journalist. Having issued chemical journals since 1803 and editing the Neues Berliner Jahrbuch der Pharmacie, 1805-1808, he founded in 1815 the Repertorium für die Pharmacie, q.v., which J. A. Buchner, q.v., continued.

Geiger, Philipp Lorenz (1785-1836), German apothecary and professor of pharmacy at the University of Heidelberg. In 1835 Geiger discovered coniine and in cooperation with Hesse isolated atropine, hyoscyamine, aconitine, and daturine. From 1824-1836 he edited the Magazine der Pharmazie. Among his books the Pharmacopoeia universalis, started by him in 1835 and continued by Friedrich Mohr, was of greatest importance. See G. Urdang; Philipp Lorenz Geiger, Pharmazeutische Zeitung, **74**:1154, 1929.

Geoffroy, Etienne François (1672-1731), French apothecary and member of a family which gave to the world a number of important scientists. His Tractatus de Materia Medica seu de Medicamentorum simplicium historia, virtute, et usu delectu, is considered the first book offering pharmacognosy in a modern sense. With his chemical relationship tables, published first in 1718 in the Memoirs of the Parisian Academy of Science, Geoffroy laid the foundation of the theory of relationship between the chemical elements.

Gerard (Gerarde), John (1545-1612), English surgeon and botanist. Gerard's Catalogus arborum, fructicum ac plantarum (1596) and The herball or general historie of plantes, published in 1597 were highly regarded. The latter was issued in a second and enlarged edition in 1633 by the English apothecary Thomas Johnson, q.v. See Dictionary of (English) National Biography, **XXI**, p. 221.

Gerard of Cremona (1114-1187), master translator of Greco-Arabic manuscripts into Latin. See Louis Figuier, Paris, 1867, Vies des Savants Illustres, p. 106.

Gessner, Conrad, also publishing under the pseudonym Evonymus Philiatrus (1516-1565), Swiss physician and botanist. His main work, Historia Plantarum was not published until 1751-1771, i.e., about 200 years after the death of the author.

Ghina or Ghini, Luca (1500-1556), Italian physician and botanist. He is assumed to be the inventor of the herbarium for the collecting of plants and preservation of the dried pressed mounts.

Glauber, Johann Rudolf (1603-1670), The work of Glauber was of an amazing extent and versatility. He taught the production of nitric acid by treating saltpetre with sulfuric acid, and of hydrochloric acid by treating sodium chloride with sulfuric acid. He produced sodium sulfate (Glauber's salt), ammonium sulfate, zinc chloride, potassium chloride, etc., and developed numerous new methods and techniques.

Glentworth, George (end of the 18th to middle of the 19th century). See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, pp. 56, 107.

Glover, John (1732-1797), American general in the Revolutionary War. See Dictionary of American Biography, **VII**, p. 331.

Glyn-Jones, Sir William (1869-1927), English chemist and druggist, manufacturer, lawyer, and legislator. See Chem. and Drug., **107**:365, 1927; Journ. Amer. Pharm. Asso., **13**:503, 1924; **16**:894, 1927.

Gmelin, Johann Friedrich (1748-1804), German chemist. In addition to many chemical treatises, pharmaceutical and chemical textbooks, etc., he wrote a history of chemistry. He was a member of the Gmelin family which, descending from an apothecary at Tübingen, gave through generations men of importance to pharmacy as well as to the natural sciences at large. See Otto Raubenheimer: Gmelin, a German Family of Pharmacists, Chemists, and Botanists, Journ. Amer. Pharm. Asso., **19**:259, 1930.

Godfrey. See Hanckwitz.

Goethe, Johann Wolfgang von (1749-1832), German poet of highest rank. His ardent interest in science brought him into close contact with several apothecaries who became his teachers in chemistry, botany, mineralogy, and meteorology. It was he who in his capacity as advisor to the Grand Duke of Saxe-Weimar, whose friend and highest official he was, caused the appointment of Döbereiner, q.v., as professor of pharmacy and chemistry at Jena. For the relations of Goethe to pharmacists see George Urdang: Goethe and die Pharmazie, Pharm. Ztg., 77:333, 1932.

Goettling, Johann Friedrich August (1755-1809), German apothecary and professor of chemistry and pharmacy at the University of Jena. He was one of the first chemists in Germany to repeat and confirm the investigations of Lavoisier, q.v., and, therefore, to abandon the phlogiston theory (see Chemistry, history of). In 1780 he started the publication of an annual under the title Almanach oder Taschenbuch für Scheidekuenstler und Apotheker, which was the first periodical to be devoted primarily to the interests of pharmacy.

Gorham, John (1783-1829), physician in Boston, professor of chemistry at Harvard and author of a system of chemistry in two volumes (1819 and 1820). See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 451.

Grahame, J. Israel (1819-1899). He was a druggist first in Baltimore and later in Philadelphia, professor of pharmacy at the Maryland College of Pharmacy and when in Philadelphia the principal of several educational institutions for women. His chief merit lies in his research work on percolation. "He formulated (in 1858) with remarkable precision the general principles of the process, specifying many details that are now universally followed." See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 115; Drug. Circ., 51:85, 1907.

Grazzini, Antonio Francesco, called il Lasca (1503-1584), Italian Apothecary and poet, especially dramatist.

Gren, Friedrich Albert Carl (1760-1798), German apothecary, physician and chemist. He isolated cholesterin from gallstones and wrote in the short time of his life an amazing number of books and pamphlets.

Grew, Nehemiah (1628-1711), English physician. In 1695 he isolated sulfate of magnesia (Epsom salt) from the water of Epsom Spring. Grew wrote botanical as well as chemical treatises.

Griffith, Ivor (1891-), American pharmacist, born in Wales, professor at the Philadelphia College of Pharmacy, and since 1937 dean of this college. See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 443.

Griffith, R. Eglesfield (1797-1850), Philadelphia physician, writer on medical and pharmaceutical subjects, for one year professor at the Philadelphia College of Pharmacy and between 1831 and 1836 editor of the Amer. Journ. Pharm. See Amer. Journ. Pharm., 22:400, 1850.

Griffits, Samuel Powell (1759-1826), physician in Philadelphia, professor of materia medica at the University of Pennsylvania. See Kelly and Burrage: American Medical Biographies, New York, 1920, p. 468.

Guiscard, Robert (died in 1130), son of the Norman count Tancred d'Hauteville, together with his brother Roger conquered the greatest part of Southern Italy and Sicily.

Guthrie, Samuel (1782-1848), American physician. In 1831 he discovered chloroform at the same time as the French pharmacist Soubeiran, q.v., and the German chemist Justus von Liebig, q.v. See "The Centenary of Chloroform." Journ. Amer. Pharm. Asso., 20:482, 1931.

H

Häfliger, Josef Anton (1873-), Swiss apothecary, professor of the history of pharmacy at the University of Basle, creator of the pharmaceutico-historical museum, forming an annex to the Pharmaceutical Institute of the University of Basle and author of numerous pharmaceutico-historical publications.

Hagen, Karl Gottfried (1749-1829), German apothecary and professor of chemistry and physics at the University of Koenigsberg. He was one of the most eminent and progressive teachers of the sciences of pharmacy in his time. His textbooks dominated the field for many decades. See Gottfried Wallrabe: Zum Gedächtnis an Karl Gottfried Hagen. Pharmazeutische Zeitung, 74: 285, 1929.

Hager, Hans Hermann Julius (1816-1897), German apothecary. He wrote commentaries on the German pharmacopoeias appearing during his lifetime and among other treatises the two

which became the most used reference books in the practice of pharmacy: his Manuale pharmaceuticum and his Handbuch der Pharmaceutischen Praxis. The Pharmazeutische Zentralhalle (Centralhalle), founded by Hager in 1859, was for a long time one of the leading scientific pharmaceutical journals in Germany.

Hahnemann, Samuel Christian Friedrich (1755-1843), Physician and chemist, creator of the so-called homeopathy. Of special pharmaceutical interest is the fact that he wrote besides the books concerning his special medical theories an excellent reference book (lexicon) on the art of the apothecary, also several chemical treatises. See Th. L. Bradford: The Life and the Letters of Dr. Samuel Hahnemann, Philadelphia, 1895.

Hallberg, Carl Svante N. (1856-1910), Swedish-born American pharmacist, manufacturer, journalist, and professor of pharmacy in the Chicago College of Pharmacy. See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 195.

Hanbury, Daniel (1825-1875), English apothecary and one of the most eminent modern pharmacognosists. His best-known work is the "Pharmacographia" which he wrote in conjunction with Flueckiger, q.v. Bibliography; see Amer. Journ. Pharm., 47:238, 1875; E. C. Cripps, Plough Court, London, 1927, p. 67.

Hanckwitz, Ambrosius Gottfried (17th and early 18th century). German chemist who in England took the name Godfrey, his anglicized second given name, instead of Hanckwitz. See C. J. S. Thompson, The Mystery and the Art of the Apothecary, Philadelphia, 1929, p. 266.

Hancock, John F. (1834-1909), Baltimore druggist. See Drug. Circ. 51:107, 183, 1907.

Hänle, Georg Friedrich (1763-1824). German apothecary. In 1823 he founded the Magazin der Pharmazie.

Hare, H. A. (1862-1931), physician, professor of therapeutics and diagnosis at Jefferson Medical College, Philadelphia. See American Men of Science, 1921, p. 289; Who's Who in America 12: p. 1405; Journ. Amer. Pharm. Asso., 20:726, 1921.

Harris, Thaddeus Mason (1768-1842). American clergyman and scientist. He gave one of the first reports of the medical use of Seneca Indian Oil (Petroleum) in America. See Dictionary of American Biography, VIII, p. 320.

Harrison, John (second half of 18th—first half of 19th century), Philadelphia druggist and manufacturer of Chemicals. Bibliography: See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 35; S. P. Sadtler; Amer. Journ. Pharm., 93:201, 1921.

Hartshorne, Joseph (1779-1850), resident apprentice and apothecary in the Pennsylvania Hospital, later on physician in Philadelphia. See Kelly and Burrage; American Medical Biographies, New York, 1920, p. 500.

Hatcher, Robert A. (1868-1944), physician and pharmacist, professor of pharmacology and materia medica 1906-1935 at Cornell University Medical College, writer on materia medica. See Who's Who in America, 20: p. 1152.

Hausknecht. See Personnel.

Hébert, Louis (about 1580-1627), French apothecary and pioneer settler in Canada.

Hebrews, medicine and pharmacy. Bibliography: Oswei Temkin, Beiträge zur archaischen Medizin, Kyklos, 1930, 3: pp. 90-135; Walter H. Blome, Plants, Drugs, and Processes of the Bible, presented before the Section on History of Pharmacy of the Amer. Pharm. Asso., Atlanta, 1939, (Manuscript, University of Wisconsin, Department of Pharmacy); Wootton, Chronicles of Pharmacy, London, 1910, I: p. 46.

Hegeman, William (1817-1875). New York druggist who as early as 1857 operated four New York drugstores, hence one of the earliest forerunners of the chainstore system. See Drug. Circ., 51:85, 1907.

Helmont, Jean Baptist van (1577-1644), Flemish physician and academic teacher in Leyden. He was a follower of Paracelsus and some historians consider him and not the later de le Boe Sylvius the founder of the iatrochemical school. His theories were, however, like those of his master Paracelsus very mysterious, while Sylvius, q.v., formulated his physiological-chemical ideas clearly and understandably. Van Helmont made the first attempt at a real analysis of urine. See Garrison: History of Medicine, Philadelphia, 1929, p. 261; Sigerist: The Great Doctors, New York, 1933, p. 157.

Henderson, Thomas (1743-1824), physician in Freneau, N. J., meritorious officer during the Revolutionary War. See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 514.

Hennepin, Louis (1640-1701), French-Canadian Jesuit and explorer. See Dictionary of American Biography, **VIII,** p. 540.

Henry, O. (real name William S. Porter) (1862-1910), famous author of short stories who began his career in a pharmacy. See Jour. Amer. Pharm. Asso., **20**:488, 1931.

Hephaistos. The god of fire and one of the gods to whom healing power was attributed. He was considered a son of Zeus and Hera and by the Romans identified with their deity Vulcan.

Heracles. A deified hero called also Hercules and considered to be the son of Zeus and Alcmene, was worshipped chiefly as the god of warlike strength and riches.

Herb. Latin Herba. In such derivations as herbalist and herborist it was not restricted to herbs as contrasted with shrubs and trees. In the same connection it not infrequently implied but part of a plant, such as roots and rhizomes as well as portions growing above ground.

Herbalist, anglicized form of herbarius, q.v., a dealer in "herbs."

Herbaliste, gallicized form of herbarius, q.v.

Herbarium. See herbarius. A collection of dried plants. Also title of book on "herbs."

Herbarius, pl.-i, from Latin herba, herb, and -arius, pertaining to, i.e., dealer in herbs. Compare French herbaliste and herboriste, and English herborist, also herbarium.

Herborist, anglicized form of herbarius, q.v. A collector of "herbs."

Herboriste, gallicized form of herbarius, q.v.

Hermbstaedt, Sigismund (1760-1833), German apothecary and professor of chemistry at the University of Berlin. Hermbstaedt made an attempt to give phytochemistry a systematic basis in his Kurze Anleitung zur chemischen Zergliederung von Vegetabilien nach physikalisch-chemischen Grundsätzen. (Short directions for the chemical analysis of vegetables according to physico-chemical principles). He investigated many technological problems and was one of the most important chemical engineers of his time.

Hernandez, Francisco (1571-1677). Hernandez wrote on the animals, plants and minerals of Mexico. See Tschirch; Handbuch der Pharmakognosie, 2nd ed., Leipzig, 1933, **I,** Part 3, p. 1546.

Hewson, Thomas Tickell (1773-1848), English-born American physician. See Journ. Amer. Pharm. Acco., **20**:680, 1931.

Hiera picra. Under this name bitter tasting powders or species were in use from antiquity until about 1800. With the single exception of the formula of Scribonius Largus, q.v., which contained colocynth in its place, all contained aloes. These powders or species were taken with honey in the form of electuaries. See Wootton: Chronicles of Pharmacy, London, 1910, **II,** p. 138.

Higby, Lewis J. (1812-1879), one of the first druggists in Milwaukee. See The Badger Pharmacist, 1930, No. 5, p. 7; J. S. Buck, Pioneer History of Milwaukee, Milwaukee, 1876-1886, **II,** pp. 121, 185, 189; **III,** pp. 100, 226, 303; **IV,** pp. 138, 151.

Hildegard of Bingen (1098-1179), abbess of a cloister at Bingen in Germany, author of a materia medica, called "physica," which according to Tschirch may be considered the first history of natural science in Germany. See Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910, **I,** Part 2, p. 667; Gertrude M. Engbring: Saint Hildegard, Twelfth Century Physician, Bull. Hist. Med., **8**:770, 1940.

Hippocratean Corpus, the books written by or attributed to Hippocrates, q.v.

Hippocrates (460-377 B.C.), a Greek physician, known as the "father of medicine." To him has been attributed the first concept of humoralpathology, q.v., which later on was systematized by Galen, q.v., and above all the concept of the sick person as an entity medically and medicinally to be treated as such instead of as merely the bearer of a particular sickness which had to be treated. This concept and the simplicity of medication in connection with adequate diet, likewise attributed to Hippocrates, made his name now and again a symbol for movements within medicine extolling these principles. See W. S. Jones: Hippocrates, with an English translation, London, 1923-1931.

Hoffman, Frederick (1832-1904), German apothecary, who in more than 30 years of pharmaceutical activity in the

United States as druggist, editor, and as analytical chemist was of greatest influence on American pharmacy. Bibliography: See Pharm. Rev., 14:1, 1896; 23:1, 1905; Amer. Journ. Pharm., 78: 144, 1905.

Hoffman, Friedrich (1660-1742), German physician and academic teacher in Halle. He is considered one of the greatest iatromechemists. In pharmacy his name has survived in connection with the Hoffman's-drops introduced by him into therapy. See Garrison: History of Medicine, Philadelphia, 1929, p. 314.

Horus. The Egyptian god of day, resembling the Greek god Apollo, and one of the gods to whom healing power was attributed. Horus was represented as hawk-headed. He was considered the son of Isis and Osiris.

Hufeland, Christian Wilhelm (1762-1836). German physician, who is considered "One of the great philanthropic physicians who are true friends of the human race" and one of the great pioneers of medical journalism. See Garrison: History of Medicine, Philadelphia, 1929, p. 366.

Humboldt, Alexander Friedrich Wilhelm Heinrich von (1769-1859), German naturalist and traveller. See Klencke: Lives of the Brothers Humboldt, New York, 1854.

