INDIGENOUS DRUGS OF INDIA

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INDIGENOUS DRUGS
OF
INDIA

Their Scientific Cultivation and Manufacture

With Numerous Suggestions Intended for
EDUCATIONISTS AND CAPITALISTS

BY

J. C. GHOSH, B.Sc. (Manchester),

Principal, School of Chemical Technology, Calcutta ;
Late Pharmaceutical Chemist, Govt. of India Medical Stores Dept. ;
Author of Technical Education, Indian Education Problem-A Solution, etc.

WITH A FOREWORD

By

Colonel R. N. Chopra, C.I.E., K.H.P.,
M.A., M.D., Sc. D. (Cantab.),
F. R. C. P. (Lond.), I. M. S. (Retd.)
Director, School of Tropical Medicine and Biochemical Standardisation Laboratory, Calcutta.

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FOREWORD

It gives me great pleasure to write a foreword for the handy little book on "Indigenous Drugs of India" by Mr. J. C. Ghosh. As one interested in the field of Indian indigenous drugs, I have followed for many years the speeches and writings of Mr. Ghosh and his untiring efforts in enlightening public opinion in the rather neglected field of indigenous drug industry. Some of his writings, Mr. Ghosh is now putting together in book form for the benefit of all those interested in the field. The time is opportune as, due to war, foreign imports are now largely restricted and a shortage of drugs may be anticipated in the future, Mr. Ghosh's mature experience in the pharmaceutical and technological fields has been well portrayed in this booklet and the industrialists will find many useful hints and concrete ideas in its pages. Mr. Ghosh's views with regard to the evils of drug adulteration and spurious drug trade in India are also given and everybody interested in the development of scientific medicine and public health in India will agree with the author that an early legislation for the control of drug adulteration, spurious drug trade and practice of pharmacy in India is urgently called for. The subject matter has been presented in an attractive manner and forms stimulating reading. I shall indeed be

glad to see that the book is appreciated widely and that it succeeds in stimulating industrialists in this country to pay more attention to the development of the vast indigenous resources of India than they have hitherto done.

Calcutta.
December 5, 1939

R. N. CHOPRA,
Colonel, C. I. E., M. A., M. D.,
Sc. D. (Cantab.), F. R. C. P. (London),
Director, School of Tropical Medicine and
the Biochemical Standardisation
Laboratory, Calcutta.

PREFACE

THE first edition (1919) of this handbook, published by Messrs. Butterworth & Co. (India) Ltd., consisted of a series of independent pamphlets on the subject of medico-chemical industries. Of these the pamphlet dealing with the " Indigenous Drugs of India " attracted greatest attention, and although it was then a pamphlet of 32 pages only, it was editorially reviewed with appreciation by the *Lancet* (22nd Feb. 1919), the *Indian Medical Gazette* (March, 1919), the *Statesman* (25th March, 1919), and by several other leading papers of the world. This new edition was intended to be issued in a revised and much enlarged form, giving a new orientation to all the subject matter dealt with in the first edition. The outbreak of war in Europe, the sudden rise in prices of materials, and other changes in market conditions, gave a rude shock to the plan conceived, and I have been reluctantly obliged to cut down matter, retaining only the portion concerned with indigenous drugs, which, even in its expurgated condition, still covers over 200 pages, Crown 8vo., against 32 pages previously. The importance of this subject, and the popular manner in which it has been presented, would, it is hoped, continue to be widely recognised as in 1919. The original tabular statement of drugs, in nine languages (*vide* Appendix I), and the previous survey of lines of development, have been largely extended in the new edition, and several drugs have

been noted on, in some detail, to stimulate research and to attract wider attention to the subject. Some more attention has been paid to the cruel injury done to public health in the absence of Pharmacy Laws in the country. This situation aggravates the necessity for *immediate* reforms which are discussed and detailed. Useful prescriptions and therapeutic notes on drugs (Appendix II) have also been added, particularly for making the handbook popular (1) with every family anxious to reduce its monthly bills for medical attendance, and (2) specially with the humbler classes in this country, who stand in need of cheap medical relief. There is further information in Appendix III showing what machinery and equipment are required for a Drug Factory.

The next important point is the economic and botanical aspect of indigenous drugs, which this new edition brings more into prominence. It is now universally conceded with regard to Indian problems that there is nothing more important and urgent than the industrial development of the country. Consequently, this manual seeks to show what is needed for the purpose in the domain of drugs and how Indian students, universities and capitalists can co-operate with a view to promote the interests of all concerned. It should, however, be clearly understood that no progress can be possible, nor even the foundation-stone laid, without this co-operation in the first instance and, *secondly*, without

students, their guardians and teachers having a **wider outlook**, which this handbook is intended to stimulate. These and other features of the new edition, as detailed here, evidently provide reasons for the book to be widely read and circulated, especially in the present crisis.

Lastly, if India has grown wiser through her bitter experience in obtaining foreign supplies of drugs during the last Great War, it is natural for her to decide not to depend *solely* on imports. She will doubtless make the best use of her indigenous drugs on scientific lines and take immediate and determined action, economic, educational and legislative, as suggested in this book, which also shows what inherent difficulties lie ahead and how they could be effectively overcome.

SCHOOL OF CHEMICAL TECHNOLOGY, CALCUTTA,
10th October, 1939.

J. C. GHOSH.

[*Copy of a letter dated the 23rd July, 1939, from* Professor Robert Wild (*vide* pages xiv—xv).]

180, Horninglow Street,
Burton-on-Trent.
23–vii–'39.

Dear Mr. Ghosh,

* * * *

I was very pleased to hear from you and to know that you are still well and busy with your scientific work; I think you are well fitted to produce a useful book on '**Indigenous Indian Drugs**' and hope it will be widely read..... .....

* * * *

(*Sd.*) *Robert Wild.*

INDIGENOUS DRUGS
OF
INDIA

Their Scientific Cultivation and Manufacture with Suggestions for the Development of

New Industries

INTRODUCTORY

Appointed originally a village schoolmaster in 1891, the writer entered the late Military Department (now the Defence Department) of the Government of India as a Secretariat Assistant in 1895, having previously passed a competitive Service Examination in 1893. He had been in the Secretariat for 15 years, dealing all this time with questions connected with the Indian Medical Service and the Medical Stores Department, before he was deputed, by the Government of India, to England in March 1910, to qualify as a Pharmaceutical Chemist from the Manchester University.

Prior to his deputation he had, with the kind permission of the Government of India, acquired practical experience in the manufacture of drugs and of leather. The notes, which he had prepared while under training, subsequently formed the basis of his pamphlets on

Drugs Manufacture and on Tanning. The deputation lasted till July 1912. During the University recess within the deputation period he was permitted by the India Office, London, to visit pharmaceutical and other factories at Manchester and elsewhere in England and Scotland. Later on he undertook an investigation into the subject of surgical dressings and their manufacture. The findings of his investigation were published in 1918.

In 1912-18 while, on return from England, the writer was at Madras in charge of a large pharmaceutical laboratory of the Government of India, his attention was drawn to a local *Ayurvedic* Library where he began studying the indigenous drugs of India, and the first fruit of his researches there was a monograph on 'Chaulmoogra Oil and Treatment of Leprosy." These, researches were communicated in 1915 to Professor Robert Wild, then Professor of Pharmacology, *Victoria University of Manchester*, and a Member of the British Pharmacopœia Revision Committee. The misunderstanding which continued in the British Pharmacopœia up to its 1914 edition, in regard to the source of "Chaulmoogra Oil," has since been removed [*vide* the British Pharmacopœia (1932)], apparently as a result of the communication referred to. There was a similar misunderstanding in regard to the direction given in the B. P. (1914) for the manufacture of *Thymol*, with the result that there was a large scarcity of this product during the last Great War. Under official orders the

writer had to find out independently in 1917 the required manufacturing process which was explained later in his article published in 1922 (q. v. pp. 65-67). The writer's third contribution was in respect of the preparation of *Oleum Psoralia Corylifolia* for treatment of *Leucoderma* and his article thereon was published in the *Pharmaceutical Journal*, London, of July 21, 1928 (q. v. pp. 115-121). A full statement of the case together with a copy of these pages was communicated to Professor Robert Wild in June 1939, and his reply dated the 23rd July, 1939, encouraging the publication of this handbook, carries special weight, as he was a member of the B. P. Revision Committee (*vide* p. xii).

Other facts connected with the publication :—With the approval of the Director-General, Indian Medical Service, the writer's monograph on "Chaulmoogra Oil" was published in 1917 by the Caxton Press, Madras. This was soon followed by the writer's other pamphlets, namely, "Drugs Manufacture" (1917), "Indigenous Drugs of India" (1918), also by a series of articles on the last named subject and on Pharmacy during 1919–39, which, on the whole, were widely appreciated. A few of these articles and other connected papers are reprinted and brought up to date here in Chapter 1, in order to stimulate further an extended *scientific* and *economic* interest in the subject and to popularise more the honest and intelligent use of indigenous drugs, some success having so far attended the efforts hitherto made since 1915 as explained above.

In 1918, Captain G. Tate, I.M.S., who was then at Madras as Deputy Medical Store-keeper, Government of India Medical Stores, was kind enough to look through the writer's pamphlet on "Indigenous Drugs" and to make certain suggestions. The author's best acknowledgments are still due to him, as also to the then Principal, Ayurvedic College, Madras, who had kindly assisted the author in finding vernacular names of B. P. drugs. A list in nine languages of these and other important drugs will be found in Appendix 1. It also shows the Natural Orders, the habitat, the active principles, and the therapeutic uses, of these drugs. In Appendix II there are further lists, one explaining some technical terms, and the other showing the *practical* application of several of these drugs to the treatment of diseases. These Appendices, as also the Therapeutic Index provided at the end, will, it is hoped, interest medical practitioners, students and others, both in and outside India, and be educative and largely serviceable to the general public in this country, particularly in respect of treatment of minor maladies at a trifling cost.

CHAPTER I.

INDIGENOUS DRUGS OF INDIA

I

Scope for Scientific Investigation

THE last Great War having rendered it increasingly difficult to obtain supplies of drugs from abroad, acute necessity was felt for developing and utilising local resources as far as practicable. To achieve this end it seemed imperative to push on researches in the cultivation and in the *local* manufacture of imported drugs. Certain salient facts regarding investigation, cultivation and manufacture of drugs were accordingly presented in a pamphlet in 1918, in order to supplement those contained in the writer's two preceding brochures issued in 1917, namely, "Drugs Manufacture" and "Chaulmoogra Oil", and the author feels sincerely gratified that his suggestions have helped in creating an interest for the wider adoption and use of indigenous drugs on scientific lines as are being pursued by the Tropical School of Medicine, Calcutta, since its establishment in 1921. It is understood that an investigation on these lines will also be undertaken by the Indian Institute for Medical Research, Calcutta. Owing to the outbreak of war again in Europe since 1st September, 1939, it is now more necessary than ever to proceed fast with these researches, to utilise *intelligently*, to a larger extent, the local supplies of indigenous drugs, as is being consistently advocated by the writer for years, and to organise forthwith, on a right basis, the pharmaceutical

profession, trade and industry in India, to which we refer later on in this chapter.

Despite the progress made during the last decade, the preliminary work involved in proceeding on scientific lines is, however, enormous, as will presently be seen. At the outset it may be said that there is a theory—and it still remains undisputed by recent advances in Pharmacology—that each and every disease is traceable to the hostile action of a specific micro-organism which finds its way into our system either through a lesion, or through the medium of foods, drinks, etc., and that a rational mode of treatment is to find, in each case, a drug of a *certain chemical constitution* which will kill the parasite without injuring the host, the desired result ensuing from " the selective action of cells ". Working on this hypothesis, Ehrlich, one of the greatest exponents of "Chemotherapy", succeeded in 1911 in introducing *salvarsan*, a specific cure for syphilis, which caused a sensation in the Western medical world. "Chemotherapy" has its further successes in the drugs found for the cure of sleeping sickness, of kala-azar, and of several bacterial (streptococcic, etc.) infections, and recent remedies, namely, *plasmoquine*, *atebrin* and *tebetren*, will attain the same position of pride if they succeed in eradicating malaria, not as substitutes for *quinine*, but as additional weapons for use in particular circumstances and for special purposes.

In the East, on the other hand, there is a very ancient theory, or rather a belief, originating apparently from *Ayurveda*, that there is a herbal specific for the

cure of each disease and that even the tiniest grass has its medicinal effect. This theory still appears to hold its ground, as there are yet reports of scientific expeditions now and then in quest of herbal specifics. Whatever the case may be, it is for the medical authorities to say how far these theories tend towards the truth. But the fact remains that a large number of important remedies, such as *quinine*, *strychnine*, *atropine*, *ephedrine*, *emetine*, *kurchicine*, etc., are still derived from the vegetable kingdom. Further, as vegetation, peculiar to diverse climates, altitudes and soils, abounds in India, doubtless a great future awaits the scientific investigation of indigenous Indian drugs. This was foreseen by the writer in 1918, and predicted later in 1923 by the late Professor Greenish. The investigation in question has seriously been undertaken by the Calcutta School of Tropical Medicine since the publication of the writer's pamphlet on " Indigenous Drugs of India " (1918), [*vide* " The Lancet ", 22nd February, 1919, pages 307-8, and " The Medical Annual ", London, 1920, page 446], although the labours of the old Indigenous Drugs Committee of Calcutta had proved disappointing as pointed out by Sir Leonard Rogers in 1916. Meanwhile, what appears to be needed is to train a body of chemists who will assist medical men in investigating the **chemical constitution and histological characters** of such indigenous drugs as will be found to be really useful on trial in hospitals and in physiological (bio-chemical) laboratories of medical colleges.