Humoralpathology, the theory that all diseases result from a disordered or abnormal condition of the fluids or humors of the body. As stated in the text Galen divided the remedies, to be used in order to counteract such conditions, into three classes. The first class comprised those remedies developing only one of the elementary qualities, i.e., warmth, cold, moisture, or dryness, i.e., drugs with "simple" effect. To the second class belonged those drugs which have besides one main effect a secondary one, i.e., drugs with "compound" effect. The third class consisted of drugs with a specific effect, i.e., drugs efficient as "entities." Each medicine, and this applied to the drugs of all classes, could exercise its effect in different degrees. Typical for modes of administration is the direction given by Galen for the use of opium: Like all other narcotics "opium is according to its temper cold and produces, therefore, in the body a considerable, in the highest degrees invincible cold. Hence in order to soften its effect we have to combine it with heating remedies, the most recommendable of these being Castoreum." See Häuser: Lehrbuch der Geschichte der Medizin, Jena., 1875, I, p. 374; Ludwig Israelson: Die Materia Medica des Claudius Galenos, 1894, p. 12.

Hunt, Reid (1870-), physician, author, teacher, president of the Pharmacopoeial Convention, 1920. Bibliography: See American Men of Science, 1938, p. 701; Who's Who in America, 20: p. 1294.

Husa, William J. (1896-), professor in the Department of Pharmacy in the University of Florida. See Journ. Amer. Pharm. Asso., 27:1199, 1938.

Hutchinson, James (1752-1793), physician in Philadelphia, professor at the University of Pennsylvania. See Kelly and Burrage: American Medical Biographies, New York, 1920, p. 584.

Hygeia. The Greek goddess of health. She was considered a daughter of Asklepios, with whom she was often worshipped.

Hynson, Henry P. (1855-1921), American druggist, one of the founders of the firm of Hynson, Westcott & Dunning, Baltimore, and professor in the Department of Pharmacy, University of Maryland.

I

Iatrochemistry. From the Greek iatros (physician). The doctrine based on a chemical concept of normal and pathological conditions of the human body. Abnormal chemical conditions were naturally combatted by chemical remedies.

Iatron. From Greek iatros (physician), the room of the physician; Galen's room for the preparation of medicaments.

I-em-hetep. See Imhotep.

Imhotep, originally written I-em-hetep, i.e., "He who cometh in peace," is also known as Imouthes and Imhotpou. He is regarded as the earliest known Egyptian deity of medicine and healing. According to Breasted the Greeks recognized in him their own Asklepios, q.v. For details see Breasted: A History of the Ancient Egyptians, p. 104; K. Sethe: Imhotep, der Asklepios der Aegypter; J. B. Hurry. Imhotep, The Vizier and Physician of King Zozer, Oxford, 1926.

Imhotpou. See Imhotep.

Imouthes. See Imhotep.

India. A country in southern Asia, the name being derived from the river Indus. For ancient Indian medicine and drugs, see the chapters India or Indians in H. Schelenz: Geschichte der Phar-

mazie, Berlin, 1904; T. Berendes: Die Pharmazie bei den alten Kulturvolkern, Halle, 1891; A. Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910 and 1933, 1, part 2. Furthermore see Fr. R. Hoernle: Studies in the Medicine of Ancient India, Oxford, 1907; G. Piso: De Indiae utriusque et Medica libri XIV (1658); Jacob Bontius: De Medica Indorum libri IV (1718). As to modern Indian pharmacy see George Cecil: Pharmacy in the Indian Native States, Pharm. Journ. 117:674, 1926; The Qualified Chemist in India, Chem. and Drug., 105:693, 1926.

Ingalls, William (1769-1851), physician in Boston, professor in Brown University. See Kelly and Burrage: American Medical Biographies, New York, 1920, p. 592.

Isidore of Seville. See Isidorus Hispalensis.

Isidorus Hispalensis (570-636), Bishop of Seville, the best known encyclopedist of the middle ages.

Isis. Egyptian goddess of fecundity and one of the divinities to whom healing power was attributed. She was considered sister and wife of Osiris and mother of Horus and Anubis (Anepu). Isis is sometimes represented as cow-headed. The word "Isis" has been used as the title of the journal of the History of Science Society.

-ist. Ending with the meaning pertaining to (comp. -arius and -er), e.g., botanist, chemist, druggist, pharmacist, physicist, zoologist, etc.

Ives, Ansell W. (1787-1838), physician in New York, author of several books and papers on medical subjects. See Kelly and Burrage: American Medical Biographies, New York, 1920, p. 594.

Ives, Eli (1779-1861), physician. See W. O. Richtmann: Journ. Amer. Pharm. Asso., 20:681, 1931.

J

Jackson, James (1777-1867), physician in Boston and professor at the Boston Medical School. See Kelly and Burrage: American Medical Biographies, New York, 1920, p. 599.

Jackson, Samuel (1787-1872), physician, for some years a druggist, the first professor of materia medica and pharmacy in the Philadelphia College of Pharmacy and from 1827-1863 an instructor, after 1835 a full professor, at the University of Pennsylvania. See J. W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 396; Amer. Journ. Pharm., 44:329, 1872.

Jacobs, Joseph (1859-1929), owner of several drugstores in Atlanta, Georgia, writer on pharmaceutical subjects and founder of the American Burns club, an organization of the lovers of the Scotch poet Burns. See J. W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 242; Pharm. Era, 66:257, 1929; Journ. Amer. Pharm. Asso., 18:1095, 1929.

Jahresbericht für Pharmacie. Published originally (1841-1866) as the Jahresbericht über die Fortschritte der gesamten Pharmacie und Pharmakologie im In- und Auslande, then (1866-1890) as Jahresbericht über die Fortschritte der Pharmacognosie, Pharmacie und Toxicologie, and since 1890 under the above title by the German Apothecaries Society.

James I (1566-1625), King of England 1603-1625 and of Scotland (under the name of James VI) 1567-1625.

James, Robert (1705-1776), English physician, medical author and patentee of "James' Powder." See Dictionary of (English) National Biography: 29. p. 220.

Janitor. See Personnel.

Japan. A large group of islands off the east coast of Asia. The culture of ancient Japan was derived from China. Hence the known ancient Japanese Medicine was Chinese. For details see the chapters Japan or Japanese in H. Schelenz, Geschichte der Pharmazie; T. Berendes, Die Pharmazie bei den alten Kulturvölkern, Halle, 1891; Tschirch, Handbuch der Pharmakognosie, 1910, 1: Part 2. Furthermore see Y. Fujikawa: Japanese Medicine, New York, 1934; Charles Rice: Japanese Medicine and Pharmacy, New Remedies, 6:20, 1877; K. L. Kaufman, A Chronology of Some Events of Pharmaceutical Interest in China and Japan, Journ. Amer. Pharm. Asso., 28:544, 1939. Now medicine and pharmacy in Japan are Europeanized. The first pharmacopoeia following occidental models appeared in 1887. In 1937 the sixth edition was issued.

Jatron. See Iatron.

Jenner, Edward (1749-1823). English physician. With his inoculations he "transformed a local country tradition into a reliable prophylactic principle." See Garrison: History of Medicine,

Philadelphia, 1920, p. 374; Sigerist. The Great Doctors, New York, 1933, p. 258.

Johnson, Joseph (1776-1862), physician, wholesale druggist and author. Among his historical publications, "Traditions and Reminiscences Chiefly of the American Revolution in the South" gained popularity. See Dictionary of American Biography, **X**: p. 108.

Johnson, Thomas (died 1644), English apothecary, botanist and active royal partisan in the struggle between the English crown and Cromwell. See Dictionary of (English) National Biography, **XXX**: p. 44.

Jones, John (1729-1791). American physician and writer on hygiene and surgery. He is said to have written with his book "Plain Remarks on Wounds and Fractures," the first comprehensive surgical work in America. See Amer. Journ. Pharm., 76:9, 1904; N. Y. Med. Reg., 17:178, 1879; L. C. Duncan, Medical Men in the American Revolution, Carlisle, Pa., 1931, p. 23; Dictionary of American Biography, **X**: p. 187.

Josselyn, John (died 1675), traveller and amateur scientist. See Dictionary of (English) National Biography, **XXX**: p. 208; Dictionary of American Biography, **X**: p. 219.

Journal de Pharmacie. French, founded in 1809 as Bulletin de Pharmacie, q.v., changed in 1815 to Journal de Pharmacie and finally in 1842 to Journal de Pharmacie et de Chimie.

Journalism. The first pharmaceutical periodical to be classed with the journals was Trommsdorff's Journal der Pharmacie which made its first appearance in 1794. The first journal published in the French language appeared in 1797, the Journal de la Société des Pharmaciens de Paris. The first pharmaceutical journal in the English language did not appear in England but in the United States, the Journal of the Philadelphia College of Pharmacy, the first number of which was issued in 1825. The first Italian journal, the Giornale di Farmacia, chimica e scienze affini, appeared in 1824; the first Spanish, El restaurador Farmaceutica, in 1884; the first Portuguese, the Journal da Societada Pharmaceutica de Lisboa, in 1840.

Most of the pharmaceutical journals have been published in these languages. The English language has been employed in the British colonies as well as in English-speaking countries. German language journals appeared in Austria and Switzerland and also for a time in the United States and Russia. The Spanish language has been used in the former Spanish colonies, the Portuguese language in Brazil.

These journals have been devoted to pharmacy as a whole or to special fields thereof. To a certain extent the subject matter has been reflected in the titles: Journal (English, French, German) q.v.; Bulletin (English, French; Bolletino, Italian) q.v.; Annals (German, Annalen; French, Annales) q.v.; Archives (German and Danish, Archiv; Italian, Archivio) q.v. Other titles are Berichte, Magazin, Nachrichten, Zeitung, etc.

A general bibliography was attempted in 1913 by Eugène Guitard in his Deux Siècles de presse au service de pharmacie et cinquante ans de l'Union Pharmaceutique; a concise bibliography of pharmaceutical journals up to 1894 using the German language (in the U. S. as well as in other countries) was prepared by Fr. Hoffmann, editor of the Pharmazeutische Rundschau (12:7-28). A more complete and up-to-date account will be found in Adlung and Urdang, Grundriss, pp. 259-271. For American journals, see Minnie Meyer, Pharmaceutical Journals of the U. S. Master's Thesis, University of Wisconsin, 1933. See preface for earlier attempts, some of which were published. A list of journals by states was published in the Journ. Amer. Pharm. Asso., 22:424, 1933.

Judge, John F. (1842-1891), druggist and physician in Cincinnati and professor of chemistry in the Cincinnati College of Pharmacy as well as in the Eclectic Medical Institute. See Druggists Circular, 51:86, 1907; Proc. Amer. Pharm. Asso., 40:19, 1892.

K

Kalefactor. See Personnel.

Kebler, Lyman Fr. (1863-), chemist of most versatile activity. Kebler has worked in the governmental service, in educational and industrial positions and has contributed to chemical, food, and medical subjects as well as on public welfare and pharmaceutical history. See Who's Who in America, 1938, p. 1386; American Men of Science, 1938, p. 759.

Kekulé von Stradonitz, Friedrich August (1829-1896). German chemist. His theory of the benzol ring laid the foundation for a new era in organic chemistry. See Chemistry, History of.

Kelly, Evander F. (1879-1944), Professor at the Maryland College of Pharmacy, active in manufacturing pharmacy, pharmaceutical author and secretary of the Amer. Pharm. Asso. Bibliography. See Journ. Amer. Pharm. Asso., 11:3, 1922.

Kemi, ancient name for Egypt, from which some historians derive the word chemia, etc.

Kieft, William (1597-1647). Fifth Dutch governor of New Netherlands. See Dictionary of American Biography, **X**: p. 370.

Kierstedt, Hans Taylor (1793-1882), druggist in New York. See Proc. Amer. Pharm. Asso., 30:615, 661, 1882.

King, John (1813-1893), pioneer eclectic and pharmacologist. See H. A. Kelly and W. L. Burrage: American Medical Biographies, New York, 1920, p. 661; Lloyd Libr., Bull. No. 19, 4, 1912, p. 3.

Klaproth, Martin Heinrich (1743-1817), German pharmacist and one of the great chemists of his period. Most of his discoveries he made in the small laboratory of his own pharmacy. He is considered the father of modern analytical chemistry and was the first to recognize with certainty the elementary character of uranium, titanium, and zirconium in 1789, strontium and cerium in 1803. He found fluorine in bones, potassium in feldspar and was the first to separate barium and strontium. One of his biographers stressed especially the fact that Klaproth has never published anything except his own investigations and some new fact and never repeated himself. When the University of Berlin was founded in 1809 he was made its first professor of chemistry and after his death the authorities left the chair unoccupied for some time because they wanted to find a successor at least approximately his equal. The first Prussian Pharmacopoeia, published in 1799, bears with its resolute adoption of the principles of modern chemistry the impress of this great apothecary. See Georg Edmund Dann, Klaproth, Gesellschaft für Geschichte der Pharmazie, Vorträge, Wien Mittenwald, 1931.

Knight, Jonathan (1789-1864), physician in Connecticut and professor at Yale Medical School. See Kelly and Burrage: American Medical Bibliographies, New York, 1920, p. 672.

Knorr, Ludwig (1859-1921), German chemist, known especially for his syntheses of derivates of quinoline and pyrrol.

Koch, Robert (1843-1910). German physician and director of the Robert Koch Institute for Infectious Diseases founded to carry on research. He discovered the tuberculosis bacillus (1882), the cholera virus (1883) and a series of other micro-organisms of pathologic character. See Sigerist: The Great Doctors, New York, 1933, p. 366; Garrison: History of Medicine, Philadelphia, 1929, p. 578.

Kolbe, Hermann (1818-1884), German chemist. His synthesis of salicylic acid was applied practically in chemical industry. He was one of the great teachers of theoretical and experimental organic chemistry.

Kopp, Hermann (1817-1892), German chemist. Best known for his classical "Geschichte der Chemie" and "Die Alchemie in Älterer und Neuerer Zeit."

Kraemer, Henry (1868-1924), pharmaceutical teacher and author. He was especially known for his botanical and pharmacognostical research work. See J. W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 415; Journ. Amer. Pharm. Asso., 13:980, 1924.

Kremers, Edward (1865-1941), professor and director of the Course in Pharmacy, University of Wisconsin from 1892-1935, editor, author, pharmaceutical historian. See American Men of Science, 1938, p. 803; Who's Who in America, 1938, p. 1457.

Kuhn, Adam, physician, botanist, and professor of materia medica and botany in the College and Academy of Philadelphia, later at the University of Pennsylvania. See Kelly and Burrage: American Medical Bibliographies, New York, 1920, p. 675.

L

La Salle, de, René Robert (1643-1687), French explorer. See Dictionary of American Biography, **XI**: p. 10.

Law for the separation of medicine and pharmacy. Issued by the Emperor Frederick II. in 1240. Following are the paragraphs covering pharmacy.

Latin text published in Lindenborg, Codex Legum Antiquarum, Frankfurt 1613.

Titulus 46: Iste medicus iurabit servare formam curiae, hactenus observatum, eo adiecto, quod si pervenerit ad notitiam suam, quod aliquis confec-

tionarius minus bene conficiat, curiae denunciabit. . . . Non contrahat societatem cum confectionariis, nec recipiat aliquem sub cura sua ad expensas pro certa pretii quantitate, nec ipse etiam habebit propriam stationem. Confectionarii vero facient confectionem expensis suis, cum testimonio medicorum iuxta formam constitutionis nostrae, nec admittentur ad hoc, ut teneant confectiones, nisi praestito iuramento; omnes confectiones suas secundum praedictam formam facient sine fraude. Lucrabiter autem stationarius de confectionibus suis secundum istum modum: de confectionibus et de simplicibus medicinis, quae non consueverunt teneri in apothecis ultra annum a tempore emptionis, pro qualibet uncia poterit et licebit tres tarrenos lucrari. De aliis vero, quae ex natura medicaminum, vel ex alia causa ultra annum in apotheca tenentur, pro qualibet uncia licebit lucrari sex tarrenos. Nec stationes huius modi erunt ubique, sed in certis civitatibus per regnum, ut inferius describitur.

Titulus 47: In terra qualibet regni nostri nostrae iurisdictioni subiecta duos viros circumspectos et fide dignos volumus ordinari et corporali per eos praestito sacramento teneri, quorum nomina ad curiam nostram mittentur; sub quorum testificatione electuaria et syrupi ac aliae medicinae legaliter fiant, et sic factae vendantur: Salerni maxime per magistros in physica haec volumus approbari. . . . Conficientes etiam medicinas sacramento corporaliter praestito volumus obligari, ut ipsas fideliter iuxta artes et hominum qualitates, in praesentia iuratorum conficiant; quod si contra fecerint, publicatione bonorum suorum mobilium sententialiter condemnentur. Ordinati vero, quorum fidei praedicta sint commissa, si fraudes in credito ipsis officio commississe probentur, ultimo supplicio feriendos esse censemus.*

II. Translation into English, published in Journ. of the Am. Med. Asso., Jan. 1908; quoted according to J. T. Walsh: The Popes and Science, p. 419-423.

Title 46: Every physician given a license to practice must take an oath that he shall faithfully fulfill all the requirements of the law, and in addition, whenever it comes to his knowledge that any apothecary has for sale drugs that are of less than normal strength, he shall report him to the court. . . . He (the physician) must not enter into any business relations with the apothecary, nor must he take any of them under his protection nor incur any money obligations in their regard. Nor must any licensed physician keep an apothecary's shop himself. Apothecaries must conduct their business with a certificate from a physician,[1] according to the regulations and upon their own credit and responsibility, and they shall not be permitted to sell their products without having taken an oath that all their drugs have been prepared in the prescribed form, without any fraud. The apothecary may derive the following profits from his sales: Such extracts[2] and simples as he need not keep in stock for more than a year before they may be employed may be charged for at the rate of three tarrenes[3] an ounce. Other medicines, however, which in consequence of the special conditions required for their preparation[4] or for any other reason the apothecary has to have in stock for more than a year, he may charge for at the rate of six tarrenes an ounce. Stations for the preparation of medicines may not be located anywhere, but only in certain communities in the Kingdom, as we prescribe below.

Title 47: In every province of our Kingdom which is under our legal authority, we decree that two prudent and trustworthy men, whose names must be sent to our court, shall be appointed and bound by a formal oath, under whose inspection electuaries and syrups and other medicines be prepared accord-

*According to Sudhoff the law was published in 1240 not only in Latin but simultaneously in Greek (Mitt. zur Gesch. der Med. 13 (1914), p. 180-182). This is important not only because it allows a comparison of the two texts but also a very interesting proof for the fact that at that time Latin and Greek were spoken in the Kingdom of the Two Sicilies.

[1] a better translation, more fitting the sense of the Latin text would be: with the approval of the physicians.

[2] the Latin word "confectiones" cannot be translated with "extracts." It means all compounded preparations in contrast to simple drugs.

[3] one tarrene equals about 30 cents.

[4] "ex natura" means because of their special nature. There is no reason for an interpretation like that given in the above translation.

ing to law and only be sold after such inspection. In Salerno in particular, we decree that this inspectorship shall be limited to those who have taken their degree as Masters in Physic. . . . We decree also that the growers of plants meant for medical purposes[5] shall be bound by a solemn oath that they shall prepare medicines conscientiously, according to the rules of their art, and as far as it is humanly possible that they shall prepare them in the presence of the inspectors. Violations of this law shall be punished by the confiscation of their movable goods. If the inspectors, however, to whose fidelity to duty the keeping of these regulations is committed, should allow any fraud in the matters that are entrusted to them, they shall be condemned to punishment by death.

LaWall, Charles H. (1871-1937). LaWall was active in almost all branches of pharmacy, as a retail druggist, in the pharmaceutical industry, as analytical chemist, as a teacher, and in official governmental positions. In addition he was a prolific writer on pharmaceutical subjects. His "Four Thousand Years of Pharmacy" represents the first attempt at a history of pharmacy written by an American and published in book form in America. See Journ. Amer. Pharm. Asso., **26**:1223, 1937; J. W. England: First Century of the Phi'adelphia College of Pharmacy, Philadelphia, 1922, p. 420.

Laborant. See Personnel.

Laboranten. The German term has two meanings: (1) During the 17th-19th centuries it designated the manufacturers and itinerant sellers—frequently the same persons—of the so-called Ölitäten, q.v. (2) In more recent times the term "Laboranten" designates people doing laboratory work requiring no or only a little technical education.

Laennec, Réne-Theophile-Hyacinthe (1781-1826). French physician and academic teacher in Paris. He is considered "the greatest of teachers on pulmonary tuberculosis." See Garrison: History of Medicine, Philadelphia, 1929, p. 411; Sigerist: The Great Doctors, New York, 1933, p. 283.

Lagerist. See Personnel.

Lasca, Il. See Grassini.

Lascoff, Leon J. (1867-1943), Russian-born American pharmacist, who has made his life work the promotion by example and teaching of American professional retail pharmacy. See Journ. Amer. Pharm. Asso., **26**:199, 1937.

Laufbursche. See Personnel.

Lavoisier, Antoine Laurent (1743-1794), French chemist and victim of the French revolutionary tribunal. His fame rests on the recognition of oxygen, discovered almost simultaneously by Priestley, q.v., and Scheele, q.v., as the principle of combustion and the experimental proof of the part played by oxygen in all chemical and biological changes (oxidation and reduction), thus disproving the phlogiston theory, q.v. See also Chemistry, History of. References: Douglas McKie: Antoine Lavoisier, Philadelphia, 1935.

LeCoste, Jean-François (1741-1819), Chief Physician of the French Expeditionary Army in the American Revolution, author of a brief formulary in Latin for the use of the hospitals under his charge, which was published under the title "Compendium Pharmaceuticum" and printed by Henry Barber in Newport in 1780. See John E. Lane, J. F. Coste, Americana, **22**:51, 1928; reprinted in Military Surgeon, **63**:219. A facsimile reprint of the "Compendium Pharmaceuticum" has been published by J. E. Lane in the Bulletin of the Society of Medical History in Chicago, **4**:214, 1930.

LeFebvre, Nicaise (Nicolas), also called Lefèvre (1610-1674). French apothecary and chemical author. His "Traité de Chymie théorique et pratique," the fifth edition of which was published under

[5] the above translation is very dubious. The Latin word "conficientes" means simply preparers. Alfred Baeumer translates it with apothecary (Die Aerztegesetzgebung Kaiser Friedrichs II und ihre geschichtl. Grundlage, Leipzig 1911). That seems to be dubious too because the duties of the apothecaries, the "confectionarii," are regulated before without, however, mentioning the penalties. There is a third and very probable possibility of interpretation. "Confectionarius" is the learned apothecary without respect to the question whether he himself prepares medicines or not. "Conficiens" is anybody who actually prepares something and "conficientes medicinas" are, therefore, all people who prepare medicines. Thus this term may be used to bring all kinds of preparers of medicines into the frame of the law whether apothecaries or not.

the title "Cours de Chymie," was considered the best chemical textbook of that period and translated into several languages including English.

Lefèvre. See LeFebvre.

Lehrbursche. See Personnel.

Lehrling. See Personnel.

Lehman, William (1779-1829), Philadelphia druggist, M. D. of the University of Pennsylvania, active in scientific and political life. See J. W. England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 352.

Lehr-Bube. See Personnel.

Lehr-Jung. See Personnel.

Lémery, Nicolas (1645-1715), French apothecary. Lémery is considered the founder of modern phytochemistry. He taught the analysis of vegetable drugs by the extraction method. In accordance with the classification of all natural objects according to the three kingdoms, he arranged the materia chemica into mineral, vegetable, and animal categories. He was one of the most translated authors of his time and his principal books went through many editions.

Lespleigney, Thibault (1496-1567), French apothecary and writer on pharmaceutical subjects. His "Promptuaire des medecines simples en rythme joyeuse" was reprinted in 1898 by Paul Dorveaux.

Lewis, William (1714-1781), English physician and chemist. His "New Dispensatory," containing the theory and practice of pharmacy, and some of his books on technical chemistry were translated into German. On the other hand Lewis translated the pharmaceutical treatise of the German apothecary Caspar Neumann, q.v., into English. See Edward Kremers: William Lewis, Journ. Amer. Pharm. Asso., **20**:1204, 1931.

Libau. See Libavius.

Libavius (the latinized form of Libau), Andreas (1540-1616), physician and one of the most eminent early chemists. See Ferchl: Chemisch-Pharmazeutisches Bio- und Bibliographikon, Mittenwald, 1937, p. 313.

Liebig, Justus von (1803-1873), German chemist, known especially because of his pioneer work in agricultural and physiological chemistry. With pharmacy he was connected by ten months of pharmaceutical apprenticeship, by a later short activity as inspector of the pharmacies in the Grand Duchy of Hessen and by collaboration with pharmaceutical chemists through his whole life. In the first laboratory at the University of Giessen he introduced a type of experimental chemical instruction which became the model for modern chemical instruction the world over. See Amer. Journ. Pharm., **45**:240, 1873; J. V. Liebig, an autobiographic sketch, translated by J. Campbell, Smithsonian Institute, Annual Report for 1891, p. 257; A. Hofman, The Life-work of Liebig (Faraday lecture 1875). See Chemistry, History of.

Liggett, Louis Kroh (1875-), American organizer of one of the largest drugstore chains in the world. See Samuel Mercin: Rise and Fight Againe, New York, 1935.

Lilly, Eli (1838-1898), druggist and founder of Eli Lilly & Company in Indianapolis. See Proc. Amer. Pharm. Asso., **46**:48, 1898. Tile and Till, **12**: No. 2, 1926.

Lilly, Josiah K. (1862-), pharmacist and officer of the firm of Eli Lilly & Co. See Tile and Till, **12**: No. 2, 1926.

Lisset-Benancio, pseudonym of the French physician Sébastien Colin (16th century). See L. André-Pontier: Histoire de la Pharmacie, Paris, 1900, p. 209.

Lister, Joseph, Lord (1827-1912). English surgeon and academic teacher in Glasgow, who gained world fame by his introduction of antisepsis into surgery. In 1867 he published his paper "On the Antiseptic Principle in the Practice of Surgery." See Garrison: History of Medicine, Philadelphia, 1929, p. 588; Sigerist: The Great Doctors, New York, 1933, p. 375.

Lloyd, John Uri (1849-1936). One of the greatest and most versatile pharmacists America has ever had. Lloyd was a scientific chemist, a pharmaceutical manufacturer, a teacher and an author of scientific literature as well as of novels, and excelled in all these fields. Early connected with the eclectic school of medicine, he played an important part in the development of plant chemistry and drug extraction. The "Lloyd Library," initiated by him in Cincinnati, is one of the most comprehensive of its kind and contains not only modern books but also valuable publications out of the pharmaceutical past. See Eclectic Medical Journal, **96**: 178, 1936; Journ. Amer. Pharm. Asso., **25**:885, 1936.

Lohoch, from the Arabian la aka, to lick. It represented a thick liquid, being of a consistency between a syrup and an electuary.

Long, John H. (1856-1918), Professor of Chemistry at Northwestern University, author of textbooks on general analytical and physiological chemistry. See The Alumni Record of the University of Illinois, 1921, p. 431.

Lonicerus, Adam (1528-1586), municipal physician in Frankfort on the Main. His herbal, the first edition of which was published in 1557 continued through more than two centuries, the last (20th) edition being issued in 1783.

Loochs. See Lohoch.

Lovell, Joseph, (1788-1836), physician, surgeon-general of the U. S. Army. See Kelly and Burrage: American Medical Biographies, New York, 1920, p. 719.

Ludovici, Daniel (1625-1680), German physician. He produced a Magisterium Opii which is considered to have been impure morphine. He was the author of a well known formulary.

Lumen. See Pharmacopoeia.

Luminare. See Pharmacopoeia.

Lunar caustic. Latin luna, moon, of or pertaining to the moon. Used also in connection with silver because of the pale color of the metal resembling that of the moon and its rays. Lunar caustic means, therefore, a silver compound, viz., silver nitrate.

Lyekopis. See Pharmacopoeia.

Lyons, Albert B. (1841-1926), M. D., retail druggist, and professor of Chemistry at Detroit College of Medicine, then editor of the Pharmaceutical Era, later government chemist and professor in Hawaii and finally manufacturing chemist. See Journ. Amer. Pharm. Asso., 15: 411, 1926; J. W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 218.

M

Maben, Thomas (1855-1937), English pharmaceutical chemist and member of the English staff of the American pharmaceutical firm of Parke, Davis & Co. See Chemist and Druggist: 126:675, 1927.

MacNaughton, James (1796-1874), Scotch-born physician in New York, surgeon-general of the state of New York, professor of anatomy and physiology in the College of Physicians and Surgeons of the Western District of New York and later on professor of the theory and practice of medicine in Albany College. See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 751.

Macfarlan, John Fletcher (1790-1861), Scotch chemist, druggist and physician. One of the foundation members of the Pharmaceutical Society of Great Britain and its representative on the London Board. He also played an important part in medical association work, being (1822) president of the Royal Medical Society of Edinburgh and after 1850 an honorary member. See Pharm. Journ. 20:488, 1861.

Magazin für Pharmacie (1823-1832). See also Annalen der Pharmacie. In 1824 the name was changed to Magazin für Pharmacie und Experimental Kritik.

Maimonides or Abû 'Imram Mûsa ben Maimon (1135-1204). A Jewish-Spanish physician, who wrote in Arabic. See I. Muenz and H. T. Schnittkind: Maimonides, Boston, 1935; E. H. Rodin: Maimonides, Calif. and West Med. 44:192, 1936; J. J. Walsh: Old-Time Makers of Medicine, New York, 1911, p. 90.

Maisch, John M. (1831-1893), Maisch entered pharmacy after his arrival in the United States as a German political refugee. He soon became prominent as a teacher, an author and above all in his quality as an editor of the American Journal of Pharmacy and the first Permanent Secretary of the American Pharmaceutical Association (1865-1893). See Joseph P. Remington: J. M. Maisch, Amer. Journ. Pharm., 66:1, 1894; Joseph W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 405; M. I. Wilbert: John Michael Maisch, An Ideal Pharmacist, Amer. Journ. Pharm. 75:351, 1903.

Maisch, Henry C. C. (1865-1901), Retail druggist, manufacturing chemist, oldest son of John M. Maisch and one of the American pharmaceutical teachers who studied in Germany. See Amer. Journ. Pharm., 74:458, 1902.

Mallinckrodt, Edward (1845-1928), one of the founders and the chief organizer and leader of the firm of G. Mallinckrodt & Co., St. Louis. See Journ. Amer. Pharm. Asso., 17:208, 1928.

Mandragora. A small genus of European and Asiatic solanaceous herbs. It has a very large forked root, which was long supposed to have miraculous qualities. It is the first drug, known to be used as an anesthetic. See Charles J. S. Thompson: The Mystic Mandrake,

London 1934; Wootton: Chronicles of Pharmacy, London, 1910, I, p. 19.

Manlius de Bosco, Jacobus, (16th century), Italian apothecary and probably the first pharmaceutical author in Italy, compiler of a book on materia medica.

Mansfield, William (1880-), professor of pharmacognosy and histology at the New York College of Pharmacy from 1906 to 1918, dean of the Albany College of Pharmacy since 1918, author of several books and numerous articles. See Pharm. Era 64:275, 1927.

Marggraf, Andreas Sigismund (1709-1782), German apothecary and one of the greatest chemists of his time. Marggraf differentiated between potassium and sodium compounds, identified magnesia, produced compounds of mercury and of silver with organic acids, was the first to prepare potassium cyanide, introduced numerous reagents and discovered sugar in different plants particularly in the sugar beet. He reported this most important discovery in 1747. In his investigations he used the microscope, the employment of which in chemistry became customary.

Markham, Gervase (1568-1637). Markham wrote poems and dramas as well as books on horsemanship and agriculture. See Dictionary of (English) National Biography, **XXXVI,** p. 166.

Markoe, George F. H. (1840-1896), Boston druggist, pharmaceutical manufacturer and professor at the Massachusetts College of Pharmacy. See W. L. Scoville: Amer. Journ. Pharm. 68:593, 1896.

Marshall, Charles (1744-1824), druggist in Philadelphia. He was the first president of the Philadelphia College of Pharmacy. See Joseph W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 348; E. T. Ellis, Amer. Journ. Pharm., 75:57, 1903.

Marshall, Christopher, Jr., druggist in Philadelphia (18th century). He was the oldest son of Christopher Marshall, Sr., q.v., and for a time together with his brother, Charles, q.v., owner of the Marshall drugstore in Philadelphia. See E. T. Ellis: Amer. Journ. Pharm., 75: 57, 1903.

Marshall, Christopher, Sr. (1709-1797), Irish-born apothecary in Philadelphia. See E. T. Ellis: The Story of a Very Old Philadelphia Drug Store, Amer. Journ. Pharm., 75:57, 1903.

Martian preparations. Of or pertaining to the planet Mars or the god of war, from whom the planet's name has been derived. In other words, preparations of iron.

Martius, Ernst Wilhelm (1756-1849), German apothecary and professor of pharmacy at the University of Erlangen. He wrote one of the best known German autobiographies containing many interesting descriptions of pharmaceutical life.

Mathioli, Pietro Andrea (1501-1577), Italian physician and botanist in the service of the German Emperor Maximilian II. His revised and annotated edition of Dioscorides' De Materia Medica meant a revival of the work of the great Greek author. It went through many editions.

Mayerne, Theodore Turquet de (1573-1611), French-Swiss physician. Mayerne was forbidden to practice medicine in Paris because he was a paracelsist and employed antimony in his practice. He went to England, where he became physician in ordinary to James I. He published several formulas for chemical remedies. See Dictionary of National (English) Biography, 37:150.

Mayo, Caswell A. (1862-1928), one of the best known American pharmaceutical journalists. See Journ. Amer. Pharm. Asso., 17:209, 1928.

Mayow, John (1645-1679), English physician and chemist. His experiments on combustion and breathing resulting in the statement that the same substance is necessary to maintain both processes brought him very close to the discovery of oxygen. See John F. Fulton: A bibliography of two Oxford physiologists, The Oxford Bibliographical Society, Proceedings and Papers, 4, 1935, pp. 1-61.