It is satisfactory to note that a beginning in the direction suggested was made in 1921 by the Tropical

School of Medicine, Calcutta, and that the process has since been elaborated, particularly by the recent establishment, in the All-India Institute of Hygiene and Public Health, Calcutta, of a Central Bio-chemical Standardisation Laboratory. The results of these investigations would be monumental in that they would unmistakably settle the identity and characters of *Ayurvedic* and *Unani* drugs, " a field yet unexplored ", on the same bases as apply to the British Pharmacopœial drugs, thereby laying a solid foundation of an authoritative Indian Pharmacopœia. The work involved is so vast and so technical that it would require the services of several medical men and chemists trained, respectively, in Pharmacology and in Pharmaceutics, and the labours of these men will be given practical effect to by private firms undertaking the *scientific* manufacture of proved drugs on a large scale. This procedure alone will really determine the claims often made in favour of indigenous drugs, either during discussions at legislatures or elsewhere, will protect the public from the frauds now practised upon them by irresponsible manufacturers and patent medicine vendors generally, will protect the indigenous Indian drugs from falling into disrepute, and will finally protect and develop an industry, which offers promise of possibilities of great development, but which, in a large majority of cases, is still unfortunately left in the hands of untrained and unscrupulous men.

The position referred to above, particularly in the concluding lines, which faithfully represented the condition when the writer's pamphlet on the subject was

published in 1918, still remains materially unchanged, (*vide* the report published in October, 1939, on the survey undertaken by the Bio-chemical Standardisation Laboratory, Calcutta, during the last two years), although various efforts have been made, during nearly two decades, to improve the situation. These efforts may be summarised as pertaining to two broad facts. In the first place, Pharmacy, as understood in the West, is practically non-existent in India, and unqualified people are still unfortunately allowed in this country to practise regular pharmacy with impunity and to be employed in the export drug trade. The result in either case is disastrous. On the one hand, it is as gloomy as it is possible to be (*vide Indian Medical Gazette* editorial for March, 1938); on the other, it is a loss in *lakhs* annually, with reputation wrecked and business in decline as explained herein in the concluding remarks at page 145. Moreover, there is practically no Law as yet here to prevent drug adulteration which is widespread throughout the country. An agitation against both the evils has been continued, *first* by the writer alone, since 1917, and subsequently with the co-operation obtained in the Legislative Assembly since 1927 from Sir Henry Gidney, M.L.A. (Central), with the result that a Drugs Enquiry Committee was set up in 1930 under the orders of the Government of India. The evils were strongly condemned by the Committee which submitted their recommendations in April 1931, the main recommendation being the immediate desirability of comprehensive Central legislation for the control of drugs and pharmacy in India.

It is reported that the Government of India will shortly undertake necessary legislation. The only practical result so far of the Drugs Committee recommendations was, however, the establishment in 1937 of the Central Bio-chemical Laboratory referred to in the preceding paragraph. The other fact is that, under the auspices of the Calcutta School of Tropical Medicine, there has been considerable progress towards the scientific investigation of indigenous Indian drugs and that a technical book on the subject was issued in 1933 by Colonel R. N. Chopra, I. M. S., Professor of Pharmacology and Director of that institution, who had presided over the Drugs Enquiry Committee (1930-31) with unique success. His subsequent services in connection with the Committee's recommendations are also well-known. Ordinarily, there would have been no necessity, under the circumstances, for the writer now to publish this handbook relating to indigenous drugs. The reasons for him to think otherwise are, however, explained in the Preface.

Further, the general public requires a cheap handbook concisely presenting facts and furnishing up-to-date information in a handy form. Moreover, the circumstances contributing to the action taken by the Government of India towards undertaking necessary legislation on the recommendations of the Drugs Committee, also Dr. Anklesaria's offer to the Government of Bengal of a donation of rupees two lakhs, thanks to the strenuous efforts of Colonel Chopra, for the establishment of a College of Pharmacy in Calcutta, are very significant. It is obvious from the public feeling that a new force

is gradually gathering strength. It is hoped that ere long there will be a number of pharmacy colleges throughout India, Burma and Ceylon and that the public in general, and students of pharmacy and medicine in particular, will probably look up for a handbook of the kind mentioned. These facts apparently adduce sufficient grounds justifying the present issue. Indeed, it may be looked upon as a blessing in disguise if the fresh outbreak of war and the publication of this book at the present juncture compel the question of indigenous Indian drugs and pharmaceutical reforms to be pushed as *a war measure.*

II

Drug Cultivation

To enable the scientific investigation under consideration to proceed on right lines, it is needless to say that all possible care must be taken to ensure a collection of the unadulterated and the exact variety of the drug which it may be proposed to investigate. It is true that the recognition of crude drugs is no longer a necessary knowledge for a doctor, but while in the Western countries the collection and examination of crude drugs are undertaken by well-known firms aided by a staff of experts, the work in India is unfortunately left to a class of ignorant bazaar people. Apart from the necessity for attaching an experimental drug farm to the Calcutta School of Tropical Medicine, drug cultivation by itself is an important industry for which India, with its great diversity of climate and soil, is

admirably adapted, and which seems to deserve the attention of capitalists both here and abroad. The question (inclusive of a drug farm on a large sale in Calcutta) is so important that it was *first* prominently brought to notice in the writer's pamphlet (1918) and will no doubt receive the consideration of the Imperial Council of Agricultural Research and the National Planning Committee. The question is again reviewed here generally and in more detail later on. This industry has not only been neglected in India, but in other countries as well, with the result that the growing of medicinal herbs formed the basis of a profitable industry amongst the Central European population and that on the outbreak of the last War a great scarcity of these vegetable drugs was experienced. During that period, there were several articles in the Home papers, drawing attention to the crying need for vegetable drugs and to the necessity for a scheme of *systematic growing, collecting and marketing* of medicinal herbs, the idea being to encourage and to co-ordinate the cultivation of small crops in all parts of the United Kingdom. *If such a scheme is considered necessary in that country, it is more so out here where the bulk of medicine-consumers depend mostly on herbs.* A drug farm attached to the Calcutta School of Tropical Medicine, as suggested above, has several advantages of its own, irrespective of other considerations and the idea ought to be proceeded with now that there is a proposal to establish a College of Pharmacy in Calcutta as just mentioned in page 6.

In this connection, the following extract from the defunct "Englishman," dated Calcutta, the 9th May, 1917, is of particular interest :—

"Drug Cultivation—What India Might do"

Extract from "The Englishman"

"The *Pharmaceutical Journal*, London, writes as follows :—"The War, with the consequent cutting off of Central Europe as a source of supply of medicinal plants, has given an impetus to drug cultivation in other countries besides our own. In Russia, for instance, the problem has been tackled much more vigorously than in Great Britain. Here the only action taken by the State has been the publication, by the Board of Agriculture, of a leaflet on the subject. In Russia, on the other hand, a bureau has been established in the Department of Agriculture for the specific purpose of encouraging the cultivation of medicinal plants. This bureau has already distributed to farmers seeds to the value of something like ten million roubles and has made provision for the granting of loans to those who cultivate these plants. In France also, the War has given a considerable impetus to drug cultivation, but at present the State has not taken any part in the scheme,—at present not such an important part as that taken by the Russian Government. Recently, however, the French drug trade has been urged to publish a manual for distribution among those who are prepared to undertake this class of work and the railway authorities have been asked to reduce their rates for the carriage of medicinal herbs."

" In the course of a leading article, the *Madras Mail* of January 24, 1916, had the following :—"India offers a great field for making a systematic effort to grow several of these vegetable drugs, and we are sure that this effort, if scientifically carried out, would be as successful as has been the case with *quinine* productions in this country. There is the Department of Botanical Survey in Calcutta, which has under it a Reporter on Economic Products, and in Madras there is a Pharmaceutical Chemist with British qualifications, who is attached to the Government Medical Stores Depot, and by associating the latter with the Economic Reporter in Calcutta, a useful co-operation might be initiated which might ultimately result in the establishment of important industries in India.

(The Pharmaceutical Chemist referred to above is Mr. J. C. Ghosh, B. Sc. (Manchester), F. C. S.)"

Cinchona Cultivation

As shown in the foregoing extract, the last War emphasised the great need for paying increased attention to the cultivation of drugs in India and sometimes there were signs of a rapid extension of this branch of agriculture. Those who have studied the question have no doubts about the commercial possibilities of indigenous drug culture. In the Government cinchona plantations, the possibilities have been practically shown and years ago Major Gage, I.M.S., late Director of Botanical Gardens, advised the Indian Industrial Commission (1916) that, " given the necessary staff and equipment, it should be feasible to undertake the syste-

matic cultivation of any of all these chief species and the improvement, where desirable, of the quantity and quality of the yield."

A few facts connected with cinchona cultivation in India may be briefly noticed here. Of the anti-malarial drugs known up-to-date, cinchona and its chief alkaloid *quinine* appear to be the best and the cheapest. The Royal Commission of Agriculture in India (1927) stressed the importance of cheap *quinine* in respect of the malaria-stricken people of the country, which now consumes 210,000 lbs of *quinine* annually, while producing only 70,000 lbs. and importing the balance 140,000 lbs. mainly from Java. India's real need of *quinine*, however, has been estimated at 600,000 lbs. a year. There is, therefore, ample room for extending cinchona cultivation in the country in view of the fact that India contains enough first class land for cinchona growing. The two most important species utilised by cinchona plantations at Mungpoo in Bengal and Nilgiris (Madras), respectively, are known as "Cinchona Ledgerina" and "Cinchona Succirubra" or the red bark variety. The latter presents certain advantages for certain soils and elavations, but the former, which predominates in Bengal, has much greater commercial potentialities especially on account of its high content of the invaluable alkaloid, the cost of production being likely to be much reduced thereby in Bengal.

There are innumerable drugs in India, but up to now there has been no regular cultivation of indigenous drugs, and even those grown successfully are not col-

lected at the proper season and according to strict procedure. The growing, collecting and marketing are still in illiterate and irresponsible hands to the serious detriment of the industry (q. v. pp 5 & 145). There are, however, some firms which have made a beginning on right lines, and in the areas directly under their charge, success has attended their efforts. But for the most part the only organised cultivation of drugs is carried on in the gardens under Government supervision. This may be quite natural in such a conservative country as India, but the Government cannot ordinarily be expected to do much more than carry on experimental gardens, the duty resting with the public to take up the matter and to invest sufficient sums of money in the industry, thereby opening a new avenue of employment for the unemployed. A small beginning may forthwith be made in the school, church and temple grounds where the free labour of school boys and girls may be used to provide them with a scientific and healthy recreation and to arrange for the progressive development of an important industry.

Lines of Research

It was pointed out in the writer's pamphlet (1918) on "Indigenous Indian Drugs" that practically all drugs found in the British Pharmacopœia could be grown in India, and that more than 50 per cent. of them are indigenous to India (including Ceylon and other adjacent islands). It may be mentioned that India possesses a very rich flora containing many plants which have been utilised and are still being used for

medicinal purposes. Some people hold that many of these have been employed more from traditional choice than from an acute scientific demonstration of their virtues. The fact may perhaps be otherwise. Owing to the vicissitudes through which India has passed, and having regard to the antiquity of her civilisation, it is quite possible that the scientific work which lay behind the medicinal use of these plants, has been lost as may have apparently been the case with regard to most of the truths in respect to plant life, which were known to ancient India, and which were re-discovered by Sir J. C. Bose to some extent. Similarly, we may proceed with the research as to the therapeutical value of reputed medicinal plants and the lines on which this research should be carried on may be as follows :—

First, there are drugs to be tested, which are of established medicinal value in Western medicine and which are in use in the pharmacopœias of different countries. A large number of these grow wild in great abundance in many parts of India and some are even cultivated. There are numerous examples, but a few will suffice. Atropa Belladonna (*Anguri-shefa*) grows in abundance in the Himalayan ranges (Kashmir) at an altitude of 6000 to 12000 feet. Strychnos Nux-vomica (*Kuchila*), one of the most commonly used drugs, grows everywhere throughout the tropical parts of India, particularly in Madras. Glycyrrhiza glabra (*Mulatthi* or *Jesthimadhu*) and Citrullus Colocynthis (*Indrayan* or *Makal*), grow in north-western India. Aconite (*Katbish*), Juniper, Digitalis and Squill grow in the

Himalayas. Most of these have been tested and found to be as good or even better than the drug in use.

Potent Herbs

Secondly, it may be considered whether there are drugs which contain the same active principles as those we now use. Thus Artemesia Maritima (*Titwan*) grows abundantly in Kashmir and contains the expensive *santonin* as its active principle. Already a good deal of work in this connection was done by the late Professor Greenish, also by Dr. Simonsen. It is further understood that a factory for extraction of *santonin* on a commercial scale was started at Kashmir. Probably there are other herbs just as potent which have never come to light and these may be without the drawbacks which some of our present drugs possess.

At the Calcutta School of Tropical Medicine, it has been proved by Colonel Chopra and his colleagues that Bœrhaavia Diffusa (*Punarnava*), which was used both for lung and kidney diseases, is no good in the former condition, but has a very valuable diuretic action in certain cases of dropsy. Colonel Chopra's recent and novel investigations on the various cardiac tonics, both of indigenous and foreign origin, are particularly promising. Similarly, at the School of Chemical Technology, Calcutta, Allium Sativum (*garlic*) and Allium Cepa (*onion*) were subjected to tests since 1919 and the results thereof published in 1922 and 1925 as to their specific expectorant action. The drug has also the bactericidal effect, as well as the readiness with which its active principle, namely, a volatile oil, is excreted through the

lungs, thereby proving its usefulness in infective diseases of the respiratory system, such as pneumonia, pulmonary tuberculosis, etc. It is by such careful and systematic work, by testing the action of the drug first in the laboratory where its actions can be seen on the various tissues of the body, and then by actual clinical work, the action of the drug is proved on the patient.

Thirdly, we can economise by substituting drugs which, though not exactly the same, have similar properties and action resembling those of the imported and often expensive remedies. Picrorhiza kurroa (*katki*), of which several species grow in the Himalayas, and Picrasma Quassioides, are as good bitters as the imported articles Gentian and Quassia respectively, Ipomœa Hederacea (*Kaladana*) and Ipomœa Turpethum, (*Tribrit*), the Indian jalap, are as active as the ordinary jalap used.

Crude Drugs

Several species of plants yielding good peppermint oil grow in the temperate Himalayas and on Nilgiris. Many fresh plants may be used as greens instead of the expensive active principles obtained from them. This is a matter of moment in India, as many of the inhabitants are so poor that they cannot afford to buy the common drugs, such as quinine, castor-oil and Epsom salts. In Western medicine there is a tendency to utilise only the active principles and for this the taking of the drug through various stages of purification increases the additional cost. Colonels Mac Gilchrist and Acton have shown—and it is admitted in the B. P.

(1932)—that the total alkaloids from cinchona bark (cinchona febrifuge) are more efficient than the purified but costly quinine. This reduces the cost of treatment to less than half.

Fourthly, there is a vast field for investigation in respect of the drugs which are of known value in *Ayurvedic*, *Unani* and other indigenous systems, but which are not yet used by the Western Pharmacopœias. In all the rich foliage of India, and amongst those herbs used by the leading *kabirajs* and *hakims*, there must be many new preparations, which are at present not more widely known. Colonel Chopra's work has made this clear in the use of *Punarnava* by his pharmacological and clinical tests. There are two varieties of *Punarnava*, namely, the *red* and *white*, and the latter only (*Swet Punarnava*, Trianthema Monogyna, (*vide* Sir P. C. Roy's "Hindu Chemistry"), is of therapeutic value. This was long-known in India and modern scientific investigations afford the verification needed.

Cheap Treatment

The action of drugs can be tested scientifically and exactly only when their active principles have been extracted. This involves laborious work and the results take a considerable time. When once this exact knowledge has been obtained, the use of crude drugs happens to be the keynote of cheapness and will have to be employed among our population for may years to come. At present, the aim of superior training in Medical Colleges seems to be to turn out specialists with academic degrees who require Rs. 8 to Rs. 32 a visit and who

prescribe treatment equally expensive. What the *ryot* requires is a qualified practitioner who is willing to treat him for eight annas and for the treatment to cost two annas.

Pharmaceutical Chemists

Indian pharmacology has a great future before it and the Indian population should welcome the way that has now been shown by the work which is being carried on at the Calcutta School of Tropical Medicine on a magnificent scale, but almost *incognito* and on a humble scale at the School of Chemical Technology, Calcutta. No better example can be given than the discovery and application of the ethyl ester of hydnocarpic acid, the active principle of chaulmoogra oil, by Sir Leonard Rogers, which has now produced beneficial results in the treatment of leprosy. It may, however, be mentioned that apparently before Sir Leonard adopted this treatment, the use of hydnocarpus oil for leprosy treatment in preference to other varieties of chaulmoogra, and the real efficacy of hydnocarpic or chaulmoogric acid as opposed to gynocardic, had been shown in the writer's monograph on "Chaulmoogra Oil" published in 1917. The writer also tried to prove that the hydnocarpus oil itself instead of its ester and its combination with the active principle of catechu, would be more effective in leprosy (pp. 113-14). There is ample room for further researches to be carried on as shown in the monograph (pp. 110) and it remains for an institution like that of Tropical Medicine, with splendid facilities, to push on these researches. The scientific examination of drugs

is a laborious process in which the chemist plays as important a part as the medical man. Until recently the importance of pharmaceutical chemists in scientific medical practice was not realized by the medical profession in India and, consequently, little provision has been made for them in research schemes. A larger staff of pharmaceutical chemists under the enactment expected, and a wider co-operation of these trained men are, therefore, needed if any rapid advance is to be made and the work to be carried on at the same standard of efficiency as in other countries. There are many rich and patriotic Indians who, if they were aware of the value of work in connection with indigenous drugs, would help to make India self-supporting so far as drugs are concerned. It is by work of this type that we hope to see some day established an Indian Pharmacopœia depending mainly upon indigenous sources of supply formulated and adapted to the special requirements of this country, and bringing medicine and the healing art within the means and resources of the masses of India.

Scientific Cultivation of Drugs

Turning next to the question of scientific cultivation of drugs, we find, as already pointed out in page 10, that the cultivation of cinchona for *quinine* is a well known example of drug culture, an industry which affords a great opportunity for those interested in the subject. The importance of this line and its scientific value were first brought to notice in the writer's booklet already referred to and was widely appreciated as in evidence in the Editorial Reviews published, in

February to March, 1919, in the *Lancet*, the *Indian Medical Gazette*, the *Statesman* and even in *American Medical Journals*. That the supply of quinine is not at all equal to the demand, was made clear (q.v.p. 11) during the past few years, which have seen a great increase in price. Not only is it cultivated in the Nilgiris, but in several other parts of India valuable supplies are yearly available. The importance of quinine to this fever-stricken country, as shown during the last malaria epidemic in Ceylon, cannot be challenged. We are referring to the subject more than once from consideration of different aspects and some apparent repetition will perhaps be excused. Belladonna, a typical example of an important group of anodynes, grows well in the Western Himalayas, from Simla to Kashmir, the plant yielding about 0·4 per cent. of alkaloids *hyoscyamine* and *atropine*. Belladonna is being grown in the Darjeeling area and a supply giving the same amount of alkaloidal content was obtained by the writer from the Mungpoo garden. Digitalis is acclimatised on the Nilgiris, where it grows with little attention, while experiments are being conducted in the Botanic Gardens, Calcutta, with a view to developing the supply. Ipecacuanha has been raised with some success in the various hill stations of India, and it has been proved that it only requires care and attention to raise it in sufficient amount to make it commercially remunerative.

Emetine which is one of the alkaloids of ipecacuanha, a small plant belonging to the same N. O. *Rubiaceæ* that yields *quinine*, is practically a specific for amœbic dysentery, a disease very common in this

country. The value of this drug is being increasingly realised and a large supply ought to be available for use. It is some fifty years ago since this plant was introduced into India, but since that time, under the care of the manager of the cinchona plantation in Darjeeling district, it has already developed, it being estimated that there are now over one hundred thousand plants in that plantation alone. It is expected that it will soon be possible to manufacture *emetine* on a commercial scale.

Need for an Extended Survey

It will first be necessary to carry out a more extended survey of the possibilities of drug cultivation in India. Some work of this nature is doubtless being undertaken by the Imperial Council of Agricultural Research. What is required is apparently a concerted line of action with the mobilisation of the industrial and scientific talents of the country. The Government may perhaps be expected to give more liberal assistance to such work, but it is imperative that private individuals (including zamindars and States, or companies) should show their readiness to co-operate. When the field is surveyed, it will be possible to take steps towards the proper measures for bringing the drugs up to the standard demanded by pharmacopœias. It is here where failure is very apparent in the present trade in drugs. The variation in the quality of wild-grown drugs is a serious drawback to finding a profitable market therefor. For instance, Podophyllum Emodi, a plant discovered more than forty years ago in India, though

identical with the American drug used for medicinal purposes, remained unrecognised till 1914 by the British Pharmacopœia for the simple reason of variation in active constituents.

In the matter of climate and environments, the greatest trouble and care must be taken. At the present time the drugs are simply placed on the market and brought up by dealers without submitting them to any tests. They do not know the age of the drugs, or whether they preserve their medicinal properties. It is easy to see that there will be little prospect of advocates of Western medicine taking kindly to Indian-grown drugs if the cultivation and preparation are not carried on systematically and according to acknowledged standards, under the supervision of men who have undergone a thorough training in pharmaceutical chemistry and pharmaceutical botany.

Scope of Cultivation

A list of vegetable drugs as recognised by the British Pharmacopœia, 1898, 1914 and 1932, will be found in Appendix I and, as already pointed out in p. 12, more than 50% of these drugs, as are *official* in the B.P. (1898) and (1914),are indigenous to India and Ceylon, and nearly the whole of the rest could be cultivated. Several of these drugs are very important, being used in large quantities and containing valuable alkaloids or other active principles. It has been mentioned in pages 10-12 that a good deal of action on drug cultivation in India has already been taken by Government. In fact the matter engaged the attention of a special officer. The success of *pri-*

vate enterprise, however, depends chiefly on *honest* and careful *work* and, *secondly*, on the adoption of such *scientific* methods as obtain in European countries, Railway facilities to admit of cheap transport of Indian-grown drugs from hill and other stations to factories are also needed. In any circumstances the following instances, which have already been referred to in a general manner, seem to be worthy of the attention of cultivators and of capitalists alike :—

Belladonna—Most of this drug used to be imported till 1915 although it grows well in the Western Himalayas from Simla to Kashmir. Owing to the scarcity of imported drugs since the outbreak of last war, the Indian-grown Belladonna met local requirements till 1919, leaving a surplus for export. The plant yields important alkaloids, namely, hyoscyamine and atropine, and varies in its alkaloidal contents under climatic conditions. Investigations undertaken in Western countries with the object of determining the conditions which govern the variations in the alkaloidal content shew that the first generation of plants secured from seeds of cross-pollinated selected individuals display the characteristics of the maternal parent with regard to alkaloid productivity. There are other peculiarities which afford ample room for scientific investigation and for scientific cultivation. It is surprising that without any such attention the Indian Belladonna root is found (p. 19) to contain 0.4 to 0.45 per cent. of alkaloid against the average of 0.42 per cent. in the case of the foreign root. Better results are therefore sure to ensue from a *systematic cultivation and collection* of this drug.

Cloves—The impetus, which the boycott of Zanzibar cloves gave to the cultivation of this spice in India, has, it is reported, endured and, with the co-operation of States in South India, a valuable agricultural industry could be encouraged to render the country self-sufficient in this respect. The successful cultivation of cloves in India, as was apparent to the writer from a few samples sent to him some years ago by an agricultural farm in South India, would result in a considerable saving compared with the price of Zanzibar cloves. The present consumption in the country averages 70,000 cwts. a year and as a valuable drug, namely, clove oil, is obtained from cloves, the consumption would be more if the industry is established.

Digitalis—is quite acclimatised on the Nilgiris, growing there without any attention and the leaf has been found to be equally active to that grown in England. It is not known whether the Nilgiri supply is sufficient to meet the full requirements of the whole of India. The question is one of extending the cultivation to other places, such as Darjeeling, Dehra-Dun, etc., which might be found as good as Ootacamund for growing Digitalis. The leaves of the second year's plant alone are authorised for medicinal use. They should be collected when the plant is in full flower and dried immediately after collection. These are details which could be satisfactorily attended to only by a pharmacist.

Henbane or *Hyoscyamus niger* is a native of the temperate Himalayas. It was introduced into the

Botanic Gardens, Saharanpur, in 1840, and it has since been steadily cultivated there. Both the leaves and seeds are useful, containing the same alkaloids as in the Belladonna plant. For the British Pharmacopoeia preparation of Tincture Hyoscyamus, the carefully dried leaves of the second year's plant are required. In 1916 a bag of entire plant with leaves, branches and flowering tops was received at Madras from the Coimbatore farm and the tincture made by the writer from the leaves alone according to the British Pharmacopoeia (1914) process was found, on regular examination, to be better both chemically and physiologically than the preparation from the English leaves and flowering tops. In view of the alkaloids which are present in the leaf as well as in the seed, there is an opportunity here for the cultivation of the plant on a commercial scale.

Ipecacuanha, which has recently come into particular prominence owing to the well-known researches of Sir Leonard Rogers as to the special value of its active alkaloid *emetine* for the cure of amœbic dysentery, has been raised with a small measure of success in the hilly parts of India, and it only requires care and attention to obtain the same success as has been attained in Johore (Straits Settlement).

Ipecac root is now useful not only for the various British Pharmacopœia preparations made out of the powdered drug, but also for its active alkaloid *emetine* which is referred to above, and the cultivation of the plant on a large scale will therefore be commercially remunerative.

Jalap root grows as easily as potatoes on the Nilgiris and a sample obtained from there in 1913 was found, by the writer, on microscopical and chemical examination, to be as good as the imported variety. The powdered root is required for three British Pharmacopœial preparations (compound tincture, tincture and compound powder) and the annual requirements for the whole of India must be so large as to make the cultivation of the drug a paying industry.

Podophyllum which grows wild in India was shewn by Sir George Watt in 1888 to be identical with the American drug which alone was authorised by the British Pharmacopœia till lately for pharmaceutical purposes. The Indian variety has at last been recognized by the British Pharmacopœia (1914) and this recognition should afford an incentive for a systematic cultivation of the drug. The great advantage accruing from a systematic cultivation of drugs is that a regular supply of *genuine* drugs of *standard quality* is assured whereas the variation in the quantity and quality of wild-grown drugs is often a very serious drawback to finding a profitable market for them.