McIntyre, Ewen (1825-1913), New York druggist. See Journ. Amer. Pharm. Asso., 2:282, 417, 552, 1913.

Meakim, John (1812-1863), druggist in New York and one of the original members of the Amer. Pharm. Asso. See Amer. Journ. Pharm., 35:574, 1863; Proc. Amer. Pharm. Asso., 12:23, 1864.

Mease, James (1771-1846), physician, editor, author, one of the founders of the Philadelphia Athenaeum. See Dictionary of American Biography, 12: 486.

Medicamentarius, pl.-i, from medicamentum (comp. Greek pharmakon), a

remedy, and -arius, pertaining to, i.e., a maker of remedies or medicaments.

Medici, a Florentine family of great power and wealth in the 14th to 16th centuries, which furnished many rulers of Florence and two Popes. They were among the greatest bankers of the world and were noted for their patronage of art and literature. Because of the balls (pills) in their coat of arms the Medici are sometimes said to have been originally apothecaries.

Medicine Chest. The chest of an Egyptian princess, preserved in one of the museums of Berlin is supposed to have been a medicine chest (possibly also a cosmetic chest). The apotheca found in Herculaneum was another such chest. The German language differentiates between Hausapotheke, medicine chest or cupboard for the home (see Germanisches Museum in Nuernberg); Reiseapotheke, a medicine chest convenient while traveling; Feldapotheke, or army chest used by soldiers in the field. Such regimental chests were prepared at a central station during the Revolutionary War for regiments while in the field. Although pioneer physicians carried medical supplies in their saddle bags while on the road, in their surgeries they had small medicine chests.

Medicine, History of. The study of the history of medicine was given a great impetus by the Institute for the History of Medicine established by Sudhoff. who followed Puschmann in the chair of the history of medicine in Leipzig in 1905. The Institute of the History of Medicine at Johns Hopkins University was established in 1929 by William H. Welch after the Leipzig model. Henry E. Sigerist became his successor in 1932. Sigerist who had been a student co-worker of Sudhoff, his successor in the chair of the history of medicine and director of the Institute in Leipzig from 1929-1932, has made the Institute in Baltimore one of the world centers of the medico-historical movement. The Bulletin of the History of Medicine, started in 1933 as the Bulletin of the Institute of the History of Medicine, The Johns Hopkins University, has developed into an invaluable repository for the history of medicine and the allied sciences. Since 1938 it has been the official organ of the American Association of the History of Medicine. Another center of medico-historical research and teaching is the Institute of the History of Medicine and Natural Science founded in 1931 in Berlin and headed by Paul Diepgen. It was Diepgen whose initiative led the University of Freiburg to bestow the honorary degree of Doctor of Medicine upon the meritorious German historian of pharmacy, Herman Schelenz.

Mercer, Hugh (1725-1777). Scotch-born American physician, who fought in the Revolutionary Army first as a colonel, then as a general and died from wounds received on the battlefield. See Dictionary of American Biography, **XII,** p. 541; Journ. Amer. Pharm. Asso., **15:** 425, 1926.

Merck in Darmstadt, German pharmaceutical firm, founded in the twenties of the 19th century and grown from the "Engel-Apotheke" in Darmstadt owned by the Merck family since 1668.

Mesopotamia. "Between the two rivers," As to medicine and pharmacy in ancient Mesopotamia, see Schelenz: Geschichte der Pharmazie, Berlin, 1904.

Mesuë, Johann, Jr. A pseudonym for writings of the 13th century. The books attributed to Mesuë Junior were: 1. The Grabadin, from the Arabic al-akrâbâdhin (compounded remedy); 2. Practica Medicinarum particularium or liber de appropriatis, often designated a second part of the Grabadin; 3. De Medicinis laxativis (solutivis, purgatorüs) or de simplicibus or de consolatione simplicium or de medicamentorum purgantium simplicium delectu et castigatione. See A. Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910, **I,** part 2, p. 599.

Mesuë, Johann, Sr. (777-857), A Christian physician who wrote in Arabic. See A. Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910, **I,** part 2, p. 597.

Metcalf, Theodore (1812-1894), founder of a professional retail store in Boston which gained a nationwide reputation. See Drug. Circ., **51:**88, 1907.

Meune, Odo of (12th century), called also Odo Maydunensis, author of Macer floridus, a Latin poem about herbs. The name Macer goes back to the Roman poet Aemilius Macer whom the author wished to honor.

v. Meyer, Ernst (1847-1916), German chemist and historian. His Geschichte der Chemie von den ältesten Zeiten bis zur Gegenwart, (1889) the last (4th) edition of which appeared in 1914, has been translated into English by G. McGowan.

Migmatopolos, pl.-oi, seller of mixtures, from the Greek migma (mixture), and polein (to sell).

Milhau, John (1795-1874), American druggist of French descent and French pharmaceutical education. Milhau was one of the organizers of the New York College of Pharmacy. "The passage of the U. S. drug law of 1848 is mainly due to his persistent and conscientious efforts." See Amer. Journ. Pharm., 47: 94, 1875; Drug. Circ., 51:89, 1907.

Minderer, Raymund (1570-1621), physician in ordinary to the German Emperor Mathias (1612-1619) and municipal physician in Augsburg. He edited the four earliest seventeenth-century editions of the Pharmacopoeia Augustana and tried to bridge the break between the Galenists, who wanted to restrict therapy to the old drugs known to Galen and his classic and Arabic followers, and the paracelsists, who recommended the employment of chemicals more or less exclusively. His name has been brought down to posterity especially through the Spiritus Mindereri, representing the first known preparation of ammonium acetate and used under this name up to the present time. The original preparation, called spiritus mindereri however had nothing to do with ammonium acetate. It was the Aqua acustica (acovistica) Mindereri, first found in the Pharmacopoeia Augustana of 1643 which contained ammonium acetate. The Medicina Militaris, published by Minderer in 1619, containing prescriptions for the most common diseases to which soldiers are subject, represents one of the earliest, if not the earliest military pharmacopoeia. See Theodor Husemann, Introductory essays in facsimile of the first edition of the Pharmacopoeia Augustana, Wisconsin State Historical Society, Madison, 1927.

Minuit, Peter (1580-1638), first Dutch governor of New Netherlands. See Dictionary of American Biography.

Mitchell, George Edward (1781-1832), physician, soldier and congressman. See Dictionary of American Biography, 13: 46, 1934; Biographical Congressional Dictionary, Washington, 1903, p. 697.

Mitchill, Samuel L. (1764-1831), physician, chemist, author, editor and senator. See Lyman F. Kebler: S. L. Mitchill, Journ. Amer. Pharm. Asso., 26:908, 1937.

Modes or forms of administration. For the evolution of the modes of administration see Edward Kremers: Modes of Administration, Proc. Wisconsin Pharm. Assn., 1931, p. 321.

Classification
- Internal
- Semi-internal → (intravenous or employed on mucous membranes)
- External

Mohr, Carl Friedrich (1806-1879). German apothecary and inventor of pharmaceutical and chemical apparatus and technique. Many pieces of auxiliary apparatus used in volumetric analysis were invented by him. His balance for the determination of specific gravity became a universally used instrument. Among his many books his Lehrbuch der pharmazeutischen Technik is especially noteworthy. Upon it were based Redwood's, q.v., Book on Practical Pharmacy in England and an enlarged edition published by Procter, q.v., in the U. S.

Mohr, Charles (1824-1901), German-born American pharmaceutical manufacturer and botanist. He was one of the first, if not the first, forester agent in the U. S. Government. Bibliography: See Amer. Journ. Pharm., 74:459, 1902.

Molière, pen name of Jean Baptiste Poquelin (1622-1673). French poet, whose dramas are not only great works of literature but exposures of the corrupt situation within royalist France and therefore one of the measures which led to the French Revolution of 1789. Author of Le malade imaginaire, containing a caricature of the physician and the apothecary.

Monatsblätter, Pharmaceutische (1820-1822). See also Annalen der Pharmacie.

Mongagni, Giovanni Battista (1682-1771). Italian physician and academic teacher in Padua. According to Virchow, Mongagni introduced the "anatomical idea" into medical practice. See Garrison: History of Medicine, Philadelphia, 1929, p. 353; Sigerist: The Great Doctors, New York, 1933, p. 229.

Moore, J. B. (1832-1909), Philadelphia druggist and writer on pharmaceutical subjects. See England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 241.

Moore, J. Faris (1826-1888), druggist in Baltimore and professor at the Maryland College of Pharmacy. See Drug. Circ., 51:88, 1907; Proc. Amer. Pharm. Asso., 36:34, 1888.

Morgan, John (1735-1789), American physician, founder of the first Amer-

ican School of Medicine and the first American advocate of the separation of medicine and pharmacy. See M. I. Wilbert: John Morgan, Amer. Journ. Pharm., 76:1, 1904; Dictionary American Biography, XIII, p. 172.

Morson, Thomas Newborn Robert (1799-1874), English apothecary. See Amer. Journ. Pharm., 46:208, 1874.

Morsuli. Plural diminutive of morsus, a bite, (German **Bissen**) from mordeo, to bite. According to Trommsdorff (Wörterbuch) Morselen, lozenges are hard confections prepared from spicy and other drugs and sugar. Certain mosuli are prepared for their taste, e.g., Magenmorsellen, comparable to our candies; others are prepared with medicaments, e.g., China morsellen, Antimonialmorsellen. Wurmmorsellen. Compare Rotulae and Tabulae.

Motter, Murray Galt (1866-1926), physician, professor of physiology at Georgetown University, director of library service for the Public Health Service. See Journ. Amer. Pharm. Asso., 15:125, 1926.

Mühlenberg, Gotthilf Heinrich Ernst (1753-1815), American clergyman and botanist of German descent. Mühlenberg first determined about 100 species and varieties of American plants. See Amer. Journ. Pharm., 80:420, 1908; Pharm. Rundschau, 4:119, 1886; Dictionary of American Biography, XIII, p. 308.

Mussey, Reuben D. (1780-1866), physician in Salem, Mass., later on professor first at Dartmouth, then at Bowdoin College, then at Fairfield (N. Y.) Medical College and finally at Miami Medical College. See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 842.

Mynsicht, Adrian van, (real name Seumenicht) (1603-1683), was a German physician. In his book Thesaurus et Armamentarium medico-chymicum he for the first time described the preparation of Tartarus emeticus.

Myrepsos, pl. **-oi,** maker of ointments, from the Greek myron (ointment). See also Myropoeos.

Myropoeos, pl.**-oi,** makers of ointments, from the Greek myron (ointment). See also Myrepsos.

N

Nees v. Esenbeck, Theodor Friedrich Ludwig (1787-1837), German apothecary and professor of pharmacy and botany first in Leyden and then in Bonn. He was the first to recommend Flores Koso as a remedy for tapeworm. Among his botanical books his Plantae Officinales received much attention.

Nestorians, adherents of Nestorius, the banned patriarch of Constantinople in the fifth century, who established a special Christian sect, still in existence in Persia, India, and other Oriental countries.

Neumann, Caspar (1683-1737), German apothecary. Neumann was one of the earliest scientific phytochemists. He objected to the so called pyrochemical method of burning the plants and using the ashes as valuable therapeutic products. He discovered thyme camphor (thymol) in 1719. An English translation of his lectures by William Lewis appeared in 1760 under the title "The Chymical works of Gaspard Neumann abridged and methodized with large additions."

Newton, Robert S. (1818-1881), eclectic physician and editor. See Dictionary of American Biography, XIII: p. 475.

Newton, Vandeveer L. (1809-1880), physician and later on editor of the Druggists Circular. See Drug. Circ., 51:5, 1907.

Nicolaus Myrepsus or Alexandrinus (13th century), a physician living in Byzantium, and author of a well-known antidotarium. The cognomen Alexandrinus means the Alexandrian.

Nicolaus Praepositus (about 1500), a French physician, living in Lyon or Tours, and author of a well-known antidotarium. The cognomen "praepositus" indicates his position as presiding official, in this case dean.

Nicolaus Salernitanus. The presumed author of the oldest Antidotarium Nicolai, written about 1100 at Salerno.

O

Occo, Adolf or Adolph Occo III, to differentiate him from the two earlier Adolph Occos who before him also were physicians of Augsburg, Germany, (1524-1606). Occo III not only published treatises on medical subjects but also on philosophy, philology, and numismatics. See Introductory essays by Theodor Husemann, Facsimile of the Pharmacopoeia Augustana, 1565, Madison, Wisc., 1927.

Oerstedt, Hans Christian (1777-1851), eminent physicist, son of a Danish

apothecary. He stated the principles of electromagnetism and discovered piperine in 1820. See Philippe and Ludwig: Geschichte der Apotheken, Jena, 1855, p. 707.

Officina. See Officine, and Pharmacopeia.

Officine. From Latin opus, work (still in common usage figuratively so far as music and literature, e.g., magnum opus, are concerned) and facere, to make, (Compare factor and factory). The room in which the apothecary did his work. Later, when a separate laboratory, also a separate store room (German Materialkammer) were differentiated, the term officine was restricted to the sales room in which the apothecary compounded his prescriptions. The Latin officina was Gallicized to officine, which designation was introduced into English pharmaceutical literature by the Paris correspondent of the Chemist and Druggist of London. The German spelling is Offizin. Just as the Dutch apothek has been used as a title for a pharmaceutical treatise (e.g., pharmacopoeia) so the French word has been used by Dorvault for his handbook "L'Officine."

This designation has not only been applied to the work shop of the apothecary but also to printing offices, e.g., the world famous printing establishment of Plantin and Morehus in Antwerp. On the title page of pharmacopoeias there is frequently found the reference "ex officina," followed by the name of the printer.

O'Gallagher, James (1828-1882), Irish-born druggist in St. Louis. See Proc. Amer. Pharm. Asso., 30:615, 1822.

Oldberg, Oscar (1846-1913), Swedish-born American pharmacist. Oldberg was active and instrumental in various fields of pharmacy, as teacher, as editor, and as author of several books. See Amer. Journ. Pharm., 85:272, 1913; Journ. Amer. Pharm. Asso., 2:550, 1913.

Oleum rosatum. Rosated oil, perfume of antiquity made by steeping rose petals in specially prepared olive oil. A detailed description is given by Pliny. Not to be confounded with oil of rose, Ol. Rosae or Ol. Rosarum, one of the earliest volatile oils. Its discovery by a Persian princess is described in Flueckiger and Hanbury: Pharmacographia, 1879.

Olitäten. The German term designates popular proprietaries of secret composition, prepared since the 17th century especially in the small hamlets in the Silesian mountains and the mountainous parts of Saxony. As to the derivation of the term "Olitäten" it has been said that the oily consistence of the first and most popular of the medicines concerned is responsible for it. The peddlers selling these preparations were called Olitätenhändler. See Adlung and Urdang, Grundriss der Geschichte der Deutschen Pharmazie, Berlin, 1935, pp. 122, 129, 174.

Oliver, Daniel (1787-1848), physician, lecturer on chemistry and materia medica and professor of intellectual philosophy in Dartmouth College, lecturing also at the Harvard and Bowdoin Medical Schools and at the Cincinnati Medical College. See J. A. Spalding: Life of Dr. Lyman Spalding, Boston, 1916, p. 248.

Oreibasius Pergamenus (Oribasius) (325-403), physician in ordinary to the Roman Emperor Julian the Apostate. The remnants of his work which have come down to our time have been edited by Bussemaker and Daremberg in Oeuvres d'Oribase and translated into French in 1851-1876. See A. Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910. I, Part 2, p. 588.

Osiris. The Egyptian god of the underworld and judge of the dead. One of the gods to whom healing power was attributed. He was considered brother and husband of Isis and the father of Horus and Anubis.

P

Paine, James D. (1832-1897), druggist, first in Rochester, then in Chicago and then again in Rochester. See Proc. Amer. Pharm. Asso., 46:50, 1898.

Painter, Emlen (1844-1890), druggist in San Francisco, and later on in New York, pharmaceutical manufacturer, one of the founders of and professor at the California College of Pharmacy. See Pharm. Era. 4:21, 1890; Druggist's Bulletin, 4:36, 1800.

Papyrus. 1. The name of a tall sedge, Cyperus papyrus, which grows along the banks of the Nile. 2. The name applied to a paper-like material on which the ancient Egyptians painted their hieroglyphics. 3. The name applied to the manuscripts (pl. papyri) thus prepared. Compare Papyrus Ebers, Papyrus Brugsch, Papyrus Smith, etc. See J. E. Mitchell: The Egyptian Papyrus, Past and Present. Scientific American,

1904, p. 484; D. A. Willy, How Mud Chokes the Nile River, 1909, p. 177.

Paracelsus, Aureolus Philippus (or with his original name, Theophrastus Bombastus of Hohenheim) (1493-1541), a Swiss-German physician, whom William Osler in The Evolution of Modern Medicine, New Haven, 1923, p. 135, calls "the Luther of Medicine, the very incarnation of the spirit of revolt." His importance to pharmacy lies in his studies of drugs and their effects leading to the systematic introduction of metals into internal therapy and the dawn of pharmaceutical chemistry. See J. M. Stillman: Paracelsus, Chicago, 1920.