The above are only a few instances of what could be done in the line of drug culture in India. They also shew that efforts have been made here and there to grow a few medicinal herbs which are not indigenous to India, but unless the efforts are systematic and properly organised, commercial success is not likely to be certain. The whole activity connected with the growing, collecting, drying and marketing of vegetable drugs might

preferably be centralised in a technical department which will direct and control the cultivation *on a co-operative basis* instead of through the establishment of large drug farms which will be very costly with no guarantee for success. Under this arrangement, which may include even small activities like those shown in schools and private houses, not only an abundant supply of genuine vegetable drugs of superior quality will be assured and over-production checked, but means will be found to provide ample sources of raw materials for a very valuable industry, namely,

III

Extraction of Alkaloids

The manufacture of alkaloids, many of which are of great importance in medicine, constitutes an important branch of "fine chemical" industry. In England Messrs. Burroughs, Wellcome & Company have a special department for the manufacture of alkaloids and out here we have a long-established alkaloid industry under Government control in the manufacture of *quinine*. What is now proposed is to introduce into India more such industries so far as the raw materials in the country would permit.

Under "Drug Cultivation" it has already been mentioned that several indigenous Indian drugs (*vide* Appendix I) contain important alkaloids and that a group of such alkaloids is derived from solanaceous plants of which *belladonna* and *hyoscyamus* are familiar

members. It is also noted (p. 22) that the Indian belladonna root yields as much "total alkaloids" as the average of the imported root. These alkaloids are so important that a serious effort is now beingmade to cultivate belladonna in America in order to make that country independent of German alkaloids just as she is proposing to be in the matter of dyes and it would be a great pity if India, in spite of her natural advantages, were to lag behind.

From the above it must not, however, be understood that the extraction of alkaloids could be undertaken at once if necessary capital were forthcoming. The subject is a highly technical one, different methods being employed according to the nature of the alkaloid to be extracted. To illustrate the writer's statement it may be mentioned that the alkaloids hyoscyamine and atropine obtainable from belladonna are not chemically distinct, their difference lying in optical activity, and that the exact processes *used on a large scale* are trade secrets. The details are worked out by various firms after years of experience and research and similarly we should pass through a stage of experiments before we are in a position to place our products on the market. The processes preparatory to extraction of alkaloids are, however, largely those which a *manufacturing pharmacist* employs in preparing his various extracts and tinctures from vegetable drugs, and by profession and training he is therefore a suitable person to tackle this subject. But it is not enough to attend to the manu-

facturing processes only to make the industry commercially successful. A good deal of attention will have to be paid to drug culture in order to improve the alkaloidal content of the drug plant.

It has within recent years been shown by a French biologist that the alkaloidal content of solanaceous plants can be increased by manuring and it is also known with reference to cinchona bark that the quantity of alkaloid can be greatly increased by special cultivation and specially by selection for richness in alkaloid. *What is therefore needed for a systematic work, and thus to ensure commercial success, is a close co-operation of a manufacturing pharmacist, on the one hand, and the drug culture department on the other, and in course of time we may expect a new industry firmly established in India as has been the case with quinine manufacture.*

We have been drawing attention to these facts for years since 1918. Something in this line is apparently being done by the Imperial Council of Agricultural Research. The matter will also doubtless engage the attention of the National Planning Committee.

There are other alkaloids which are equally important and for which we have sufficient raw materials. India is famous as an opium-growing country and as the revenue from this source has lately been seriously curtailed, attention may be directed to the manufacture, on a large scale, of opium alkaloids of which *morphine* and *codeine* are the most important, although some 25 varieties are known. It is true that Indian opium is not so rich in alkaloid as the Persian or Asia-

Minor variety, but with cheap Indian labour and with special attention to the manufacture of its alkaloids, India may successfully compete with the imported alkaloids chiefly obtained from Smyrna opium.

There is still another alkaloid, the manufacture of which should have been the monopoly of India, but unfortunately the country is only the exporter of its raw material instead of being the manufacturer of the alkaloid which is known as *strychnine*. This is obtained chiefly from nux-vomica seeds which grow in South India and in Ceylon, also from Ignatius beans found in the Philippine Islands. The supply of nux-vomica seeds is so plentiful, and the initial process involved in powdering it is so laborious and slow, that several factories might be started throughout India on the principle of division of labour, the drug being powdered first and the powder sent from different centres to a central depot for the subsequent processes to be completed. It is a happy sign that the manufacture of this alkaloid has already been undertaken, with some amount of success, by Messrs. Smith Stanistreet & Co., Calcutta.

IV

Galenical Preparations

The last but not the least line of important industries, which could be developed out of indigenous drugs in India, lies in the *scientific* manufacture of standard preparations, such as tinctures, extracts, etc. Several of these indigenous drugs are recognised (*vide* Appendix

I) by the British Pharmacopœia and the authorised preparations have hitherto been largely imported into India. The Government Medical Stores Department, however, undertook the pioneer work in this line several years ago, thus introducing into this country the local manufacture of imported medicines to a certain extent. The factories attached to Government Medical Store Depots have been in existence for a few decades and the success achieved seems fully to justify the expansion of this business either out of public or private funds, especially when it is remembered that the *Government activity reaches only a fringe of the Indian population in hospitals only, while millions of civil population remain to be served by outside agencies. The scope of the business is accordingly so extensive that there is ample room for both Government and the people to invest their capital profitably in the manufacture of "galenicals," the profits being quite attractive as explained in the writer's pamphlet on "Drug Manufacture".*

Requirements

Assuming that the necessary capital will be forthcoming, there being a certainty of profits, the next requirements will be (*a*) raw materials and (*b*) professional knowledge. India is immensely rich in raw materials required for *galenical* preparations, although she is otherwise in chemicals. The question therefore arises what professional knowledge is required and whether this is available in India. To consider this

question with reference to India's requirements it is necessary to divide the galenical preparations into three groups :—

Indigenous Drugs.

Groups.	Requirements.	Remarks.
(1) *Official preparations, i.e.*, those which are recognised by and included in the British Pharmacopœia.	(a) Raw materials to be of the nature, substance, and quality required by the British Pharmacopœia. (b) Standardisation of preparations.	To determine the nature and composition of substances to be used for both (1) *Official* and (2) *Officinal* preparations and finally to standardise the strength of preparations, *it is necessary to employ pharmaceutical chemists who are trained in the microscopical, chemical and physiological examination of drugs and who know exactly what the commercial varieties, substitutions and adulterations of drugs are and how to detect them. Such chemists are now rare in India and means will have to be found to provide them, namely, by a Pharmacy Act as recommended by the Drugs Enquiry Committee, 1931, and as urgently required.*
(2) *Officinal preparations, i.e.*, those for which there are well-recognised formulæ, but which are not mentioned in the British Pharmacopœia.	Raw materials to be of the nature, substance, and quality required by the authoritative books in which the officinal preparations are mentioned and their formulæ laid down.	
(3) Other preparations from indigenous drugs not falling under (1) & (2) above, but chiefly known as *Ayurvedic* and *Unani*.	(a) To find out by scientific investigation which of the indigenous drugs are of therapeutic value. (b) To lay down standards and formulae on the conclusion of investigation.	This investigation has been undertaken by the Calcutta School of Tropical Medicine and an extension to useful Indian drugs of B.P. methods of manufacture as explained in the writer's 'Drug Manufacture' will lift the haze which now surrounds the indigenous drugs of Ayurvedic and Unani Practitioners.

Need of Official Control over the Sale of Drugs

As mentioned above in the remarks against (1) and (2), there is one risk in obtaining supplies of medicines from a private firm in India. There being no "Drugs and Pahrmacy Act" as yet in the country (*vide* page 5), a position which is, however, happily going to be ended by central legislation very soon according to a press report of Nov. 11, 1939, there is no guarantee that the medicines manufactured will be of the nature, substance or quality required. The importance of strict control over all raw materials used in a drug factory and over the manufactured products cannot be over-estimated. If, therefore, the manufacture of drugs is ever to be undertaken generally in India, the work, it is thought ,must in the present circumstances be under the supervision of a responsible department. This restriction, however, will render it impossible for the industry to develop in India under private management except in a very objectionable way by unscrupulous manufacturers who are not practically penalised at present and who are now free to advertise their preparations and to trade upon the credulity and the ignorance of the public. This has been amply shown by the writer by his continued agitation since 1917 and later by the report of the Drugs Enquiry Committee (1930—31). Public interests apart, this freedom is prejudicial to the interests of honest manufacturers who are subject to the penalties of the "Food and Drugs Act" in their country and who in their trade with India have to compete with the Indian and the

foreign manufacturers placed in a secure position to flood the market with cheap and inferior as well as spurious preparations. An inadequate Bill known as the *Import of Drugs Bill* was introduced by the Government of India in the Central Assembly in 1938. This was, however, withdrawn in deference to strong public opinion against such piecemeal legislation. These circumstances seem to call urgently for the introduction into India of a comprehensive " Pharmacy and Drugs Act ", as strongly recommended by the Drugs Committee 8 years ago. But the introduction of this Act would require the presence in the country of a sufficient number of trained pharmaceutical chemists to enforce the operation of the Act. The immediate difficulty involved in finding a body of such chemists will perhaps be solved by providing arrangements for chemistry and botany graduates as well as for medical graduates to undergo a short course of practical instruction. In other words, the same devices as were adopted in other countries under a similar situation will have to be followed here also. The practical course will consist not only of instruction in a drug factory, but also of a good deal of chemical and microscopical examination which could conveniently be arranged for in the several college laboratories pending the establishment of regular Pharmacy Colleges throughout India. There was a proposal in 1938—39 to establish one such college in Calcutta. Although the idea is slowly progressing, *it is expected that in the course of a few years there will be several such colleges, as also a large body of trained chemists in the country, not only to*

work successfully the "Pharmacy and Drugs Act" if introduced into India, (q.v. p. 32), *but also to assist in the development of the pharmaceutical trade and industry on an honest and scientific basis.*

Apart from the question of introduction into India of the "Pharmacy and Drugs Act," the interests of indigenous Indian drugs alone, which give promise of a bright future, seem to necessitate (1) the employment of a body of trained analysts and (2) the provision of some arrangement for a course of practical training in analytical *and manufacturing* work. *Not only will* these arrangements provide *a new opening for several of the educated Indians,but* will ensure *the growth of a valuable industry in connection with indigenous drugs, leading automatically to a much desired reform in the teaching and in the practice of* **Ayurveda and of Unani Medicines.** This view, originally expressed by the writer in 1918 and further in a series of articles since 1919, was subsequently endorsed by the recommendations of the Drugs Enquiry Committee (1930—31). Recently, in June 1939, the Government of Bengal was reported to have addressed a letter to the General Council and the State Faculty of *Ayurvedic Medicine*, on the subject of standardising the drugs included in the indigenous systems of medicine and on the need of compilation of an Indian Pharmacopœia. As this letter is a tardy recognition of the writer's views, the facts already set forth, as also those in the following paragraph and pages, seem to be deserving of special attention.

With reference to what is mentioned above, some of the writer's articles, which were published 20 years

ago, and which related to the need of official control over the sale, storage and manufacture of drugs in India and over the profession of pharmacy and pharmaceutical education in the country, are of particular interest at the present moment and may well be re-produced here :—

Adulteration of Foods and Drugs

Reprinted from the " Indian Medical Record, " May, 1919.

As remarked the other day by *the Statesman* of the 25th March, 1919, in the course of an editorial article on the writer's pamphlet on Indigenous Drugs, there is, in most civilised countries to-day, a " Food and Drugs Act " which aims at the prevention of adulteration. It is, however, open to question whether India is a civilised country and whether an Act of this nature is really called for here. It is admitted that the masses in India are poor and it is doubtful whether they could afford to pay for the luxury of pure food and pure drugs at prices generally beyond their means. The middle classes are supposed to be the backbone of all nations and represent all that is best and choicest in a progressing country. According to some accounts there is a good deal of mortality among the middle classes in India and this is attributed to malnutrition arising from poverty. With a decaying middle class it is no wonder that India's progress will shortly be arrested. From a medical standpoint we are not concerned with measures calculated to remedy poverty. It is, however, true that a man in health is a better wage-earner than in disease and, as such, considerations of health have much to do with questions of poverty and of national

decay. Food and health, also drugs and disease, being inseparably associated together, it becomes a question of prime importance to provide pure food and pure drugs, whether a country is civilised or not and whether the people have the necessary buying capacity. It may be questioned whether it is advisable to insist on purity at a higher cost, but it is a fact that, so long as there is no lack of supplies, prices and buying capacity adjust themselves, and that measures for the prevention of adulteration result in an improvement of quality. The whole question, therefore, is what measures should be adopted for the prevention of adulteration. With reference to this point the Indian Industrial Commission in para 217 and page 168 of the report writes :—"We have examined with considerable care the arguments for and against legislation to prevent the adulteration of articles intended for local consumption and of produce for export. The case of food-stuffs for local consumption presents few difficulties, for public opinion is agreed that, so far as these are concerned, their adulteration should be punishable by law. In the United Provinces, an Act has been in force for some years, penalising the adulteration of food and drugs, and legislation in other provinces is following similar lines. The adulteration of drugs is, however, much more difficult to deal with; and it is doubtful if legislation is likely to be very effective in this direction. The organisation for enforcing the existing Acts requires considerable strengthening ; at present it exists only in certain municipal areas." From these remarks it appears that, in addition to legislation, there should be an efficient organisation

to enforce the Act. An efficient organisation for the purpose lies, as is already well known, in a staff of competent pharmaceutical and analytical chemists. In the United Kingdom, as well as in other advanced countries, there are institutions for training such chemists. Unfortunately for India there are as yet no such institutions here and it is sickening to find unqualified men generally posing themselves as analytical chemists. Neither a medical man without a chemical qualification as an analyst, nor a general chemist from an Indian University, is ordinarily an analytical chemist who is a combination of the two in certain specialised subjects, both pure and applied. It is not understood why the Calcutta Municipality, or an institution like the Science College, could not take an initiative in the matter. Measures for the prevention of adulteration of food and drugs are urgently called for in the interests of the well-being of our nation and the money and energy spent to this end will no doubt be well spent.

[The view expressed above in the concluding sentence is fully corroborated by disclosures from the survey undertaken by the Bio-chemical Standardisation Laboratory, Calcutta, during 1937—39, and its suggestion, as published in the Press on 7th October, 1939, is as follows:—" It also seems imperative that the profession of pharmacy in India should be placed on a better footing so that compounders who compound, dispense, or otherwise distribute drugs, are given such training and status as to enable them to discharge in a more responsible manner the duties and responsibilities attached to their calling. "]

Standardised Drugs

Reprinted from "The Indian Medical Record," Calcutta, June, 1919.

In paragraph 79, page 53, of the report of the Indian Industrial Commission, (1916), it is mentioned that India imports *chemicals* to the value of more than a *crore of rupees a year.* It is understood that this sum is spread over a large variety of articles and that owing to the relatively small quantities of each kind consumed in India under peace conditions, local manufacturers have hitherto limited their attention to the few "heavy" chemicals which were in sufficient demand to support an economic unit of manufacture. It is further stated in that paragraph that "simple drugs and extracts are also manufactured on a small scale, but only in official medical stores and a few private factories on any recognised standard of purity and strength." The official medical stores which undertake the manufacture of drugs are the government depots at Madras, Bombay and Lahore. These depots are Imperial institutions, being directly under the Government of India, and the standards of purity and strength, which the preparations made there are required to conform to, are those laid down in the British Pharmacopœia.

The British Pharmacopœia is a compilation of medicinal drugs (chemicals, vegetables, etc.), *first* issued in 1864 under the authority of the General Medical Council of the United Kingdom and since revised four times, the present B. P. of 1914 being the 5th edition, and affords to the members of the medical profession and to those engaged in the preparation of medicines

throughout the British Empire, *one uniform standard and guide*, whereby the nature and composition of substances to be used in medicine may be ascertained and determined. *Manufactured* drugs, which are up to this standard, are called *standardised drugs*. Drugs of inferior quality, or their commercial varieties not recognised in the British Pharmacopœia, are not fit for use in medicine and must be rejected, it being impossible to obtain the curative effect from inferior and wrongly selected drugs.

The selection of genuine drugs, their manufacturing processes, and finally the standardisation and assay methods, are highly technical subjects and it is quite impossible for a general chemist, namely, a B. Sc., an M. Sc., or a D.Sc., and Ph. D. in pure chemistry, or for a medical man (L.M.S., M.B., etc.), to undertake these specialised duties without a thorough previous technical training. This training demands a knowledge not only of chemistry, but also of botany, (both pure and applied), and of a few other subjects widely divergent from chemistry, and unless there are regular arrangements here, as in a modern British University of Manchester, Leeds, Sheffield, Birmingham, Bristol and Liverpool, to provide for an up-to-date training in the various branches of applied science, it is hopeless either to develop or to initiate industries in India on right lines. What we need immediately for the development of chemical industries is, therefore, a body of technical chemists and the remarks already made are enough to show that there is a good deal of difference between a qualified technical chemist in a factory and a general

chemist teaching in, or passing out of, a college in India. A technical chemist is a general chemist *first* before he qualifies for employment in his particular line of industry. Courses of regular instruction in the various branches of applied science, coupled with requisite practical training in laboratories equipped almost on the scale of manufacturing factories, are what are needed to transform a general chemist into a capable technical chemist. Without this complete practical and theoretical training in applied chemistry and allied subjects, a general chemist is not ordinarily competent to undertake the manufacture of standardised drugs in which a *standard of quality* is either demanded or essential.

Looking at the appalling rate of mortality in India, and knowing as we do that inferior, adulterated, or badly manufactured drugs are worthless as therapeutic agents, we cannot but insist upon the *immediate* adoption, by Indian Universities, of such measures as will provide for courses of instruction in the manufacture and assay of drugs. Apparently under the initiative taken by the Sanitary Commissioner of Bengal, who deserves our heartfelt thanks, arrangements have been made in the Medical College, Calcutta, for a diploma course in Public Health. Similar arrangements may also be made for a course in Pharmacy as at the University of Manchester. It is true that Public Health officers are *urgently* needed to combat diseases by instituting searching inspections and adopting preventive measures. It is equally true to combat diseases by providing for an abundant supply of pure and standardised drugs

through *indigenous methods of local manufacture.* India is too poor to pay either for the luxury of expensive imported drugs, or for high salaries of technical experts from England, and the result is that thousands of people in this country die either without medicines, or by taking worthless medicines. Fine bottles and artistic labels, or grandiloquent advertisements, do not impart therapeutic values, and in the interests of humanity and public health we must see that qualified *manufacturing and analytical chemists* are turned out *locally* to replace the unqualified men employed on manufacturing and analytical work,—an arrangement which no civilised country would tolerate even for a day,—and the sooner the evil complained of is eradicated, the better for India. So was the remark in a leading article on Ghosh's " Indigenous Drugs " in the March 1919 issue of *the Indian Medical Gazette,* the concluding remark being " There is much to be done, and the sooner the work is begun in India the better. "

A new Drugs Act to improve Pharmacy in India—Position reviewed

Reprinted from the " Indian Medical Journal, " February, 1938.

In the last paragraph of editorial columns in the October, 1937, issue of the *Indian and Eastern Chemist,* Colonel R. N. Chopra, I.M.S., head of the School of Hygiene and Tropical Medicine, Calcutta, who, while recently in Great Britain, was interviewed by the London correspondent of that Journal, is reported to have remarked as follows :—

> "Government has approved a new Drugs Act and will put it into force. The effect of this is going to be a vast improvement in the standard of Indian manufacture, and this will lead to a vast increase in manufacture which, in its turn, will make additional products available to multitudes who must now go without. Only 15 per cent of the total population are reached by imported products. This seems to indicate that there is a market of almost fantastical proportions still to be covered. "

In the issue of the *Statesman* of October 5, 1937, a report was published of the introduction in the Indian Legislative Assembly of a Bill to regulate the *import* into British India of drugs and medicines. Apparently this Bill regarding the control of only *imported* drugs is referred to as a new Drugs Act in Colonel Chopra's remarks mentioned above. It is presumed that the control will extend over such drugs, as are not of the standard quality laid down in the Bill, and that the standards to be complied with have, for the purpose of this Bill, generally been those prescribed in the British Pharmacopœia.

One form of variation from the standard is adulteration. It is, however, not confined to such drugs as are only imported, but is widely prevalent throughout India, as disclosed in the report of the Drugs Enquiry Committee (1930). Presumably the distinction drawn by the Government of India is that the responsibility for control does not rest on the central authority alone, but is divided between provincial Governments on the one hand, and the central authority on the other. The contention seems to be that, so far as preventive measures and control of pharmacists within the provinces

are concerned, the matter is provincial, while in respect of imported drugs, which enter the country through the ports, the responsibility is central, the ports being under the direct control of the Government of India.

There are adulterations in various commodities, but all civilised countries have dealt with the drug adulteration in one uniform way, namely, by creating a statutory pharmaceutical profession and leaving all control and preventive measures to be undertaken by this profession. In no country the customs, the excise, and the police authorities are allowed to interfere with drugs, nor is any distinction drawn between ports and inland country in this respect. It is not understandable to a layman why the subject should be treated in a different way in India. In several editorial articles the *Indian Medical Gazette*, an organ of *official* medical profession in India, strongly held the view that the entire cases of drug adulteration in this country should be met by a central legislation.

More than a century ago the position in Great Britain, and possibly in other European countries, as regards adulteration in drugs, was not less serious than in India at present. Extracts from reports published at the time are interesting. It is also interesting to know what action was then taken in England to bring the situation under control. A contemporary pamphlet entitled *Frauds Detected* stated that few foreign drugs brought into England were free from impurities, being mixed with sticks, stones, straw, dirt, etc. A report issued about 1794 pointed out the

increasing evils accruing from the toleration of the abuses. "There was scarcely a village or hamlet without a druggist ; adulteration and sophistication seemed to be general, and the druggists of Manchester appeared to excel all others in such nefarious ingenuity." An analytical Sanitary Commission sat in England about the middle of the 19th century. The Commission found that " nearly all the most useful and important articles of the Materia Medica were grossly and systematically adulterated to an enormous extent." The pharmacists also were generally illiterate and unscrupulous.

With the position painted as above, the solution found was no other than the transfer of entire drug control to the Pharmaceutical Society of Great Britain, which was founded in 1841 and incorporated by charter in 1843. The *Pharmaceutical Journal*, London, first appeared in 1841, and the Society established in 1842 a School of Pharmacy with Professors of Botany, Chemistry, Materia Medica and Pharmacy. In later years Physics, Mathematics, Bacteriology and Pharmacy Law came to be added, and since 1935 the subjects of Zoology, Physiology and Pharmacology have been included in the pharmaceutical curriculum. The object of the founders of the Society was to effect improvements by *educational means* and to render unnecessary extraneous inquisitorial interference. With this view the medical authorities of Great Britain agreed, indicating that " the chemists and druggists having undertaken to reform themselves would be allowed to proceed unmolested in their laudable undertaking."

If the solution described above has proved a success in Great Britain, it follows that India too, which is being constitutionally remodelled on British lines, will find the same solution equally successful here. This view has been repeatedly brought to the notice of the Government of India through the representations submitted by the School of Chemical Technology, Calcutta, to the Department of Education, Health and Lands, and a summary of the action taken by the School, since 1919, for the promotion of pharmaceutical education in India, was attached to the School's representation of February 14, 1936. As a new Drugs Bill dealing with *imported* drugs only is now before the Indian Legislative Assembly, the whole difficulty will be met if this Bill is just amplified to include the *local* drugs as well and to combine with the draft a Pharmacy Bill, as recommended by the Drugs Enquiry Committee. The contention that the latter measure is essentially for provincial Governments to deal with, appears to have little force if we take into consideration the very large interests involved in the establishment forthwith of a Central Pharmaceutical Association for the whole of India, with provincial branches on the lines of the Pharmaceutical Society of Great Britain.

In dealing with quinine problem in India at the first meeting of the Central Advisory Board of Health held at Simla on June 22, 1937, Sir Henry Gidney had a resolution passed for the production, distribution and sale of quinine to be controlled by the Government of India. It is respectfully submitted that quinine falls under the category of " drug" in the same way as any

other drug and that the distinction made in the new Bill in respect of *imported* and *local* drugs is equally applicable to quinine. If the central authority takes the responsibility for control in regard to quinine, they ought to take it in respect of other drugs as well. This anomalous distinction is done away with by making the pharmaceutical profession responsible for the purity of all drugs including quinine.

The administrative control of the pharmaceutical profession is vested in the Pharmaceutical Association of all countries, and it is not apparent ift he Government of India Act debars the formation in India of a Statutory Pharmaceutical Association by a central legislation.

In western countries the pharmaceutical profession not only controls the purity of drugs, but takes all action for promotion of pharmaceutical education by establishing teaching institutions, etc. Even for the periodical revision of the British Pharmacopœia under the direction of the General Medical Council, pharmacy and medicine have equal representation on the permanent Pharmacopœia Committee. The Pharmaceutical Association is thus an administrative and controlling centre in regard to drugs, and exercises a strong driving force for developing a branch of technological education, as also an important section of chemical industry.

From all points of view it appears to be inconsistent and out of correspondence with the practice in other countries to split up drugs in India into *imported* and *local*, so as to necessitate a differentiation between

ports and inland country, and between the manner of action thought to be called for to deal with the one or the other, and to divide responsibility for control.

Finally, it may be added that the problem of unemployment will be largely solved, and important educational reforms carried out, by the creation of a Pharmaceutical Association either under a separate Pharmacy Act or under a combined Drugs and Pharmacy Act, as recommended by the Drugs Enquiry Committee. It is true that the educational question involved in drug control may be under separate consideration,that there may be a *second* file on the quinine problem,as also a third file dealing with the recommendations of the Drugs Enquiry Committee. To facilitate consideration of the whole problem relating to drugs, extracts from the report of educational experts and from the quinine question may be brought on the Drugs Committee file and a combined Drug and Pharmacy Bill, instead of a piecemeal Bill to control *imported* drugs only, may be placed before the Central Legislative Assembly during the next Delhi session,—a definite action on the Drugs Committee's comprehensive recommendations being long overdue, eight years having already been spent in consideration. As the question is apparently a complicated one, all provincial Governments will feel relieved by the Central Government's lead in the matter, and there would be no question of the Central Government treading on a provincial subject, should there be a central legislation covering all the points connected with drugs.

The strongest argument in favour of the proposed legislation is that the Indian Pharmaceutical Association, if created, will be a *self-supporting* institution as in other countries, the fees, fines, stamp duty, export duty, etc., realisable under legislation, being sufficient to meet all expenses, and that a central legislation is the only suitable instrument to cover all these details which have already been fully furnished in the report of the Drugs Enquiry Committee. What is, therefore, needed is to substitute a combined Drugs and Pharmacy Bill for the new Drugs Bill already introduced in the Indian Legislative Assembly, and it is confidently hoped that my suggestion will receive general support, an efficient Indian Pharmaceutical Association, both central and provincial, being rightly essential in the interests of public health.