Parke, C. H. (died in 1899). One of the founders of Parke, Davis & Company, Detroit. See Amer. Journ. Pharm., 71:208, 1899.

Parke, Thomas (1749-1835), well-known Philadelphia medical practitioner. See J. A. Spalding: Life of Dr. Lyman Spalding, Boston, 1916, p. 354.

Parkinson, John (1567-1650), English apothecary and botanist, author of several treatises on botany. Parkinson was appointed apothecary to King James I who honored the learned man by the title Botanicus Regius Primarius. See Dictionary (English) National. Biography, **XLIII,** p. 315.

Parmentier, Jean Antoine Augustin (1737-1813), French apothecary. He introduced potatoes into France and popularized their use as food. He investigated milk and published a number of fundamental treatises about foodstuff chemistry.

Parrish, Edward (1822-1872), Philadelphia pharmacist and professor at the Philadelphia College of Pharmacy. See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 404; Amer. Journ. Pharm., 45:225, 1873.

Pasteur, Louis (1822-1897), French chemist and finally director of the Paris Institut Pasteur founded to carry on his researches. Although his purely bacteriological work is his most important contribution to science and public welfare, it should not be overlooked that Pasteur with his first investigation, his conversion of dextrotartaric acid into the inactive forms and his discovery of the splitting up of racemic acid into dextro and laevo tartaric acid, laid the foundation for modern stereochemistry. See Garrison: History of Medicine, Philadelphia, 1929, p. 575; Sigerist: The Great Doctors, New York, 1933, p. 360.

Pastophori. Egyptian priests who carried about the images of their deities in a little shrine for the purpose of collecting alms.

Patin, Guy de (1601-1672). French physician and head of the antiparacelsist group of the French medical world of that time, especially of the medical faculty of the University of Paris. See Fr. R. Packard: Guy Patin and the Medical Profession in Paris in the 17th Century, New York, 1925.

Patrons of pharmacy. See Deities, and Christian Saints.

Patterson, Robert (1748-1824), Irish-born American mathematician, general in the American Army during the Revolutionary War. See Dictionary of American Biography, **XIV,** p. 305.

Paullini, Christian Franz (1643-1712), German physician. Besides his famous Dreckapotheke Paullini wrote numerous books on a multitude of subjects, containing "approximately 18,000 printed pages." See Leo Kauner: Christian Franz Paullini, Medical Life, 41:231, 1934.

Pelletier, Joseph (1788-1842), French pharmacist and the first and most successful investigator in the field of alkaloids after Sertürner, q.v. He discovered, together with Caventou, q.v., strychnine in 1818, brucine in 1819, quinine and cinchonine in 1820, caffeine (simultaneously with Robiquet and Runge) in 1821. In cooperation with Dumas, q.v., he discovered narceine, thebaine and pseudomorphine.

Pemberton, Henry (1694-1771), English physician, pupil of Boerhaave, author of several books on medicine, physics and chemistry. See Dictionary of National (English) Biography, **XLIV:** p. 280.

Penn, William (1644-1718), English Quaker, statesman and founder of Pennsylvania. See Dictionary of American Biography, **XIV,** p. 433.

Pereira, Jonathan (1804-1853), English apothecary, physician and finally professor of materia medica at the School of Pharmacy of the Pharmaceutical Society of Great Britain. See Amer. Journ. Pharm., 25:287, 1853.

Perkin, Sir William Henry (1838-1907). In 1856, Sir William discovered aniline mauve in the course of attempts to prepare quinine artificially. This aniline dyestuff, although preceded by the emeraldine of Runge, opened the way for the dyestuff industry with all its side-

lines. See H. Goodman: William Henry Perkin, Medical Life, **42**:151-162, 1935.

Perkins, Elisha (1741-1799), American physician. See Dictionary of American Biography, **XIV**, p. 466.

Persia. Ancient Persia had its period of highest development between 600-330 B.C. (Kyros to Darius III) and included the land southeast of the Caspian Sea, Mesopotamia, Asia Minor, and Egypt. As to medicine and pharmacy in ancient Persia see Tschirch's Handbuch der Pharmakognosie, Leipzig, 1910, **1**: part 2; T. Berendes: Die Pharmazie bei den alten Kulturvölkern, Halle, 1891; H. Schelenz: Geschichte der Pharmazie, Berlin, 1904; C. Elgood: Medicine in Persia, New York, 1934. As to recent pharmaceutical practice in Persia see George Cecil, How pharmacy is practiced in Persia (Iran), Pharm. Era: 57:43, 1923.

Personnel English	German
Apprentice (French: Elève)	Lehrling Lehrbursche
	Lehr-Junge Lehr bube Tyro[1]
Assistant (French: Compagnon-Apothicaire)	Assistent Geselle Subject[1] Adjunkt[1] Defectar[2] Defectuar[2] (Latin: Defectuarius)
Prescription clerk	Receptar
Dispenser	Receptuar (Latin: Receptuarius)
Dispensing lady	
Manager	
	Stoesser[3] Laborant[4] Kalefactor[5]
Relief clerk	Vertreter
	Lagerist[6]
Porter Janitor	Hausknecht
Errand boy	Laufbursche

[1] Designation Common in Austria rather than in other parts of Germany.

Peters, Hermann (1847-1920), German apothecary and historian of pharmacy. Of his many publications especially the books "Der Arzt und die Heilkunde in der deutschen Vergangenheit" and "Aus pharmaceutischer Vorzeit" gained widest acknowledgment. The greatest part of the sketches, contained in Volume I of "Aus pharmaceutischer Vorzeit" has been translated into English and with some changes and additions published by William Netter under the title "Pictorial History of Ancient Pharmacy." See Introduction to Peters: Aus der Geschichte der Pflanzenwelt in Wort und Bild, Gesellschaft für Geschichte der Pharmazie, Mittenwald, 1929.

Pettenkofer, Max Joseph von (1818-1901), German apothecary and professor of medicinal chemistry at the University of Munich. He is considered the father of modern hygiene.

Pharmaceut. German for pharmacist, q.v. Also spelled Pharmazeut, q.v.

Pharmaceutical chemist. English title, introduced by the Pharmacy Act of 1852. American degree, introduced by the Pharmacy School of the University of Michigan in 1869. American manufacturers (Amer. Asso. of Pharm. Chem.).

Pharmaceutische Monatsblätter. See also Annalen der Pharmacie.

Pharmaceutist. See pharmacist.

Pharmacien. French for pharmacist, q.v. Succeeded apothicaire. For some time there were two groups of "pharmaciens," the Pharmacièn à première classe, entitled to open a pharmacy without restriction, and the Pharmacièn à seconde classe, allowed to operate a pharmacy only in the district in which he had passed his examination.

Pharmacist. See Titles.

Pharmacist, from Greek pharmakon (remedy) and -ist, pertaining to, a maker of or dealer in remedies. Also title of pharmaceutical textbooks, etc., and journals. Compare pharmacopoeus and pharmacopolus. See also French pharmacien and German Pharmaceut or Pharmazeut. Compare also Pharmaceutical Chemist.

[2] The person who attends to the work in the laboratory. As opposed to the Receptar.

[3] One who comminutes drugs.

[4] A laboratory worker.

[5] A person somewhat between "Stoesser" and "Laborant."

[6] Person in charge of the stock.

Pharmacopèe. See Pharmacopoeia.

Pharmacopoeia. From the Greek word pharmakon (remedy), and poiein (to make). As the title for a formulary it was first used by Jacques du Bois (Sylvius) in his "Pharmacopoeae, libri tres," printed in Lyon in 1548, and Piacotomus—Bretschneider in his "Pharmacopoea in Compendium Redacta," printed in Antwerp in 1560. The spelling varies in different countries: pharmacopoea, pharmacopea, pharmacopoee, pharmaecopee, farmacopea, farmacopen, farmacopee, farmacopoea, farmakop. Earlier treatises on the preparation of medicaments were also known under the following designations: antidotarium, apotteck, codex, codigo, concordantia, concordia, dispensatorium, enchiridion, formularium, gyógyserkönyi, ljekopis, lumen, luminare, methodus, officina, ratio, receptarium, recettario.

Whereas the two earliest pharmacopoeias mentioned were issued in private initiative, since the 17th century the designation pharmacopoeia has been mostly restricted to treaties issued authoritatively.

Pharmacopoeus, pl. -i, Latinized form of the Greek pharmakopoeos, q.v., maker of remedies. Compare medicamentarius.

Pharmacopola. Latinized form of pharmakopolos. See also pharmacopolus.

Pharmacopolae circumforaneae, itinerant venders of remedies, the Latinized form of the Greek pharmakopoloi, q.v., and circum-foraneus, of or around the forum or market. They traveled from market to market. Compare German Marktschreier. Contrast Sellularii.

Pharmacopolus, pl. -i. Latinized form of the Greek pharmakopolos, q.v. See also pharmacopola.

Pharmacotritae }
Pharmacotribae } drug grinders.

They are said to have been employed by the seplasiarii, q.v. Compare Rhizotomoi, also modern drug millers.

Pharmacy. From pharmakon (remedy). 1. The art and science of the pharmacist; 2. his place of business (synonymous with apothecary shop); and 3. the title of books dealing with the art or science or both. See French pharmacie, German Pharmazie and Pharmacie, Italian farmacia, etc.

Ph-ar-maki, related to Pharmagia, the art produced by magic, i.e., magic. In Duemichen: Die Flotte einer aegyptischen Koenigin, (plate XXXI) the ibis-headed god Duhit is represented by the hieroglyphic symbol of the later Egyptian ph-ar-maki, for pilot, i.e., conveyor of security (against disease). He is one of the Egyptian deities to whom healing qualities were attributed. The ibis, q.v., was sacred to him and he was represented as cynocephalus (dog-headed). For further details see Schelenz: Geschichte der Pharmazie, Berlin, 1904, p. 32.

Pharmakon. The Greek word from which many modern terms pertaining to pharmacy have been derived. It, in turn, however, has more recently been traced to the Coptic Ph-ar-magia (See Ph-ar-maki). The meaning of the Greek word developed from that of a charm or magic agency, exerted by means of plants with healing but often also with poisoning effect (Homer) to that of a remedy without any collateral significance. Often the designation was restricted to purgatives in a real as well as in a figurative sense. Pharmacoi was the name applied to the two human scapegoats who in early Athens were driven out at the Thargelia feast (the feast of the first bread made of fresh grain) as a symbol of the purification of the city from all evil. These men were considered as personified pharmakon, in the meaning of a purifying purgative, hence the name. In addition the word pharmakon meant dyestuff. See Walter Artelt; Studien zur Geschichte der Begriffe "Heilmittel" und "Gift" in Studien zur Geschichte der Medizin, Leipzig, 1937.

Pharmakopoeos, pl.-oi, maker of remedies, from the Greek pharmakon (remedy) and poiein (to make). Compare also Pharmacopoeia, a book that treats of the making of remedies, also Pharmacopoloi. See French pharmacien, English pharmacist and pharmaceutist, German Pharmaceut or Pharmazeut.

Pharmakopolos, seller of remedies, from the Greek pharmakon (remedy) and polein (to sell).

Pharmazeut. German for pharmacist, q.v. Also spelled Pharmaceut, q.v.

Philiatrus, Evonymus. See Gessner.

Phlogiston theory. See Chemistry, History of.

Pigmentarius. pl.-i. from pigmentum (paint, also used to designate ointment or pigmented paste and a plant juice) and -arius, meaning pertaining to, i.e., makers of colored cosmetics.

Pill. Latin pila (ball).

Pitt, Robert (1653-1713). English physician and author of a pamphlet "Craft and Frauds of Physik Exposed" (1703). See Dictionary (English) National Biography, **XLV,** p. 346.

Plato (427-347 B.C.). Famous Greek philosopher, pupil of Socrates and teacher of Aristotle. The main thesis of Plato was the distinction between self-moving forces and that which is moved. The former are immortal, the latter are mortal and die after losing the activating principle. Thus the soul as a self-moving force is immortal, the body moved by the soul, mortal. Every phenomenon has its self-moved "idea" and is the more alive or perfect the more it approaches this idea. As to the contrast between Plato and Aristotle in their attitudes toward natural science see H. Silvette: Medicine in Utopia, Bulletin of the History of Medicine 7:1013, 1939; G. Kasten Tallmadge: Misconception of a Utopia, Ibid., 8:666, 1940; and L. Edelstein: Platonism or Aristotelianism? Ibid., p. 757. The question has been furthermore discussed by P. Shorey: Platonism and the History of Science, Proceedings of the American Philosophical Society, 66:161, 1927.

Platearius, Matthaeus (12th Century), descendant of a well known Salernitan family of physicians and a renowned physician himself, author of the "Circa Instans," q.v., and of the enlarged and annotated Salernitan Antidotarium Nicolai.

Pliny. (23-79 A.D.) Author of the most comprehensive known natural history in antiquity. See Pliny, Natural history, with an English translation by H. Rackham, London, 1938; John Bostock and T. H. Riley: The natural history of Pliny (Bohn's classical library), London, 1855-57; M. E. Littre: Histoire naturelle de Pline, avec la traduction en francais, Paris, 1877; K. C. Bailey, The elder Pliny's chapters on chemical subjects, London, 1929-32.

-poeos, Greek ending signifying maker, from poiein (to make). See Pharmacopoeos, Myropoeos.

-polos, Greek ending signifying seller, from the Greek polein (to sell). See Migmatopolos, Pharmacopolos.

Poor, Enoch (1736-1780), general in the American Army during the Revolutionary War. See Dictionary of American Biography, **XV,** p. 69.

Porter. See Personnel.

Potts, Jonathan (1745-1781). American physician, serving in the Revolutionary War as Deputy Director General and later on as head of the purchasing department for all medical supplies. See L. C. Duncan: Medical Men in the American Revolution, Carlisle, 1931, p. 184; Dictionary of American Biography, **XV,** p. 137.

Papyrus Ebers. Bibliography: George Ebers: Die Masse und das Kapital Ueber die Augenkrankheiten, Abhandl. der philol.-histor. Classe der kgl. Saechs. Gesellschaft der Wissenschaften, **XI,** No. 2, Leipzig, 1889; George Ebers: Das hermetische Buch über die Arzneimittel der alten Aegypter in hieratischer Schrift, Leipzig, 1875; H. Joachim: Papyros Ebers, translation into German, Berlin, 1890; Walter Wreszinski: Der Papyrus Ebers, Umschrift Übersetzung und Kommentar, Leipzig, 1913; B. Ebbel: The Papyrus Ebers, translated from W. Wreszinski's hieroglyphic transcript into English Oxford, 1937.

Power, Frederick B. (1853-1927). Power belongs to the American pharmacists who completed their professional education by studying at German universities. Organizer and first dean of the School of Pharmacy at the University of Wisconsin, scientific director of the Fritzsche Brothers laboratories in New Jersey, 1892-1896, director of the Wellcome Research laboratories in London (England) 1896-1914, and head of the phytochemical laboratory of the U. S. Department of Agriculture, 1916-19, Power became one of the world's best known research workers in the field of phytochemistry. See J. W. England: First Century of the Philadelphia College of Pharmacy, 1922, p. 410; The Badger Pharmacist, 1936, No. 16; Journ. Amer. Pharm. Asso., 16:380, 1927; Amer. Journ. Pharm., 96:601, 1924, containing a chronological record of Power's scientific contributions.

Powers, Justin L. (1895-), pharmaceutical teacher and research chemist. Since 1940 Director of the Research Laboratory of the Pharmaceutical Institute in Washington, D. C. See American Men of Science, 1938, p. 1135.

Powers, Thomas H. (1812-1878), Philadelphia retail and wholesale druggist, became (1838) partner of John Farr in the business later known as Powers and Weightman. See J. W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 33.

Prescott, Alfred Benjamin (1832-1905). Without any drugstore practice the

physician Prescott became closely connected with American pharmacy and as dean of the University of Michigan School of Pharmacy one of its most progressive teachers. He was author of several textbooks and a member of the United States Pharmacopoeia convention from 1880 to the time of his death. See Oscar Oldberg: A. B. Prescott, Amer. Journ. Pharm., 77:251, 1905.

Prescription Clerk. See Personnel.

Priestley, Joseph (1773-1804), English clergyman, chemist, physicist and author. In spite of the fact that he not only in 1774 had discovered oxygen (by concentrating the sun's rays upon mercuric oxide by means of a lens) but has proved it to be necessary for the process of respiration, he remained a follower of the phlogiston theory of Stahl, q.v. Priestley called the gas which he had discovered "dephlogisticated air." The part of Priestley and Lavoisier, q.v., in the discovery of oxygen has been described by Douglas McKie in his book on Antoine Lavoisier, published at Philadelphia in 1935. As an ardent admirer of the French Revolution Priestley had to leave England and lived from 1794 until his death in Northumberland in Pennsylvania. See W. Cameron Walker, The Beginnings of the Scientific Career of Joseph Priestley, Isis 21:81, 1934; Craven-Hartog, Date and Place of Priestley's Discovery of Oxygen, Nature, 132:25, 1933; Anne Holt: A Life of Joseph Priestley, Oxford, 1931. See also Chemistry, History of.