[Mr. J. C. Ghosh who is well qualified to write on this subject points out the defects and the limitations of the Bill 'to regulate drug imports' into India which is on the anvil of the Central Legislature. If the proposed Bill is to serve any useful purpose it should regulate not only the imports but also local manufactures. As the writer pertinently remarks, it would be inconsistent and injurious if the drugs are split up into *imported* and *local*. What is really wanted is a proper control of all drugs, Indian and foreign, and we trust that the criticisms of Mr. J. C. Ghosh will receive the attention of the Central Government before the bill is finally enacted.

Ed., I. M. J.]

Drug Control in India—Need for Immediate and Comprehensive Legislation (Central)

Reprinted from the "Indian and Eastern Chemist", May, 1938.

In 1917, while employed as Pharmaceutical Chemist, Government of India Medical Stores

Department the writer issued a pamphlet on "Drugs Manufacture—what it means," and pointed out therein what mischief was being done by adulterated and spurious drugs, and how urgent was the need for such pharmaceutical education and drug control in India as obtained in other civilised countries. In 1919, a second pamphlet entitled "Indigenous Drugs —their scientific cultivation and manufacture" was published, in which the writer put up a strong plea for a Food and Drugs Act, and the scathing remarks made therein on prevailing adulteration in drugs on the Indian market were endorsed by the *Indian Medical Gazette* and the *Statesman* in their editorial articles of March 1919 and the 25th March, 1919, respectively.

More agitation was organised through medical journals and leading newspapers in India, also through the *Pharmaceutical Journal* and the *Indian and Eastern Druggist*, London. In 1924, a draft Bill was submitted to the Bengal Council, but the Government of India withheld their preliminary assent simply because of a technical objection to inclusion of pharmaceutical education in a Food and Drugs Bill. In 1926, a book on "Technical Education" was published, which devoted a chapter to pharmaceutical education, drug analysis, standardisation, etc. In 1927, a resolution was passed in the Council of State on the subject of drug control in India. In July 1928, the *C. and M. Gazette*, Lahore, undertook a vigorous campaign, exposing serious adulteration in drugs.

In September 1928, an adjournment motion was moved, and questions were asked in 1929, by Colonel (now Sir Henry) Gidney, I. M. S., at the Legislative Assembly (Central), which brought the matter to a head, while representations were submitted to the Government of India by the Indian Merchants' Chamber, Bombay, and by the Calcutta School of Chemical Technology, the latter also publishing a series of articles in London Pharmaceutical Journals during 1928-30, with the result that the Drugs Enquiry Committee was set up by the Government of India in September 1930.

The Committee was presided over by Col. R. N. Chopra, I. M. S. They carefully went into the subject of drug adulteration in India, of its consequences, and of what was required to improve pharmaceutical training, trade and industry. Comprehensive recommendations were submitted by the Committee in 1931, and as a *first step in* recognition of these recommendations the Central Government, which set up the Committee, sanctioned a year ago the establishment in Calcutta of a Central Drug Testing Laboratory. The *second* step taken in October, 1937, to implement the recommendations, was the introduction in the Indian Legislative Assembly of a small Bill to control only the *import* of drugs and medicines. These two measures touch only the fringe of the Committee's recommendations and, as already seven years are past in consideration, there is an uneasy feeling that the trade in adulterated drugs has increased in the meantime, which is not only a fraud on the consumer's pocket, but constitutes a serious menace to public health. As an explanation of the difficulty

experienced, it now appears from the statement of objects and reasons accompanying the *Import of Drugs Bill*, that the manufacture, storage and sale of drugs, as also control of pharmacists and pharmaceutical education, are essentially for provincial Governments to deal with, and that the Government of India are precluded from undertaking the necessary legislation.

Strong protests against the view expressed above were laid in the writer's articles appearing in the January, 1938, issue of the *Indian and Eastern Chemist*, in the *Pharmaceutical Journal*, London, of the 12th February, and in the same month's issue of the *Indian Medical Journal*. The writer's view is shared by other writers. In its issue of March 21, 1938, the *Statesman's* leading editorial calls the *Import of Drugs Bill*, as "a very inadequate measure of defence against the evil it aims at overcoming" and remarks that "what the Government of India is doing cannot be regarded as "action as a whole", for the Bill deals only with imports and importers, a limitation that will certainly not put an end to adulteration, but will put the honest importers at the mercy of the dishonost manufacturers or distributors in this country." *The Indian Medical Gazette's* editorial comment referred to in the opening lines of this article also asks for "action as a whole," it being clearly felt that any piecemeal legislation would defeat the object for which the Indian public opinion has been agitating so long and which formed the subject matter of the Chopra Commitee's recommendations.

The protests made have had some effect. The *Import of Drugs Bill* was recently referred to a Select Committee during the last Delhi session of the Legislative Assembly. It is reported that the Select Committee has recommended that instead of the present Bill a more comprehensive one should be introduced, the provincial Governments either enacting a uniform legislation, or authorising the Central Government by a resolution passed by their legislatures to undertake necessary legislation. The action taken by the Select Committee doubtless clears the line for further steps to be expedited. But the procedure indicated still retains the element of delay. Assuming, however, that the legal view taken is correct, we may ask whether, in a situation like the present uncontrolled state of the Indian drug trade, which is both a scandal and a danger and which is lowering India in the eyes of the civilised world, the Central Government would not be competent, under the new constitution, to deal with provincial subjects with the previous sanction of the Governor-General.

In addition to the legal point raised there is another aspect for consideration. Pharmaceutical control in India, as in other countries, is a question of considerable expense on account of the need for provision of requisite pharmaceutical education, supervision, equipment and staff. To meet this expenditure the Chopra Committee recommended several financial measures. Of these (1) an extra 5 per cent import duty on drugs, (2) a minimum stamp duty of 12½ per cent on locally manufactured patent medicines, (3) an additional 20

per cent duty on all patent medicines, imported and local, with undisclosed formulæ, and (4) an export duty on drugs obtainable only from India, are apparently possible to be levied by a central legislation. If so, the whole argument of the case being one of *provincial legislation* falls through, and "action as a whole" is immediately called for from the Central Government.

The last and the most important point is to note the trend of recent pharmacy legislation in Western countries. It is desirable that a qualified pharmacist should be allowed facilities to have his own pharmacy and to do his useful work there *independently*, thereby contributing to the creation of a voluntary National Health Service—an ideal dealt with in the writer's booklets on "Automatic Rural Reconstruction" and "Indian Educational Reconstruction". It is therefore essential that the *retail* sale of all Western medicines, as well as dispensing, should be reserved to the qualified pharmacist by legislation. There should also be Pharmaceutical Boards, provincial and central, the funds to be obtained by levies being assigned to the Central Board for expenditure on pharmaceutical education, progress and control. The Boards will further arrange for co-ordinated buying of medical stores for distribution on payment according to individual pharmacist's requirements compiled by districts and provinces. This arrangement, as well as the preparation of a drug tariff for each province, will keep the price of medicines reasonable and the quality pure, will do a way with the growth of multiple medical stores and prevent commercialisation of pharmacy. There is a great deal of work

to be done and every effort may be made to bring into existence, as soon as possible, a pharmaceutical profession which is as noble as the medical profession, the one concerned with dispensing and with the purity and efficacy of drugs, while the other with diagnosis and prescribing. The pharmaceutical profession, as outlined, will be a valuable asset for India, both in rural and urban areas, its work will provide a new career for the educated classes of either sex, thereby reducing unemployment to some extent, and its training will introduce a new system of education, self-supporting, cultural as well as practical.

Extract para. 2 of a letter dated the 23rd September, 1938, from the Editor of the *Pharmaceutical Journal*, London, addressed to Mr. J. C. Ghosh, School of Chemical Technology, Calcutta:—

* * *

"2. In this country we are watching very closely and with very great interest the progress, slow though it is, in the stabilisation of Pharmacy in India. It is to be hoped before long your efforts and those of Dr. Chopra will be rewarded with a proper pharmacy bill to cover not only the question of a pharmaceutical register, but also the points made by the Drugs Enquiry Committee in 1930."

* * *

Pharmacy in India—An Exposition

Reprinted from the Indian Medical Journal, January, 1939.

In the course of his comments on the medical profession in India, as recently published in the *Indian*

Medical Review, the Director-General, Indian Medical Service, refers to pharmacy in this country in the following terms :—

> "A close study irresistably points to the pressing need for immediate improvement of the situation in regard to the profession of pharmacy in India and to manufacture, sale and import of drugs included in the British Pharmacopœia as well as of those which are known and approved.
>
> Both Bengal and Madras have instituted advanced courses in Pharmacy, but they are not popular mainly because the prospects for future remunerative employment are meagre. The probable solution would be to insist upon a reasonable standard of general education, such as is guaranteed by passing the Matriculation examination of an Indian University, an adequate course of training, including apprenticeship of not more than 9 to 12 months and properly organised "provincial examinations."

2. The Director-General admits the "pressing need for *immediate improvement*", but if the concluding words of his comment are meant to leave the initiative and subsequent executive action with the Provinces, it will probably take years for the whole scheme to mature, for the funds to be found in the present financial stringency, and for the final start to be given. Hence it is clear that the conclusion is directly in conflict with the previous admission of pressing need. In the circumstances, one or the other must stand. Apparently there is no *via media* unless immediate action is taken by the Central Authority, the details being left to be carried out by the Provinces so far as they are concerned and as their funds admit. As, however, the pressing need was fully established long ago by the findings of the Drugs Enquiry Committee (1930), we are afraid we

make ourselves ridiculous by continuing to talk of pressing need and still refraining from pressing for immediate legislation.

3. The question would have been easy of solution if immediate legislation for the whole of India by the Central Government in respect of the subject under discussion were possible. The difficulty, however, arises from the fact that, under the Government of India Act, (1935), the control of drugs and the practice of pharmacy being mostly provincial subjects, the Government of India are precluded on technical grounds from taking action without the previous concurrence of the local Governments.

4. Even under the Reforms (1919), preliminary to the introduction of the new Act, the difficulty referred to existed. In fact, that matter received due consideration at the hands of the Drugs Committee. Nevertheless, in view of the public health and economic interests of the whole country (which were at stake in the pharmaceutical line), and as the abuses therein could not be checked and a uniform programme, educational and administrative, laid down unless there was a uniform and simultaneous legislation throughout the provinces, it apparently occurred to the Drugs Committee that there should be Central Legislation to meet the situation effectively and with uniformity. Under the special powers vested in the Governor-General in Council, Central Legislation in respect of provincial matters was also possible. Accordingly, Central Legislation was strongly and deliberately recommended by the Committee in their report of 1931.

5. It is more than seven years since the report was submitted to the Government of India and the question arises why despite pressing need so much time has been allowed to pass away without a final decision having been arrived at hitherto. The first instalment of orders on the report was issued two years ago by the Government of India with the result that a Central Drug Testing Laboratory financed by Central Revenues has been established in Calcutta to give effect to one of the recommendations of the Drugs Committee. The other main recommendations were (1) a comprehensive Drugs Bill dealing with both *imported* and *local* drugs and (2) a comprehensive Pharmacy Bill to regulate pharmaceutical practice and training, both the Bills operating concurrently and both being enacted by the Government of India apparently for the reasons mentioned above.

6. It appears that the constitutional and legal difficulty explained in paragraphs 3 and 4 swayed so long with the Government of India, for under the Constitution the responsibility of seeing to the purity of drugs is divided between the Central and Provincial Governments. So far as the Sea and Land Customs are concerned, the import of drugs is exclusively under the control of the Central Government. Accordingly, in response to the findings of the Drugs Committee, they introduced in the Central Legislature in October 1937, a Bill dealing with *imported* drugs only, leaving the question of *local* drugs (manufacture, sale and storage) and of pharmaceutical practice and education within the limits of the Provinces to be dealt with by the Local Governments. The Select Committee to

which the *Import of Drugs Bill* was referred, considered the Bill to be inadequate and incomplete and public criticism was also loud and hostile. In these circumstances, the Government of India had to withdraw the Bill early in 1938 and to ask for the concurrence of the local governments in the proposal for the introduction in the Central Assembly of a more comprehensive Bill dealing with both *imported* and *local* drugs. It is understood that an All-India legislation by the Central Legislature in regard to drugs has been generally accepted by the Local Government. This, however, would not solve the problem in its entirety for the control of drugs is quite distinct from the control of pharmacists and of pharmaceutical education. And as pharmacists are the custodians of drugs, the effectiveness of drugs cannot be separated from the training given to and the efficiency attained by the former. Consequently, a comprehensive Drugs Bill, as desired, should include not only provision relating to drugs, but also to pharmaceutical training, the duties and the status of pharmacists, and how they are to be employed. This is exactly what the Drugs Committee recommended and what the public have so long been agitating for. This also covers the solution suggested by the Director-General, Indian Medical Service, himself in his comment. Any deviation from what is universally desired, would again lead to consequences which sealed the fate of the *Import of Drugs Bill*.

7. Then there is a further aspect of the matter to be considered. This is the question of expenditure and how it is to be met. The Drugs Committee were

aware of this aspect and although they were unable to estimate the extra cost involved, they recommended certain financial measures, namely, the imposition of certain export and import duties on drugs and a levy of fees for registration, licensing and testing of samples, which the committee thought would produce sufficient revenue to meet the whole cost. There being no other practical alternative to the present one, which is a *self-supporting* and *beneficial* scheme of cultural and industrial education associated with public health and social service work, it is clear that it deserves to engage the attention of the whole country and to be taken up immediately.

8. The manifold aspects of the problem of control of drugs and pharmacy in India have already been discussed by the writer in various previous articles appearing in newspapers and periodicals. To add further to the articles, brochures, pamphlets and books published by him since 1917 is hardly possible or necessary. A brief résumé, however, will be found in the opening paragraphs of the article on "Pharmacy in India" in the *Indian and Eastern Chemist* for May 1938, page 153. The writer's last article in the same Journal for November 1938, containing suggestions for economising expenditure in the event of the establishment of a College of Pharmacy in Calcutta was published editorially because of the importance of the subject.

9. My final remarks are therefore that there is no time to lose by referring the proposed imposition of export and import duties on drugs and of registration

and other fees to Provinces for their respective opinions. Seven years have already been spent over the consideration of the Drug Enquiry Committee's recommendation, The previous concurrence of the Provinces in a comprehensive Central Legislation must be taken to cover all points. Therefore what remains to be done is to arrange for a debate in the Central Legislative Assembly during the first, second and third reading of the proposed Bill before it is finally placed on the Statute Book before the current financial year closes. The necessary financial measures have to be provided for in the annual Finance Bill and the Finance Department of the Government of India will have to immediately take all preliminary steps. It is clear that the Drugs Bill includiug Pharmacy must be passed by the Central Legislature. If the Bill has to be initiated by the Department of Education, Health and Lands, that Department, in collaboration with the Legislative and the Finance Departments, will have to issue telegraphic reminders, where necessary, to the Provincial Authority.

10. My concluding suggestions are that a Central Pharmaceutical Council under the Government of India, as recommended by the Drugs Committee, be provisionally created at once. In addition to necessary departmental work, this Council will be able to control the expenditure, as also the funds to be raised by proposed impositions, and introduce economies wherever possible. It need hardly be said that the creation of the aforesaid Central Council will supply the needed driving force to stimulate the provinces and to help them to

co-ordinate their separate efforts, and preserve a uniform standard and objective.

Proposed Pharmacy College in Calcutta

(Written statement submitted by the writer on the 10th April, 1939, to the Bengal Government Pharmacy College Committee, in compliance with the Committee's requisition for an expression of opinion on the subject)

Dr. D. E. Anklesaria offers a princely, but a conditional, grant of rupees two lakhs for the proposed college. Of the conditions mentioned the most important is to insist on a qualified chemist for conducting a pharmacy. Under existing practice or rule there is no such restriction in this country. Moreover, medical men are reported to have employed under their protection non-qualified compounders to carry on responsible duties which should have been performed by *at least qualified compounders*. The alleged misuse by medical men of their privilege is most regrettable and could only cease if, on ethical grounds or under legislation, they would refrain from dispensing and from having connection in any shape with a drug or pharmacy business.

2. Taking the best view of the present situation as detailed above, one will find that a qualified compounder is all that is required at present to conduct a pharmacy or to perform similar duties in medical institutions. So long as this ugly state of affairs continues, no one will care to think of a College of Pharmacy and to spend money thereon, for there will be no opening either for employment of the pupils who pass

out of this college, or for improvement of existing standard. What is, therefore, needed in the first instance is *to change the present gravely objectionable situation altogether by legislation* and to proceed at the same time with the establishment of the proposed college which is urgently called for in Calcutta.

3. The required legislation, which has long been in incubation, is a Drugs *cum* Pharmacy Act by the Central Government. Already the subject has been much commented upon in the Press and I have elaborately dealt with the point in a series of articles (copies enclosed). If the desired comprehensive legislation is passed, compounders as a class will eventually disappear and will be replaced by a well-organised Pharmaceutical Profession, as in the West, which will consist of (i) *qualified pharmacists*, (ii) *pharmaceutical chemists* and (iii) *University graduates in pharmacy*. Merging (ii) and (iii) preferably in one class of pharmacy graduates, we shall have only two classes, A and B, who alone will be legally entitled (*a*) to be designated as "*Chemists and Druggists*", (*b*) to own or to conduct dispensaries, also manufacturing as well as analytical pharmacies, class B being further designated as Pharmaceutical Chemists and finally regarded as fully qualified chemists in respect of Drugs as there are chemists in respect of Agriculture, Leather, Dyes, etc. Under such an arrangement there will be no difficulty in completely satisfying the restriction imposed by Dr. Anklesaria. Qualified medical men who have, by further work, qualified as Pharmacologists, are, however, competent to undertake *bio-chemical analysis* of

drugs, but they have nothing to do with the chemical and microscopical analysis which constitutes a large volume of work pertaining purely to the province of Pharmaceutical Chemists (Pharmacy Graduates).

4. Institutions like the proposed College of Pharmacy, or existing Universities in specialised classes, will provide suitable courses of instruction for training in Pharmacy in either 2 or 4 years after Matriculation according as the case is either for qualifying as a Pharmacist or as a Pharmaceutical Chemist roughly according to the syllabus recently drafted by the Education Committee of the Bengal Pharmaceutical Association. The minimum two years should be a period of intensive training in order to provide for at least 3000 hours total work. A Diploma in Pharmacy will be considered as equivalent to the I. Sc. to enable a student to proceed for the Degree courses. As the syllabus is meant for application to all Provinces, the final draft will rest with the Central Pharmaceutical Board which needs to be created forthwith by the Government of India if the required legislation is to be given effect to without any further delay.

5. The question that now arises is how the extra cost involved will be met. The simple answer is that donors like Dr. Anklesaria will be forthcoming more and more, Universities will open specialised courses as at the Benares University, private enterprise, as in European countries, of which a humble example is furnished in the Calcutta School of Chemical Technology (1919), will gradually multiply, and finally sufficient

funds will be raised by imposition through *central legislation* of certain import and export duties on drugs, as recommended by the Chopra Committee (1930), in order to make the *whole organization self-supporting*. More information in this connection has already appeared in the publications of the School of Chemical Technology, Calcutta, as also in the issues of the "Indian and Eastern Chemist" for January, May and October, 1938, respectively, and for January 1939, to which I beg to invite a reference.

6. My further suggestions for the staff required and for economising expenditure were editorially published in the "Indian and Eastern Chemist" for November 1938 and it is earnestly hoped that members of the Central Legislature, who devote much of their time sometimes to less important measures, will, in the circumstances explained, take such interest in the long overdue *Drug and Pharmacy Bill* as will render it impossible for the measure to hang fire longer. The Government of Bengal may perhaps consider it their worth while to submit a strong telegraphic representation to the Government of India (Department of Education, Health and Lands), inasmuch as the Bill affects the health of millions of people and refers to an educational programme designed for public service, public welfare and public utility, both economic and social.

CHAPTER II

MONOGRAPHS

[The articles contributed by the writer since 1919 continued and the following **Monographs** published by him in 1922 and thereafter on certain important drugs, coupled with a concluding note on **India's contribution to Pharmacological Progress,** are supplementary to the volume of information concisely and usefully furnished in **Appendices I and II.** The economic aspect of the whole subject has always been in view under each section, but a special section thereon will be found under Chapter III]

"Ptychotis Ajowan Fructus"

Reprinted from the Indian Medical Record, Calcutta, January, 1922.

AJOWAN—The dried fruit of Carum Copticum (N.O. Umbelliferæ).

Vernacular names.—*Yamani* (Sans.), *Omam* (Tam.), *Omamu* (Tel.), *Oma* (Can.), *Omam* (Mal.), *Jowan* (Beng.), *Ajvan* (Hind.), *Ajwan* (Mar.).

Characters and Tests.—About 2.5 millimetres long and 1 millimetre broad, compressed or arched on one side and convex on the other, of a very pale-brown colour with a tubercular surface. Each mericarp has fine prominent ridges and contains 9 oil tubes. In odour and taste Ajowan strongly resembles Thyme. Incinerated it yields about 10 per cent of ash.

The volatile oil contained in Ajowan is known as Ajowan oil obtained by distillation with steam. Specific

gravity 0.895. About half of this oil is Thymol. The other constituents of the oil are Terpene and Cymene. The oil left after the extraction of Thymol is sold as "Thymene" oil, as a soap perfume. But there may be instances of unscrupulous manufacturers selling this dethymolated bye-product as Aqua Ptychotis (conc.) at a high price.

Pharmacological Action.—Antispasmodic and antiseptic. Considered the most powerful of all umbelliferous carminative fruits. Employed with advantage in chronic bronchitis with excessive secretion, the therapeutic effect being due to the antiseptic property which is particularly in evidence in Thymol used both as an internal and an external antiseptic.

Preparation.—Aqua Ptychotis and Thymol are the well-known preparations out of Ajowan seeds which are cultivated throughout India. There are several Indian preparations made in combination with asafœtida, rock salt, myrabolans, etc., employed as carminatives. The popular carminative is, however, Aqua Ptychotis (Omam water), but it is unfortunate that several spurious preparations thereof are on the market.

The extraction of the essential oil present in the seeds is usually effected in large stills. The seeds are introduced in cages or trays which occupy the interior, and a current of live steam is passed through the still. The oil, carried along by the steam, condenses with it

and floats upon the surface of the water of condensation, from which it is drawn off. This water, which is Aqua Ptychotis, is used repeatedly in the production of steam, in order to avoid any loss of the small amount of oil held in solution. Ajowan oil consists of Thymol to the extent of 40 or 55 per cent, accompanied by Cymene and by a Terpene hydro-carbon. A separation from the two hydrocarbons is effected by agitation with a weak solution of caustic soda in which the Thymol dissolves in the form of its sodium salt. From the alkaline solution the Thymol is precipitated by the addition of hydrochloric or sulphuric acid, the latter yielding a white crop. The crude Thymol is purified by crystallisation from alcohol. The better method of extracting Thymol is, however, to submit the oil to fractional distillation and to obtain large white crystals from the higher boiling fractions.

The manufacturing detail given above is obtained from the writer's own experience during the last Great War period when he had to undertake, under Government orders, the manufacture of Thymol, which was a German product. The process mentioned in the B. P. of 1914, namely, to crystallise at O°C temperature, having proved infructuous, the writer had to take great pains till he succeeded in discovering the commercial process in the summer of 1918.

(q. v. pp. xiv-xv.)

Carum Copticum grows well all over India. It is particularly abundant in Bengal, Central India (Indore),

and Hyderabad (Deccan), nearly 7,000 to 8,000 acres of land being under cultivation each year in the Nizam's Dominions alone.

Aconite Radix*

(Reprinted from the "Indian Medical Record", February, 1922).

Aconite Root [N. O. Ranunculaceæ.]

Vernacular names :—Vatsanabha (Sans.), Vasanabi (Tam.), Vasanabhi (Tel.), Vasanabhi (Can.), Vasanabi (Mal.), Kath-bish (Beng.), Mithabish (Hind.), Bachnag, (Mar.)

Varieties :—Several species of Aconite are known in India and elsewhere, namely, *Indian Varieties* :—Aconitum Ferox, Aconitum Heterophyllum, Aconitum Palmatum, Aconitum Chasmanthum, Aconitum Multifida, Aconitum Rotundifolia ; *European Varieties* :—Aconitum Napellus, Aconitum Variegatum, Aconitum Septentrional, Aconitum Lycoctonum (this also occurs in India) ; *Japanese Varieties* :—Aconitum Fischeri.

Medicinal use :—In India Aconite has long been known as a virulent poison and has been used in medicine from a very remote period, the drug having been

*[Published also in the "Antiseptic" Madras, and other medical journals.]

mentioned in old Sanskrit books, although its use in British medicine is comparatively of recent date.

Habitat :—The Indian varieties of Aconite are found wild in Nepal, Sikkim and other temperate Himalayan regions from Kashmir eastwards and are less toxic than the British variety [Aconitum Napellus] which is cultivated in England and on the Continent as a garden plant and for medicinal use.

Characters and Tests :—According to the British Pharmacopœia the root of Aconitum Napellus varies usually from two to four inches in length, from one-half to three quarters of an inch in diameter at the upper extremity, gradually tapering below. Dark brown in colour, marked with the scars and bases of broken rootlets and crowned with the remains of an undeveloped bud.

Internally the root is whitish and starchy. The transverse section exhibits a thick parenchymatous cortex and a large stellate pith with about seven projecting angles. Taste at first slight, followed by a persistent sensation of tingling and numbness in the mouth.

The chief varieties of Aconite root, whether *Indian* or *foreign*, compare as below as regards their physical characters, constituents and pharmacological action :—

Pharmacological Action.

Characteristics.	Chief varieties of Aconite.				
	A. Napellus. (British).	A Fischeri. (Japanese).	A. Ferox.	A. Heterophyllum.	A. Palmatum.
			Indian.		
Physical characters	Dark brown; 2 to 4 inches in length; whitish starchy internally.	Light grey; much smaller in size than the British; very starchy internally.	Black; much larger than the English, measuring 6 inches in length; yellowish and then brownish, red and horny internally.	Grey or white generally; grey shrivelled tubers larger and longer than the white ($\frac{3}{4}$ to 2 inches in length); white and starchy internally.	Light brown; 2 to 4 inches long; branched; whitish and starchy or hornv and yellowish internally.
Constituents	Aconitine. Benzaconine and Aconine.	Japaconitine apparently identical with aconitine.	Pseudaconitine similar to aconitine in action.	Atisine (not poisonous like aconitine.)	Alkaloid similar to Atisine.
Pharmacological action	Cardiac sedative, Diaphoretic and local Analgesic.	Similar in action as A. Napellus.	Similar in action as A. Napellus, rather preferable in several respects.	Bitter, stomachic, aphrodisine, and antiperiodic.	Intensely bitter like quinine; used as a remedy for pains in the bowels, diarrhœa and vomitting; anthelmintic; local analgesic.