Procter, William, Jr. (1817-1874), one of the most eminent of American pharmacists. Proctor was the ninth child of an English-born Quaker and entered pharmacy when the early death of his father forced him to devote himself to a calling. At the age of 20 he graduated from the Philadelphia College of Pharmacy. Only 4 years later he acted as secretary to the Committee on Revision of the U. S. P. In 1844 he opened a drugstore which he conducted for many years besides carrying on his comprehensive and successful work as experimenter, teacher, and author. In 1846 he became professor of pharmacy —the first in the U. S.—at the Philadelphia College of Pharmacy. From 1850-1871 he was the sole editor of the American Journal of Pharmacy. He published the first textbook on pharmacy, compiled by an American pharmacist for American students of pharmacy. Not less than 550 original articles in the Amer. Journ. Pharm. bear witness to Proctor's indefatigable industry. His early and consistent endeavor in behalf of professional American pharmacy was recognized by his contemporaries as well as by posterity by calling him "The father of American Pharmacy." See J. W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 402.

Prometheus, a deified Titan who saved mankind from darkness by bringing fire from heaven. He was said to have embodied his medical knowledge in charms.

Proust, Joseph Louis (1754-1826), French apothecary. He discovered mannite (1806) and leucin (1819) and found the element nickel in meteoric iron (1799).

Puckner, W. A. (1864-1932). Active pharmacist, later professor at the Chicago College of Pharmacy and consulting chemist. In 1907 he became director of the American Medical Association Chemical Laboratory. See Journ. Amer. Pharm. Asso., 21:1115, 1932; Industrial and Engineering Chemistry News Edit., 10:255, 1932.

Pulvis, pl. pulveres. In classical Latin, powder, dust. Contrary to coarsely comminuted drugs or species, the finely comminuted ones were designated pulveres. Powdering drugs facilitated their administration. Even today mortar and pestle are the symbol of the art of the apothecary. The early pharmacopoeias designated as such a special class of preparations. With the advance of iatrochemistry, the term was also applied to mineral preparations in powder form, e.g., Allgaroth powder. So far as vegetable preparations are concerned, it was applied to mixtures as well, e.g., Pulvis Opii compositus (Br.) and other mixtures contained inorganic chemicals (Pulvis infantum=Pulvis Rhei compositus) or organic chemicals (Tully's Powder=Pulvis Morphinae compositus).

Q

Quercetanus. See Quesne, Joseph du.

Quesne Joseph du, latinized Quercetanus, (1544-1609), French physician and medical author. As a follower of Paracelsus, q.v., he recommended chemicals as remedies, especially antimony and mercury preparations without, however, neglecting galenicals. He was the first to employ calomel and sulphurated antimony.

Quincy, John (died in 1722). English apothecary, later physician, and very successful author on medical and pharmaceutical subjects. See Dictionary (English) National Biography, **XLVI,** p. 112.

Quintessence. This term, used by Paracelsus for preparations which he considered to represent the most perfect extract of the essential contents of the raw material, has been derived from the fifth (Latin quinta = five) essence, added by the Pythagoreans to the four elements of the ancient Greeks, thought to be a most subtle "ether," a kind of immaterial radiation of the material world.

R

Rafinesque, Constantine Smaltz (1784-1841), French-born botanist residing in Philadelphia. He wrote several books on history, botany and science, of which his treatises on medical botany were of greatest influence on American Eclectic Medicines. See Dictionary of American Biography, **XV,** p. 322. Alexander Wilder, History of Medicine, New Sharon, Maine, 1901, pp. 421-432, 438, 439.

Raimes, Richard (1797-1888), English chemist and druggist. See Pharm. Journ., 47: 698, 1888.

Ratio. See Pharmacopoeia.

Raubenheimer, Otto (1867-), German-born Brooklyn pharmacist, original member of the "Gesellschaft für Geschichte der Pharmazie," pharmaceutical historian, author, editor, and teacher. See N. Y. Apoth. Ztg., 47:2, February, 1927.

Receptar. See Personnel.

Receptarium. See Pharmacopoeia.

Receptarius. See Personnel.

Receptuar. See Personnel.

Recorde, Robert (about 1510-1558), English physician and mathematician. See Dictionary of (English) National Biography, **XLVII,** p. 368.

Redman, John (1722-1808), well-known Philadelphia physician. See W. S. Middleton; John Redman, Annals of Medical History, 8:213, 1926; Dictionary American Biography, **XV,** p. 443.

Redwood, Theophilus (1806-1892). English chemist and druggist, editor of the Pharmaceutical Journal and professor of chemistry and pharmacy to the Pharmaceutical Society of Great Britain. He edited an enlarged translation of Friedrich Mohr, q.v., Lehrbuch der Pharmaceutischen Technik. See Amer. Journ. Pharm., 64:223, 1892.

Relief Clerk. See Personnel.

Repertorium für die Pharmacie. (1815-1876.) In 1851 the title was changed to "Neues Repertorium für die Pharmazie.

Rhizotomos, pl.oi, literally root cutters, from the Greek rhiza (root); temnein (to cut). The name was also applied to collectors of indigenous drugs.

Rice, Charles, German-born American pharmacist (1841-1900). Rice was apothecary at the Bellevue Hospital in New York and not only an excellent chemist but a man of broadest cultural and scientific background. His phenomenal knowledge of languages gave him the opportunity of keeping himself informed of the progress in pharmacy all over the world and facilitated the reform of the United States Pharmacopoeia, effected under his chairmanship. See Proc. Amer. Pharm. Asso., 49:45, 1907; John Uri Lloyd: Dr. Charles Rice, Journ Amer. Pharm. Asso., 25:1143, 1936.

Ricettario. See Pharmacopoeia.

Robbia, della, Florentine sculptors of the 15th century. Of the two brothers especially Luca della Robbia (1400-1482) became famous because of his enameled terra-cotta sculptures.

Robinson, James S. (1849-1923), druggist in Memphis and active in a series of commercial undertakings. See Journ. Amer. Pharm. Asso., 12:742, 1923.

Robiquet, Pierre Jean (1780-1840), French apothecary. He was one of the most successful phytochemists and found asparagine simultaneously with Vauquelin in 1805, narcotine in 1817, caffeine in collaboration with Pelletier and simultaneously with Runge in 1821, alizarin in collaboration with Colin in 1826, amygdalin in 1830, codeine in 1832.

Rochambeau, Jean Baptiste Donatien de Vimeur, Count de (1725-1807). Rochambeau was Marshal of France and commander in chief of the French auxiliaries supporting the Americans during the Revolutionary War.

Rokitansky, Carl (1804-1878). Bohemian physician and academic teacher in Vienna. Virchow called him the ablest descriptive pathologist of his time. See Garrison: History of medicine, Philadelphia, 1929, p. 432; Sigerist: The Great Doctors, New York, 1933, p. 291.

Rolfink, Werner (1599-1673), German physician. In his book "Chymia in artis formam redacta" he attacks the claims of alchemy.

Rondelet, Guglielmo, French physician and academic teacher at the University of Montpellier as well as practising apothecary (1507-1566). Besides his Methodus de Materia Medicinali et compositione Medicamentorum, he wrote several books of which Liber de Ponderibus (Book of Weights) lived to see several editions.

Rother, Reinhold (1843-1889), German-born American druggist, and writer on pharmaceutical subjects. See Amer. Journ. Pharm., **61**:639, 1889.

Rotheram, John (1750-1804), professor of natural history at St. Andrews University, Scotland. See Dictionary of National (English) Biography, **XLIX,** p. 300.

Rotuli. Latin rotula, a little wheel. Wheel-shaped lozenges. See Morsuli.

Rouelle, Guillaume François (1703-1770), French apothecary and chemist. He was the teacher of Lavoisier and one of the most eminent and diligent chemical authors of his time. He originated the chemical definition of the concept salt. See Chemistry, History of.

Rouelle, Hilaire Marie (1718-1778), French apothecary. He was the younger brother of Guillaume François Rouelle, q.v., and a chemist of high merit. He discovered urea (1773), hippuric acid (1776), recognized the iron content of the blood and found natural sulfide of hydrogen.

Rousseau, Georges Louis Claude (1724-1794), German apothecary of French descent and professor of chemistry at the University of Ingolstadt. Lecturing in the laboratory connected with his apothecary shop he was one of the first teachers of chemistry who, before Liebig, accompanied his lectures by experiments and gave his students an opportunity for individual experimental work.

Ruddiman, Edsel A. (1864-), pharmaceutical teacher, from 1901-1914, U. S. food and drug inspector, research chemist, author. See Who's Who in America, **20**:2157, 1938. American Men of Science, 1938, p. 1217.

Ruellius. See Ruelle.

Ruelle, Jean de, latinized Ruellius, (1474-1537), French physician, canon, and writer on botanical and medical subjects. His translation of Dioscorides' materia medica appeared in 1549 with annotations of Euricius and Valerius Cordus (father and son). Of his further translations that of the Byzantine physician Johannes Actuarius' book De Compositione Medicamentorum became especially noted.

Runge, Friedlieb Ferdinand (1794-1867), German apothecary. He discovered aniline, which he called Kyanol, in coal tar (1834) and simultaneously carbolic acid, rosolic acid and other chemicals contained in the same substance. This was the beginning of coal tar chemistry. It was likewise he who showed the way to produce dyestuffs with aniline as base. He discovered caffeine (1821). It is of interest to note that aniline had previously been prepared from indigo, first by means of dry distillation by Unverdorben, who called it Krystallin (1826) and then by treating Indigo with potassium hydroxide by Fritzsche (1841). The designation "aniline" was coined by Fritzsche from the Spanish word Anil-indigo. Aniline was prepared by Zinin by reduction of nitrobenzene with ammonium sulfate (1841). Zinin called his product Benzidam. In 1843 A. W. Hofmann recognized the identity of all these products.

Rusby, Henry H. (1855-1940), M. D., botanist, professor at the N. Y. College of Pharmacy, 1888-1920. See J. W. England: First Century of the Philadelphia College of Pharmacy, p. 219.

Rush, Benjamin (1745-1813). Rush was "probably the ablest American Medical man that the times produced." He excelled as physician, and as a teacher of medicine and chemistry. His syllabus of chemistry was the first textbook published by an American in America. See L. C. Duncan: Medical men in the American Revolution, Carlisle, 1931, p. 186; Dictionary of American Biography, **XVI,** p. 227.

Ruth, Robert J. (1891-1931), retail pharmacist, teacher, organizer and leader in industrial pharmaceutical service, "Father" of American pharmacy week. See Journ. Amer. Pharm. Asso., **20**:725, 1931.

S

Sadtler, Samuel P. (1847-1924), professor of Chemistry at Pennsylvania College, then at the University of Pennsylvania College, then at the University of Pennsylvania and the Philadelphia

College of Pharmacy. See Amer. Journ. Pharm., 96:134, 1934.

Sal oleosum volatile. A preparation under this name was introduced into medicine by François de le Boe, called Sylvius (1614-1672). According to Trommsdorff it was "nothing else than an alcoholic solution of ammonia and some volatile oils." See J. B. Trommsdorff: Die Apothekerkunst in ihrem ganzen Umfange, Erfurt, 1810, III, p. 363.

Salmon, William (1644-1713), English empiric, who wrote several books and pamphlets on medical subjects. See Dictionary of National (English) Biography, 50: p. 209.

Santorio, Santorio, called Sanctorius (1561-1636), Italian physician and academic teacher at Padua. See Garrison: History of Medicine, Philadelphia, 1929, p. 260; Sigerist: The Great Doctors, New York, 1933, p. 150.

Savory, John (1800-1871), English apothecary. See Pharm. Journ., 31:319, 1871.

Sayre, Lucius E. (1848-1925), retail druggist in Philadelphia, later professor at the School of Pharmacy of Kansas State University. See Journ. Amer. Pharm. Asso., 8:3, 1919; J. W. England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 260.

Scammon, Frederick (1810-1864), physician and druggist, professor of botany at the University of Chicago. See the Alumni Record of the University of Illinois, 1921, p. 431; Amer. Journ. Pharm. 36:277, 1864.

Scheele, Carl Wilhelm (1742-1786), one of the greatest chemists of all times, who never left the pharmaceutical profession and made all his discoveries in the laboratories of the pharmacies in which he worked, in the last eleven years of his life first as manager and then as owner of the pharmacy in the small town of Koeping (Sweden). Of inorganic acids, Scheele discovered arsenic (1771-1772), hydofluoric (1771), molybdic (1778), tungstic (1778); of organic acids citric (1784), gallic (1770), lactic (1780), malic (1784), mucic (1780), oxalic (1770), pyrogallic (1770), tartaric (before 1768), uric (1776). He identified baryta (1771-1774), chlorine (1774), glycerin (1783), manganese (1773), and milk-sugar (1780), discovered oxygen (prior to 1773), hydrochloric acid gas (1770), ammonia (1770), arsenetted hydrogen (1775), and ascertained the chemical nature of sulfuretted hydrogen (1768). Among the new processes he invented are of special interest those for preparing phosphorus (1770), calomel (1774), and benzoic acid (1775). See George Urdang: The Apothecary Chemist, Carl Wilhelm Scheele, Madison, Wis., 1942.

Schelenz, Hermann (1848 in Kempen, Germany; died 1922 in Cassel). Passed the "Staatsexamen" (state board examination) as "Apotheker" in 1873. Proprietor of a pharmacy in Rendsburg, Schleswig, from 1875 to 1893. Frequent contributor to pharmaceutical journals, more particularly on historical subjects. Author of the following books:—

1904. Geschichte der Pharmazie, q.v.

1913. Zur Geschichte der pharmazeutisch-chemischen Destilliergeräte.

1914. Shakespeare und sein Wissen auf dem Gebiete der Arznei-und Volkskunde.

Was awarded the honorary M.D. by the University of Freiburg in 1920. Honorary member of the Amer. Pharm. Asso. since 1912. For a more detailed account of his life work, see Pharm. Ztg., 67:841, 1922 and especially Walter Zimmermann: H. Schelenz' Lebenswerk, in Pharm. Monatshefte, 4:137, 1923. The last essay by Schelenz to be published before his death was devoted to "American apothecaries in literature," Pharm. Zeitung, 67:371, 1922.

Schieffelin, Henry H. head of the New York wholesale drug firm W. H. Schieffelin & Co. (at that time called H. H. Schieffelin & Co.) from 1814 to 1849. See One Hundred Years of Business Life, 1794-1894. W. H. Schieffelin & Co., New York.

Schlotterbeck, Julius Otto (1865-1917), one of the American pharmaceutical teachers, who studied at German or Swiss universities. He taught pharmacognosy at the University of Michigan and wrote a number of scientific papers. Later he took up industrial work. See Amer. Journ. Pharm., 89:336, 1917.

Schmidel, Ulrich (16th century). See Schmidel: Reise nach Süd-Amerika in den Jahren 1534-1554, edited by V. Langmantel in 1889.

Schmidt, Ernst Albert (1845-1921), German apothecary and professor of pharmacy at the University of Marburg. Schmidt specialized in alkaloid chemistry. His "Ausführliches Lehrbuch der pharmazeutischen Chemie" is highly

regarded and went through several editions.

Schoepf, Johann David (1752-1800), German physician and botanist. See H. Peters: Joh. David Schoepf, Pharm. Rundschau, 13:151, 1895.

Schulze, F., German military apothecary in 1914-1918. See Devin: Die deutschen Militaerapotheker im Weltkriege, Berlin, 1920.

Scotch Pills. The pills contain, according to a formula published by the Philadelphia College of Pharmacy in 1833, aloes, soap, colocinth, gamboge, oil of anise. See Journal of the Philadelphia College of Pharmacy, 5:25, 1833.

Scott, John Morin (1730-1784), American general in the Revolutionary War, lawyer and one of the leading revolutionary spirits. See Dictionary of American Biography, **XVI,** p. 495.

Scoville, Wilbur L. (1865-), pharmaceutical teacher, from 1907-1934 research pharmacist with Parke, Davis and Co. and since 1924 head of the analytical department of the firm, author, editor. See American Men of Science, 1938, p. 1263; Who's Who in America, 20: p. 2221.

Scribonius Largus, (1st century A.D.). A Roman physician. The cognomen Largus is presumably derived from Latin largiri and means the liberal giver. The formulary of which he is the author was printed in several editions between the 16th and the 18th centuries under different and sometimes quite arbitrary titles.

Sealsfield, Charles, pen name of the German-Moravian born writer Karl Anton Postl, (1793-1864). With his novels, describing American life and people during the first half of the eighteenth century he created a new type of fiction, the enthnographical novel. See Dictionary American Biography, **XVI,** p. 532.

Seaman, Valentine (1770-1817), New York physician and promoter of vaccination. See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 842.

Seau, du. See Dusseau.

Sellularius, pl. -i, from Lat. Sellula, a little seat, and -arius, pertaining to. People who had sedentary occupations or trades. Hence, stationary venders of remedies, as contrasted with pharmacopolae circumforaneae, q.v. They were also called seplasiarii, q.v.

Seplasiarius, from seplasia, a street in Capua where unguent (Possibly also frankincense and other Oriental drugs) were sold, and -arius, pertaining to. Compare Sellularius.

Sertürner, Friedrich Wilhelm Adam (1783-1841), German apothecary, who became famous by his discovery of morphine as the principium somniferum (somniferous principle) in opium. His first publications about "Meconic Acid," which also contained his discovery of the first alkaloid to be prepared in a pure state, appeared in 1805 and 1806 in Trommsdorff's Journal der Pharmazie, q.v. The fact that he discovered the basic nature of the substance called by him morphium, made him the pioneer of alkaloid chemistry. See Franz Kroemecke, Fr. W. Sertürner, Jena, 1925.

Sérullas, Georges Simon (1774-1832), French apothecary. He discovered iodoform (1822) and produced several new compounds of bromide.

Seumenicht. See Mynsicht.

Sharp, Alpheus Pireas (1824-1909), one of the founders of the firm of Sharp and Dohme, Baltimore. It is remarkable that "Mr. Sharp read the first scientific paper before the American Pharmaceutical Association, and . . . that the identical paper was read again at the annual meeting held fifty years later." See American Durggist and Pharmaceutical Record, 54:352, 1909.

Sheppard, S. A. D. (1842-1915), Boston druggist and for 22 years treasurer of the Amer. Pharm. Asso. He collected the "Sheppard Library," consisting of about 2500 volumes among them about 300 pharmacopoeias of different countries and periods, which he bequeathed to the Massachusetts College of Pharmacy. See Bulletin of Pharmacy, 22:323, 1908; Journ. Amer. Pharm. Asso., 4:1515, 1915.

Shippen, William (1736-1808), American physician of high repute, who after his return from his study in Europe, began a course of lectures on anatomy even before the Philadelphia Medical College was founded, of which he became the first professor of anatomy and surgery. See L. C. Duncan, Medical Men in the American Revolution, Carlisle, 1931, pp. 276, 291-300; Dictionary of American Biography, **XVII,** p. 117.

Shoemaker, Robert (1817-1897). Philadelphia wholesale and retail druggist, pharmaceutical manufacturer. Shoemaker is believed to have been the first to manufacture glycerin in the United

States (1848). See England: First Century of the Philadelphia College of Pharmacy, p. 106.

Show glasses. There has been much conjecture about the origin of the peculiarly shaped bottles filled with colored liquids which have been used for a long time as a sign of pharmacy, especially in Anglo-Saxon countries. Attempts have been made to trace them back to antiquity. In fact there is no mention of this use anywhere before the 17th century. C. J. S. Thompson thinks there is probably a connection between these bottles and the carboys, use of which as means of transport and preservation of liquids became general at about the same time. (The Mystery and the Art of Apothecary, Philadelphia, 1929, p. 251.) It seems certain that the peculiarly shaped bottles filled with colored liquids originated with the early English chemist shops, the owners of which wanted to utilize the attractive power of the mysterious bottle (apparatus) as well as of the mysterious products (represented by the colored liquids) obtained from the new art of chemistry. Later on the druggists seized upon these signs as well as upon the production or at least the sale of medical chemicals until both groups merged into the united profession of chemist and druggist.

Simon, William (1844-1916), German-born and pharmaceutically educated apothecary, professor of chemistry at the Maryland College of Pharmacy, 1872-1902, at the College of Physicians and Surgeons of Baltimore, 1880-1916, and at the Baltimore College of Dental Surgery from 1888 to 1916, author of a well-known textbook. See Journ. Amer. Pharm. Asso., 5:886, 1916.

Simplicia, from the Latin simplex (simple), generic term for all those drugs not classified as composita, q.v. Lists of such simples were compiled very early. In the eleventh century Constantinus Africanus wrote his treatise De Gradibus Simplicium and in the twelfth century Matthaeus Platearius his famous Liber de Simplici Medicina Dictus Circa Instans. Later on such lists appeared in the pharmacopoeias, (after the 18th century chiefly under the title of materia medica). In general only such drugs were listed as simplicia as had not passed a process of preparation beyond that of comminution or purification. This principle was, however, not strictly followed. Thus the first U.S.P. (1820) mentions on the one hand prepared carbonate of lime, a purified simple drug, among the preparations, while on the other hand its materia medica presents "a catalogue of simple medicines together with some prepared medicines which are kept in the shop of the apothecary but not necessarily prepared by him."

Skoda, Josef (1805-1881). Bohemian physician and academic teacher in Vienna. He was the leading clinician of the so-called New Vienna School of medicine and the exponent of its therapeutic nihilism. See Garrison: History of Medicine, Philadelphia, 1929, p. 431; Sigerist: The Great Doctors, New York, 1933, p. 297.

Smith, Daniel B. (1792-1883), Philadelphia druggist. He was one of the founders of and leaders in the Philadelphia College of Pharmacy and a man of high scientific and literary attainments. See England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 353.

Smith, Elihu H. (1771-1798), New York physician, a founder of the Medical Repository (in 1796 in co-operation with S. L. Mitchill, q.v.) and writer not only on medical subjects but also of poetry. See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 842.

Smith, Peter (1753-1816), American preacher, farmer, and medical practitioner, the so-called "Indian Doctor." See Bull. Lloyd Library, No. 2.

Soubeiran, Eugène (1797-1858), French apothecary. Simultaneously with the American, Samuel Guthrie, q.v., and the German Justus v. Liebig, q.v., he discovered chloroform (1831). The trichlormethane found by them was called chloric ether by Guthrie, bichloric ether by Soubeiran and trichloride of carbon by Liebig. Dumas, in 1834, gave to it the name of chloroform, from formyl (CH) and (tri) chloride. Among his publications are two textbooks on pharmacy.

Spagiric, from the Greek spak (to rend) and ageirein (to collect). The term spagiric art used by Paracelsus as a synonym for chemistry means therefore, the art of separating and combining.

Spalding, Lyman (1775-1821), physician, the "Father of the U. S. P." See Journ. Amer. Pharm. Asso., 6:675, 1917; James A. Spalding: The Life of Dr. Lyman Spalding, Boston, 1916.

Species. From the Latin verb specio, to look, to behold, changed in its meaning from the abstract sight to the thing seen. Compare specimen. In late Latin it was specialized to mean goods, wares generally, e.g., wine, but more particularly spices and drugs. Hence speciarius, pertaining to species, Italian spetiali, speciaria, a female spice-dealer. In more modern pharmaceutical practice the designation species has been applied to mixtures of coarsely comminuted (cut or bruised) mixtures of parts of vegetable drugs, such as roots, barks, woods, leaves, flowers, stems, mosses and lichens, seeds and fruits. Occasionally gums or gum resins were added (Trommsdorff, Wörterbuch.) e.g., Species pectorales, German Brustthee, and Species laxantes, laxative tea. The designation tea, however, is also applied to unmixed vegetable drugs, e.g., senna tea (leaves), fennel tea (fruit), etc. In this sense it is also applied to tea par excellence, or Chinese tea, the leaves (or tips of leaves) of Thea chinensis, also to its substitutes, e.g., Jersey tea (the flowering tips of Monarda didyma) and American tea (the leaves of Ceanothus americana).

Speciaria, a female dealer in spices. See speciarius.

Speciarius, from spices, and -arius, pertaining to. As opposed to genus, the word species in botany is used to designate a kind. Compare the Latin specialiter (specifically). In late Latin the word was used to designate goods, wares, more particularly spices and drugs. pl. -i. Hence, pharmaceutically speaking, a dealer in drugs or spices, which were considered as drugs. See also specialus (spetialus), Italian spetiali, English spicer and French epicier.

Speck, William Alfred (1864-1928), American-born pharmacist of German descent, until 1913 owner of the New York pharmacy inherited from his father. From then until his death curator of the unique Goethe Collection created by him at Yale University. See Carl F. Schreiber: William Speck, in Memoriam, Yale University Library Gazette, 3:55, January, 1929.

Spiritus aromatici. Like the Aquae aromaticae, q.v., aromatic spirits were made by distillation of aromatic drugs with wine, spirits, or even stronger alcohol. Such a preparation was the Eau des Cannes, which was later introduced into the pharmacopoeias as Spiritus Melissae compositus. The terms Spiritus and Aqua were used interchangeably, as indicated by the Eau des Cannes mentioned. Spiritus Vini was commonly known as Aqua vitae. Today they are commonly prepared by the solution of volatile oils in alconol.

Squibb, Edward R. (1819-1900). He was physician. manufacturer, chemist and in his early days, from 1837 to 1842, apprentice in a drugstore. Squibb belongs to the great men who became equally important to pharmacy and medicine. See J. P. Remington: E. R. Squibb, Amer. Journ. Pharm., 73:419, 1901.

Squire, Peter (1798-1884), English apothecary. He was appointed chemist in ordinary in the court pharmacy of Queen Victoria and was one of the founders of the Pharmaceutical Society of Great Britain. See Amer. Journ. Pharm., 56:400, 1884.

Stahl, Georg Ernst (1660-1734), Professor at the University of Halle, later physician in ordinary to the King of Prussia and formulator of the phlogiston theory (see History of Chemistry). He developed the ideas of Becher, q.v., to a complete system and coined the name "phlogiston" (from Greek phlogizein=set on fire) for the hypothetical principle of combustion assumed by Becher. See Garrison: History of Medicine, Philadelphia, 1929, p. 312; Sigerist: The Great Doctors, New York, 1933, p. 183.

Starkey, (Stirk), George (about 1620-1665), American physician and the only American alchemist of note. He wrote under his own name and under that of Eirenaeus Philoponus Philalethes. See George Lyman Kittredge: Dr. Robert Child, the Remonstrant, Transactions of the Colonial Society of Massachusetts for 1919, 21:1-146, 1920; Isis, 9:440, 1927.

Stationarius, pl. -i, from Latin statio and -arius, of or belonging to a post or station. Compare the older sellularius. The term appears in the edict of Frederick II of 1240.

Stearns, Frederick (1832-1907), retail druggist first in Buffalo, then in Detroit and later on founder of the pharmaceutical manufacturing house of Frederick Stearns & Co. of Detroit. See Drug. Circ., 51:244, 1907.

Stillé, Alfred (1813-1900), Philadelphia physician and professor of medicine at the University of Pennsylvania. His Elements of General Pathology (1848),

represented the first American book on the subject. See Dictionary of American Biography, **XVIII**, p. 23.

Stirk, George. See Starkey, George.

Stoesser. See Personnel.

Stoughton's Elixir. The preparation, the composition of which has not become known, was called Stoughton's great cordial elixir. See A. C. Wootton: Chronicles of Pharmacy, London, 1910, **II**, p. 162.

Stuyvesant, Peter (1592-1672), last Dutch governor of New Netherland. See Dictionary of American Biography, **XVIII**, p. 187.

Subject. See Personnel.

Süddeutsche Apotheker-Zeitung founded in 1861 as "Pharmaceutisches Wochenblatt"; present title since 1886.

Sydenham, Thomas (1624-1689), English physician of great fame. Of special pharmaceutical interest is his popularization of Peruvian bark, iron tonics in chlorosis and the liquid opiate which bears his name. See Garrison: History of Medicine, Philadelphia, 1929, p. 269; Sigerist: The Great Doctors, New York, 1933, p. 175.

Sylvius. See: 1. Boe, François de; 2. Bois, Jacques du.

Sylvius, Franciscus, or François de le Boe Sylvius (1614-1672). A Dutch follower of Paracelsus. He prepared the scientific foundation for the application of chemicals in therapy preached by Paracelsus, hence may be regarded as the real founder of the iatrochemical school. He introduced the word and concept fermentation and by means of it explained the chemical changes that take place within the human body. Not only was the food converted into blood under the influence of the saliva and the glandular secretion but the blood itself was transferred by certain "ferments," into a so-called "ether" a hypothetical substance which according to this theory is responsible for the life processes. The ultimate products of these changes were acids and alkalines, the proper relation of which in the body guaranteed health. Disturbances produced the so-called acrimoniae, which were either acid or alkaline and were to be corrected by the administration of drugs of alkaline or acid character.

Symon, or Simon Januensis, (died in 1303). An Italian medical author. The cognomen Januensis means from Genoa.

T

Tabernaemontanus, See Johann Theodor. The word Tabernaemontanus means from Bergzabern, his birthplace.

Tabulae. Latin for board or plank, also tablet, diminutive for table. Comparable to our troches and lozenges.

Talbor, Robert, also called Talbot (1642-1681). Talbor started his career as an apprentice to the apothecary Dear in Cambridge, became a physician and, after having cured the English King Charles II with a decoction of cinchona bark, was appointed physician in ordinary to His Majesty. See C. J. S. Thompson: The Mystery and Art of the Apothecary, Philadelphia, 1929, p. 232; Wootton: Chronicles of Pharmacy, London, 1910, **II**, p. 97.

Taylor, Alfred B. (1824-1898), Philadelphia druggist. Taylor was the first treasurer of the Amer. Pharm. Asso., very active in the work of pharmacopoeial revision and belonged to the early American pharmacists who combined practical retail business and scientific work. See Proc. Amer. Pharm. Asso., 46:51, 1898; J. W. England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 207.

Terrell, Terril William (1778-1855), physician and twice a representative from Georgia to Congress, declining a re-election. See Biographical Congressional Directory, 1903, p. 837.

Thacher, James (1754-1844), American physician. Besides his American New Dispensatory he wrote some other books, among them an American Medical Biography. During his service in the Revolutionary Army, he kept a rather full journal, which is one of the most complete diaries of the war. See L. C. Duncan: Medical Men in the American Revolution, Carlisle, 1931, p. 262. Dictionary of American Biography, **XVIII**, p. 387.

Thénard, Louis Jacques (1777-1857), French chemist, academic teacher of chemistry at the College de France. He was made a baronet and a peer of France. Thénard is considered one of the founders of physiological chemistry. He discovered the element boron in 1808, and peroxide of hydrogen in 1818. He assumed catalytic processes as the reason for physiologic changes in plants and animals, explained the origin of esters and recognized grape sugar in the urine of diabetics.

Theodor, Johann (Jacob), called Tabernaemontanus (1510-1590), German apothecary, physician, and botanist. The first part of his New Vollkommentlich Kreuterbuch (new perfect herbal) was published in 1588, the second part after his death in 1613 by Caspar Bauhin, q.v.

Theodoric, Ostrogothic King of Italy with capital at Ravenna, (455-525). He tried to combine German customs and Greco-Roman culture. See Cassiodorus.

Theophrastus Bombastus of Hohenheim. See Paracelsus.

Theophrastus, Theophrastus Eresios (371-286 B.C.), pupil of the Greek philosopher Aristotle and one of the oldest botanists whose writings have come down to us. He has been called "the father of botany." See Tschirch: Handbuch der Pharmakognosie, Leipzig, 1910, I, Part 2, p. 545.

Theriac, also treacle. Greek thēriakē Latin theriaca, French theriaque.) The Greek term thēriakē derived from theriakós, (of wild or venomous beasts) hence theriaca or theriacē was an antidote first primarily against the bite of serpents, then against poisons in general. Later it was regarded as a general panacea, although it retained its special reputation as an antidote. Nicander of Colophon, who lived during the second century B.C., is said to have been the first to recommend it. Its highest reputation, however, was gained when prepared according to the formula of Mithridates, King of Pontus in Asia Minor (132-63 B.C.) or according to the modified formulae of Democrates or Andromachus, physicians who lived in Rome during the first century. During certain periods and in certain countries its composition was regarded as of sufficient importance to have it made by the apothecary under the supervision of representatives of the medical faculty. See J. Berendes, Die Pharmacie bei den alten Kulturvoelkern, Halle, 1891, p. 281. Peters and Netter, Pictorial History of Ancient Pharmacy, Chicago, 1899, p. 115; C. J. S. Thompson, The Mystery and Art of the Apothecary, Philadelphia, 1929, p. 58.

Terra sigillata. Clay originating from certain districts and made up into round tablets of about half an ounce in weight which were stamped with designs alluding to the places of their origin. These earth tablets were given in dysenteries, internal ulcers and hemorrhages; also in gonorrhea and in pestilential fevers. Externally they were applied to festering wounds. See Wootton: Chronicles of Pharmacy, London, 1910, II, p. 53.

Thompson, William S. (1822-1894), druggist in Baltimore and editor of the Journal of the Maryland College of Pharmacy. See Proc. Amer. Pharm. Asso., 43:47, 1895.

Thoms, Hermann (1859-1931), German apothecary and professor of pharmaceutical chemistry at the University of Berlin. The exemplary Institute of Pharmacy at the University of Berlin was the fruit of his endeavor and built according to his plans. See Pharm. Rev. 26:1, 1908. Thoms was the founder of the Deutsche Pharmazeutische Gesellschaft. Of his discoveries, the synthetic substitute for sugar, which he called Dulcin found widest recognition. See Pharm. Ztg., 76:1349, 1931.

Thomson, Samuel (1769-1843). Thomson founded the American botanical school of medicine which later on was merged in the eclectic school of medicine. See Lloyd Libr. Reprod. Ser. No. 7; Dictionary of American Biography, XVIII, p. 488.

Thoth. Egyptian god of wisdom, magic, and one of the gods to whom healing was attributed. He was represented with the head of Osiris or as a cynocephalus (dog-headed) and identified with ph-armaki.

Tilton, James (1745-1822). Surgeon-General of the U. S. Army. See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 1149.

Tinctures. Earlier historians attributed the introduction of tinctures into pharmacy to a mysterious alchemist, Raymundus Lullus (1235-1315). Now it has been stated that some of the writings ascribed to him are not his work. The early tinctures as they are found under this designation in the pharmacopoeias of the 16th and even the 17th centuries differ essentially from the products called tinctures in later times. Minerals, corals, rust (prepared by roasting of vitriol) together with orange peel, red rose petals, aloes, myrrh, crocus, etc., were digested with alcohol and the product called tinctura coralliorum or martis e vitriolo or proprietatis. A reddish alcoholic solution of roasted potassium carbonate was called tinctura tartari. Preparations like the usual tinctures of later times, i.e., alcoholic or hydro-alcoholic solutions of the contents of vegetable or animal drugs produced by maceration are in the 17th cen-

tury sometimes enumerated as aquae cum spiritu vini. In the language of alchemy, tincture, like elixir, was a term for the mysterious means producing the transmutation of base metals to gold or silver.

Titles. Apothecary, German Apotheker. etc., Assistant Pharmacist, Chemist and Druggist, Magister (Pharmaciae), Pharmaceutical Chemist, Pharmacist. See also Degrees.

Torrey, John (1796-1873), physician, botanist and from 1830-1854 professor of chemistry and natural history in the College of New Jersey at Princeton. "His published works are numerous and of the highest value." See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 1155.

Trimble, Henry (1853-1898). He started his career as a retail druggist in Philadelphia and was from 1883 professor of analytical chemistry at the Philadelphia College of Pharmacy and since 1894 editor of the Amer. Journ. Pharm. See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 412.

Trommsdorff, Johannes Bartholomaeus (1770-1847), German Apothecary. Trommsdorff was a great teacher of pharmacy, devoting his life to the education of the apothecaries and the elevation of pharmacy. He founded a private school of pharmacy in Erfurt which gained international fame and was the first of its kind in the world. He wrote several textbooks on pharmacy and chemistry, among them his Handbuch der Apothekerkunst (1790), the Apothekerschule (1804), the Allgemeines pharmaceutisch-chemisches Wörterbuch oder die Apothekerkunst in ihrem ganzen Umfange, in 5 volumes (1605-1813) and 2 supplements (1821 and 1822), and the Handbuch der gesamten Chemie, in 8 volumes (1800-1804). Besides he was the first real pharmaceutical journalist, founding not only the first periodical devoted especially to pharmacy, Trommsdorff's Journal der Pharmacie, q.v., but trying to write in an interesting way. His research was devoted primarily to pharmaceutical preparations. See Otto Rosenhainer and Trommsdorff: Trommsdorff's Lebensbild, Jena, 1913; Curt T. Wimmer, Journ. Amer. Pharm. Asso., 27:56, 1938.

Trommsdorff's Journal der Pharmacie (1794-1834). See also Annalen der Pharmazie. In 1817 the name was changed to Neues Journal der Pharmacie für Ärzte, Apotheker und Chemiker. Under this name the journal was continued until its merger with the Annalen der Pharmazie in 1834.

Troth, Henry (1794-1842), Philadelphia wholesale druggist and one of the most active founders of the Philadelphia College of Pharmacy. See England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 354; Amer. Journ. Pharm. 14:174, 1842.

Tschirch, Alexander (1856-1939). His chief work was the Handbuch der Pharmacognosie which not only supplies detailed accounts of the history of each drug, but also contains a comprehensive Pharmacohistoria. For further details about his lifework see Pharm. Zeitung 83:1293, 1295, 1926. A bibliography, enumerating the publications of Tschirch to January 1, 1923, appeared in Schweiz. Apoth. Zeitung 60:730-742, 1922.

Tschirnhaus, Ehrenfried Walter (1651-1708), Count of. German amateur scientist. He worked with Boettger, q.v., on the invention of European porcelain.

Tully, William (1785-1859), physician and pharmacologist at Yale College. See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 1166.

Turlington's Balsam. The Philadelphia College of Pharmacy published in 1833 a formula calling for the compound tincture of benzoin as the basis and adding myrrh, angelica, and balsam of Peru. Gradually Turlington's Balsam, called also Friar's Balsam, Commander Balsam, Jesuit's Drops and Traumaticin Balsam, became a synonym for compound tincture of benzoin. See Journ. Phil. Coll. Pharm., 5:28, 1833; Wootton: Chronicles of Pharmacy, London, 1910, II, p. 135.

Turner, William (1515-1568), English physician and botanist. He founded the Botanical Garden at Kew and is considered the father of English botany.

U

Unguentarius, pl.-i, from the Latin unguentum and -arius, pertaining to, i.e., maker of ointments. Compare myropoeos and myrepsos.

V

Vauquelin, Louis Nicolas (1763-1829), French apothecary. He discovered chro-

mium (1797), asparagine simultaneously with Robiquet (1805), nicotine (1811), lecithin (1811), cyanic acid (1818).

Vertreter. See Personnel.

Virchow, Rudolf (1821-1902), German physician, the creator of the so-called cellular pathology. See Sigerist: The Great Doctors, New York, 1933, p. 335; Garrison: History of Medicine, Philadelphia, 1929, p. 569.

Virey, Julien Joseph (1775-1841), French pharmacist, physician, professor of natural history and pharmacology. Virey was one of the founders and co-editor of the Journal de Pharmacie, q.v., and a facile writer.

W

Wackenroder, Heinrich Wilhelm Ferdinand (1798-1854), German apothecary and professor of pharmaceutical chemistry at the University of Jena. He discovered corydaline and carotine and worked intensively in the field of phytochemistry.

Wall, Otto A. (1847-1922), professor at the St. Louis College of Pharmacy and author of several books. See Journ. Amer. Pharm. Asso., 11:226, 1922.

Wardner, Fred (19th century), early owner of a general store including a drug department in Milwaukee. See The Badger Pharmacist, 1930, No. 5, p. 7; James S. Buck: Pioneer History of Milwaukee, Milwaukee, 1876, I, p. 230.

Warner, William R. (1836-1901), American druggist and manufacturer. See Amer. Journ. Pharm., 73:414, 1901.

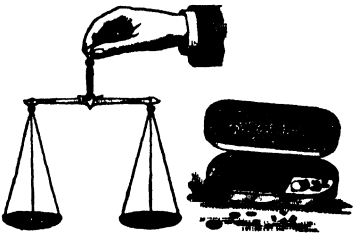
Warren, John C. (1778-1856), physician, founder of the Massachusetts General Hospital and responsible for the introduction of ether anesthesia. See Kelly and Burrage, American Medical Biographies, New York, 1920, p. 1196.

Wayne, Edward S. (1818-1885), druggist in Cincinnati and professor at the Cincinnati College of Pharmacy. See Drug. Circ., 51:93, 1907; Amer. Journ. Pharm., 58:54, 1886.

Wedel, Georg Wolfgang (1645-1729), German physician and chemist. He wrote many essays on the constituents and the use of vegetable drugs.

Weightmann, William (1813-1904), English-born chemist. In 1878, he became executive head of the firm of Powers and Weightman. See J. W. England, First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 33.

Weights and Measures. In general the old systems are built up on the division of a certain unit by 12, the so-called duodecimal system, while the modern system, the decimal system, provides a division by 10.



The Babylonians, Assyrians, Egyptians, Hebrews, Greeks, and Romans had their own weights and measures. A general and comparative survey of the weights used for pharmaceutical purposes from the Babylonian period to the present time is given by Ludwig Winkler under the title "Das Apothekergewicht" in Pharmazeutische Monatshefte, 1924, No. 6. An article "Weights and Measures in History," Chemist and Druggist, 110:817, 1929; contains 84 photographs of weights and balances which have been used from ancient times to the present with an explanatory text referring especially to medicine and pharmacy. Further details may be found in the following books and articles: William Ridgeway: The Origin of Metallic Currency and Weight Standards, Cambridge, 1892, Francis Adams: Paulus Aeginata, London, 1844-1847, 3, p. 609; Ch. Rice: On the Origin of Our Pharmaceutical Signs for Weights and Measures, New Remedies, 6:212, 1877; Sigerist: Masse und Gewichte in den Medizinischen Texten des frühen Mittelalters, Kyklos (Leipzig) 3:439, 1930; George Sarton: The First Explanation of Decimal Fractions and Measures by S. Stevin, Isis, 23:153, 1935; Oscar Oldberg: Metrology, Parts 4, 5, 6, Pharm. Era, 13:198, 1895; and Oldberg: The Development of Our Systems of Weights and Measures, Pharm. Era, 14:713, 1895.

Wellcome, Sir Henry Solomon (1853-1936), American pharmacist and founder of the English firm of Burroughs, Wellcome & Co. Sir Henry was a scientific pharmacist as well as an anthropologist, an archaeologist, a writer, a philanthropist, and a collector of all items of historical pharmaceutical and medical

interest. See Journ. Amer. Pharm. Asso., **23**:285, 1934; **25**:734, 888, 1936.

Westrumb, Johann Friedrich (1751-1819), German apothecary. He published many papers especially on technical chemistry and analyzed many mineral waters.

Whelpley, Henry Milton (1861-1926), pharmacist, anthropologist and archaeologist. Professor and Dean of the St. Louis College of Pharmacy from 1904, active in all possible offices of the A. Ph. A. See Journ. Amer. Pharm. Asso., **15**:523, 1926.

Wiegand, Thomas Z. (1825-1909), Philadelphia druggist and pharmaceutical author. For many years Registrar at the Philadelphia College of Pharmacy. See Amer. Journ. Pharm., **81**:502, 1909.

Wiegleb, Johann Christian (1732-1800), German Apothecary. An opponent of alchemy, he was at the same time one of the last and most zealous defenders of the phlogiston theory (see Chemistry, history of). Among his numerous publications was a chemical instructor in the form of letters, an attempt at popularizing chemical knowledge and a precursor of the famous Chemical Letters, published half a century later by Liebeg.

Wilbert, Martin I. (1865-1916). For 17 years apothecary at the German Hospital in Philadelphia and later on, from 1908-1916, Assistant in the Division of Pharmacology of the Hygienic Laboratory, U. S. Public Health Service. Wilbert was a voluminous writer on pharmaceutico-historical subjects. For a number of years he edited Comments and Criticisms on the U. S. P. See John K. Thum: Amer. Journ. Pharm. **89**:49, 1917.

Wilder, Hans M. (1831-1901), Iceland-born American druggist and pharmaceutical author. See Amer. Journ. Pharm., **73**:411, 1901.

Willdenow, Carl Ludwig (1765-1812), German apothecary, after 1801 director of the Botanical Garden and after 1810 professor of botany at the University of Berlin. He was one of the best known botanists of his time.

Williamson, Peter (1795-1886), wholesale druggist and one of the founders of the Philadelphia College of Pharmacy. See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 351.

Willoughby, Westel (1769-1844). He first practised medicine in New York, near Fairfield and was Vice-president of the New York Medical Society. Later on he moved to Erie where he established a Medical School. The name of the town was changed in his honor to that of Willoughby. See J. A. Spalding: Life of Dr. Lyman Spalding, Boston, 1916, p. 203.

Winthrop, John (1588-1649), governor of Massachusetts Colony. See Dictionary of American Biography, **XX**, p. 408.

Winthrop, John, Jr. (1606-1676), governor of Connecticut colony. See Dictionary of American Biography, **XX**, p. 411.

Wiskirchen, Paul (1859-), German apothecary. Bibliography: See Pharm. Ztg., **74**:1344, 1929.

Wistar, Caspar (1761-1818), physician in Philadelphia, instrumental in effecting the union of the medical school attached to the University of Pennsylvania and the College of Philadelphia. See American Medical Biographies, New York, 1920, p. 1248.

Withering, William (1741-1799), English physician. Withering revived the use of digitalis leaves as a remedy for dropsy and gave it a scientific basis. His pamphlet "An account of the foxglove and some of its medicinal uses with practical remarks on dropsy and other diseases" appeared in 1785. See Louis H. Roddis: William Withering, New York, 1936; H. Weese: Digitalis, Leipzig, 1936.

Witting, Ernst (1795-1861), German apothecary. He was one of the founders of the "Apothekerverein in noerdlichen Teutschland," q.v. Of his publications his "Lexikon chemisch-pharmaceutischer Nomenclaturen" was the most important.

Wöhler, Friedrich (1800-1882), German chemist. His artificial preparation of urea in 1828 broke down the supposed impassable barrier between inorganic and organic chemistry. He first isolated or improved the process of isolation of several elements, like potassium, beryllium, aluminium, titanium, boron. Without being a pharmacist himself, as a teacher of students of pharmacy and for some time inspector of the pharmacies of Hannover he kept in contact with pharmacy. Bibliography: See Amer. Journ. Pharm., **54**:591, 1882.

Wood, George B. (1797-1879), physician, professor at the Philadelphia College of Pharmacy and later at the Medical Department of the University of Pennsylvania. Wood was for several decades

the decisive factor in the revisions of the U. S. P. and, in collaboration with Franklin Bache, editor of the U. S. Dispensatory. See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 397.

Wood, Horatio C. (1841-1920), physician, author and professor at the University of Pennsylvania. See Amer. Journ. Pharm., 92:136, 1920; Dictionary of American Biography, **XX,** p. 459.

Wood, Horatio C., Jr. (1874-), physician, professor at the University of Pennsylvania and, since 1921, at the Philadelphia College of Pharmacy. See First Century of the Philadelphia College of Pharmacy, First Supplement, Philadelphia, 1934, p. 102.

Wood, William (17th century). It has not been determined which of the several William Woods who lived in New England between 1629 and 1633 was the author of the book, "New England's Prospect." See Dictionary of American Biography, **XX,** p. 476.

Wulling, Frederick J. (1866-). Professor and dean of the College of Pharmacy, University of Minnesota, 1892-1938, author of numerous pharmaceutical papers, etc., one of the foremost agitators for and promoters of the betterment and broadening of American pharmaceutical education. See Journ. Amer. Pharm. Asso., 23:177, 1934.

X

Ximenez, Francisco (late 16th-early 17th century), Dominican monk and botanist. See Tschirch, "Handbuch der Pharmakognosie," 2nd ed., Leipzig, 1933, I, Part 3, p. 1346.

Y

Yaple, Florence (1865-1912), one of the most outstanding American woman druggists. Miss Yaple was closely connected with the Philadelphia College of Pharmacy and participated, for many years, in the work of editing and managing the Amer. Journ. Pharm. See Amer. Journ. Pharm., 84:481, 1912.

Year Books. The annual report is a special type of pharmaceutical periodical. Indeed, the very first pharmaceutical periodical, the Almanach, oder Taschenbuch für Scheidekünstler und Apotheker of 1780, was an annual of this sort. See also Berlinisches Jahrbuch of 1795. With the specialization in pharmaceutical journalism there developed an annual publication which was devoted exclusively to supplying, in convenient form, abstracts of original articles published in any and all journals, no matter in what country or language. Thus at the present time the pharmaceutical field is well covered by three yearbooks, viz., the German Jahresbericht, the British Yearbook, and—until 1937—the Year Book of the A. Ph. A., q.v.

Year Book of the A. Ph. A. In 1912 this replaced the report on the progress of pharmacy which had been published in the Proceedings of the Amer. Pharm. Asso. The report for 1935 was the last to be published under this title in 1937. Since then it has been replaced by the publication of "Pharmaceutical Abstracts" in the Journ. Amer. Pharm. Asso.

Yearbook of Pharmacy. From 1864-1870 this was published under the title Proceedings of the British Pharmaceutical Conference. With the union of the conference with the Pharmaceutical Society of Great Britain in 1926, the Yearbook has been published by the latter organization. Since 1928 the contents of the Yearbook have been published as abstracts in the Quarterly Journal of Pharmacy and Pharmacology.

Youngken, Heber W. (1885-), American botanist and pharmacognist, professor at the Massachusetts College of Pharmacy. See England: First Century of the Philadelphia College of Pharmacy, Philadelphia, 1922, p. 418.

Z

Zinzendorf, Nikolaus Ludwig Count, (1700-1760), German aristocrat, who restored the Moravian sect and founded a Moravian colony in America. Dictionary of American Biography, **XX,** p. 657.

Zwelffer, Johann (1618-1668), at first apothecary in Palatine (Germany), later physician in Vienna. His "Animadversiones in Pharmacopoeam Augustanam" (1652) are the first known commentary on a pharmacopoeia. He was also the author of a "Pharmacopoea Regia seu Dispensatorium novum et absolutissimum, adnexa spagyrica Muntissa."

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