Preparations :—The preparations mentioned of Aconite in Sanskrit books are chiefly those for (1) *external* applications either as liniment or ointment and (2) *internal* use as pills. In view of the existence of different varieties of *Aconite* with properties widely varying from extremely poisonous to non-poisonous character, the Indian preparations, in the absence of a definite method for identification and for assaying the active principle of the drug, are unfortunately unscientific and unreliable. This remark also applies to preparations under Western names if made by unqualified people which is generally the case in India. European preparations of Aconite are :—(1) Liquid extract of Aconite, (2) Liniment Aconite and (3) Tincture Aconitine. Unguentum Aconine is made from the active principle and not from the root itself.

Assay of Aconite :—The various assay processes which have been devised by modern science and which it is absolutely necessary to apply to the preparations of drugs, particularly to *galenicals*, in order to be assured of their potency, are very *technical* and so far as the assay of *Aconite* is concerned, the process is *briefly* to exhaust the finely powdered drug with alcohol, to remove alcohol by distillation and evaporation, to dissolve the risidual with a weak acid, to treat the acid solution with a weak alkali and ether, finally to estimate aconitine by a volumetric method.

Conclusion :—The indentification of a drug from among its numerous varieties, substitutes and adulterants, the examination of its relative medicinal value

as obtained by cultivation under different conditions and by collection at different stages of the growth of the plant and at different seasons, the manufacturing details, and lastly the assay processes are long, tedious and technical methods and unless the people engaged in the manufacture or investigation of vegetable drugs are themselves fully qualified pharmaceutical chemists, or work in collaboration with them, there are likely to be serious pitfalls which will entirely vitiate the quality of the work undertaken.

Allium Sativum.—(Garlic.)*

(Reprinted from the "Indian Medical Record," Calcutta, March, 1922.)

The undried bulb of Allium Sativum (N. O. Liliaceæ).

Vernacular names :—Rason (Sans.), Rasun (Beng.), Lasun (Hind.), Ballai Pandu (Tam.), Tella ulleeganda (Tel.), Velluli (Mal.), Viliya Velluli (Can.), Lasan (Mar.)

Habitat and Varieties :—This bulbous plant is allied to *Urginia Scilla* of the British Pharmacopœia and is indigenous to Central Asia, India and Ceylon. There are several species of Allium of which the two most widely known are *Allium Sativum* (Garlic) and *Allium Cepa* (Onion). Both these varieties of Allium are articles of condiment and are extensively used for culinary purposes.

*[Published also in the "Indian and Eastern Druggist" London, May, 1922.]

Characters and Tests ;—Allium Sativum is a perfectly white bulb, tapering at both ends, about 2 inches in length and one inch in diameter and consisting of a dozen or more bulblets.

There is a larger variety which, according to Sanskrit writers, is known as *Maharasan*. It has a strong and characteristic odour as well as taste and some people have a peculiar antipathy to either.

Medicinal use and pharmacological action. The medicinal value of *garlic* was well known to the ancient Hindus, the bulb having been mentioned in CHARAK and described as a valuable medicinal article as indicated by one of its Sanskrit names, namely, *Mahausadha*. Latest scientific researches as to the action of garlic, which is still vaguely known in the Western science, fully confirm the uses that were made of *garlic* by ancient Hindu physicians. These uses may be summarised in the following words :—As a gastric stimulant, it aids in digestion and is given in flatulence ; as an expectorant, it has a special influence over the bronchial and pulmonary secretions ; as an emmenagogue, it promotes the flow of menses and is generally used after child birth ; it is a tonic, a carminative, also a stimulant of the skin and kidneys. In large doses, it is an irritant and produces flatulence, headache, nausea, vomiting and diarrhœa. As a local stimulant and irritant, it reddens the skin and causes vesication. It is applied to the nose of hysterical girls when in a state

of swooning. Given with common salt, it relieves colic and nervous headache. As a vermifuge, it expels round-worms. It causes copious diuresis and is hence used in dropsy. Locally applied in bronchitis and in cold catarrh in children, also applied to the chest as a poultice or liniment. Internally given for the treatment of tuberculosis and in certain fevers. It is rubbed over ring-worm with relief and improves foul ulcers and tuberculous lesions. Garlic juice slightly warmed or oil boiled with garlic bulb and cooled and then dropped into the ear relieves ear ache. Garlic oil similarly prepared is analgesic and antiphlogistic in cases of rheumatic affections and is hygroscopic, absorbing accumulated fluid.

Constituents :—An acrid volatile oil, starch, mucilage, albumen, sugar, etc. The active principle of this oil is usually taken to be Allyl Sulphide which can be made by interaction of alcoholic Potassium Sulphide with Allyl Iodide.

Preparations :—The oldest preparations of *garlic* as found mentioned in Sanskrit books are chiefly (1) *Decoction of garlic* made with garlic, water and milk boiled together, (2) *compound garlic powder*, and (3) *Garlic Juice* freshly made. The modern preparations according to Western science are (1) Acetum (10 to 30 minims), (2) syrup (½ to 1 fluid drachm), (3) Tincture (5 to 15 minims), (4) Succus (10 to 30 minims), (5) Extract (4 to 10 grains), (6) Juice with Tincture Lavendula Co. and Syrup simplex (½ to 1 drachm), (7) Essential oil (½ to 2 minims), (8) Allyl Sulphide (2 minims),

(9) Unguentum, (10) Emplastrum, (11) Inhalation and (12) Ester of oil or a soluble salt for injection. The problem to be tackled by the pharmaceutical and the medical profession is to obtain a preparation with a maximum therapeutical effect and a minimum of repulsive odour characteristic of garlic.

Extract (Editorial) from "The Indian and Eastern Druggist," London, May, 1922. issue.

"Mr. J. C. Ghosh, late Pharmaceutical Chemist to the Government of India (Medical Stores Department), contributes to this issue a short but useful and interesting article on Garlic. Mr. Ghosh is well known as an authority on the indigenous drugs of India and a man who has endeavoured to create a system of pharmaceutical and chemical education in that country. His notes on a drug which is becoming increasingly in vogue in Europe, deserve careful perusal."

Tuberculosis and Allium Sativum.

(Reprinted from the "Antiseptic" Madras. January, 1925, issue.)

Standardisation of a preparation from Allium Sativum and Cepa.—The readers of the "Antiseptic" are perhaps familiar with the paper in the May 1922 issue of this journal, pages 228-230, in which the medicinal use and the pharmacological action of *Allium Sativum* (garlic) were discussed. The writer has since carried on investigations to standardise a method of extracting the active principle of *Allium Sativum* in conjunction with that of Allium Cepa. The active principle of *Sativum* is a dark brownish-yellow volatile oil while *Cepa* contains mostly *glucosides* as its active constituents and in this respect it is more akin to *Urginea Scilla* than to

Sativum. The form in which the volatile oil and the glucosidal content of *Allium* has been extracted at the laboratory of the Calcutta School of Chemical Technology is suitable for administration either by mouth or by injection. The first alternative of oral administration requires an *ordinary* dose of 5 to 15 minims and has practically no drawback unless the slight alliaceous odour inherent in these few drops is taken exception to by people of peculiar idiosyncrasies. The second alternative of injections may be proceeded with very cautiously with a dose of 0·1 to 0·3 cc. to begin with. The preparation referred to is perfectly miscible with water and may be conveniently handled if administration by injection is generally preferred by the medical profession and the patients alike.

Name of the preparation.—It has been issued under the name of Tincture Garlic (S. C. T.), but in future it will be known as Allyl Co. (S. C. T.), the latter designation appearing to be more appropriate to and indicative of the character of the preparation.

Dosage.—The ordinary adult dose, as mentioned, is 5 to 15 minims diluted with a little water, milk, syrup, honey or fruit juice and taken twice daily either after or before meals. The dose may be safely raised to 30 minims and repeated every 3 or 4 hours until acute symptons are relieved.

Treatment.—Allium Sativum *cum* Cepa has already been tried in the treatment of Tuberculosis and other

infective diseases and the following is a summary of a few interesting cases :—

(1) *Tuberculosis* (reported by Dr. S. K. Chatterjee, B. Sc., M. B., of Messrs. Banks & Co., Calcutta). A young man, Hindu, aged 21, with T. B. history in the family and parent died of T. B., was having hacking cough ; sometimes spat blood ; fever 99° ; very little clinical sign in the lungs. After a two months treatment with ten drops twice daily there was no fever, less cough and the patient much improved in health.

(2) *Asthma*, 15 years standing (reported by (*a*) Mr. T. D. Pal, aged 64, 45 years experience in the medical line, residing at 3, Fakir Chand De Lane, Calcutta, and (*b*) by Mr. M. D. Isaac, Cashier, Tataparai Camp, Tinnevelly)—Much relief experienced.

(3) *Influenza, whooping-cough, chronic bronchitis and gastric disorders* (reported by Dr. S. N. Sardar, L. M. S., late Chief Medical Officer, Kalahandi Feudatory State)—Excellent results.

Extended Trial.—(1) The preparation is understood to be still under trial at the Central Jail, Salem, S. India. Dr. A. Apparameswaram, L. M. P., reports that the result is still non-encouraging. Fresh supply of preparation taken and further reports awaited. (2) Dr. V. N. Ramaswami Iyengar, private Medical Practitioner, Woriur, Trichinopoly, reports that he has obtained good results in the two cases tried, namely, one for asthma and the other for fetid bronchitis. On the

29th November last he wired for two pounds and no doubt the result is promising. (3) The School of Chemical Technology, Calcutta, has sent supplies to various parts of India in compliance with requisitions and if results, whatever they may be, are kindly communicated, it may serve the interests of science and of humanity as well.

Need for further research.—From the reports received up to date and from the results experienced in the family of the writer and of his relations it is presumed that Allyl Co. affords a valuable intestinal antiseptic and bactericide to combat several bacillary diseases. It now rests with the medical profession to give the preparation, which is really a food article, an extended trial and to note the clinical and metabolic changes that are produced, also to observe its physiological and bacteriological action. The School of Chemical Technology, Calcutta, feels very mueh handicapped in carrying out its humble work in the domain of medical research, there being no hospital attached to the School. It, therefore, most earnestly invites the cooperation of all interested in the work and begs to thank them for the assistance they have already rendered.

Aloes.

(Published in the "Indian and Eastern Druggist", London, July, 1922, with the following additional note.)

[Mr. Ghosh is a recognized authority on the indigenous Drugs of India, and has published a work on this specialized

subject. In view of the importance of developing India's natural medicinal resources, we are pleased to be able to place at the disposal of Mr. Ghosh, from time to time, a portion of our space, in order that he may give our readers the benefit of his knowledge.]

There are various species of aloe plant (N.O., *Liliaceæ*) and the juice obtained from the *transversely* cut leaves of certain species of aloe and evaporated to dryness is known as *aloes*.

Varieties and Habitat.—The present state of our knowledge as to (1) the exact localities in which aloes is obtained, (2) the botanical sources of the plants that yield it, and (3) the medicinal uses of the drug is still unsatisfactory. The chief commercial varieties, however, are :—

Botanical Names.	Commercial Names.	Habitat.
		East Africa.
Aloe Perryi	Socotrine aloes ...	(1) Island of Socotra, 600 miles west of Aden.
	Zanzibar aloes ...	(2) Zanzibar.
		South Africa.
Aloe ferox	Cape aloes ...	(3) Cape Colony.
	Natal aloes ...	(4) Natal.
		West Indies.
Aloe chinensis *Aloe vera* *Aloe vulgaris*	Barbados or Curacao ...	(5) Islands of Cura-cao. Aruba and Bonaire.

Vernacular Names.—The aloe plant was known to the ancient Hindus, who were, however, unfamiliar with the use of its dried juice, which is called *aloes*.

The latter was introduced into Indian Medicine apparently by the Mohammedans, and entirely different sets of vernacular names have thus come into use to designate the one and the same drug in two different forms, the vernacular names being :—

Aloe Plant.	Aloes (dried juice).	Remarks.
Ghrita-Kumari (Sans.)	..	The use of crude drugs either in the green or in the dried condition was the predominating feature of the ancient Hindu system of medicine. Although modern science has largely developed the use of active principles instead of the crude drug, the latter is often recommended nowadays as being more effective, the impurities, ferments, etc., which are retained intact in the crude drugs having now been proved to impart particular therapeutic and nutritive (e.g., food articles) effects in some cases.
Ghi-Kavar (Hind.)	Musabbar (apparently an *Arabic* or a *Persian* name.)	
Ghrito-Kumari (Beng.)	Moshabbar	
Kattalai (Tam.)	Kariya polam	
Kalabanda (Tel.)	Mushambaram	
Kattala (Mal.)	Chenninayakam.	
Koraphad (Mar.)	Musambarbol	

Characters and Tests.—The distinguishing physical characters of the different varieties of *aloes* (dried juice) and the chemical tests applied to identify them are given in the British Pharmacopœia. The botanical characters of the Indian and the African *aloe* plant are interesting, and are briefly referred to here :—

Varieties of Aloe Plant.	Botanical Characters.
African.	
Aloe socotrina	Stem woody, leaves crowded and fleshy, flowers numerous, produced in spikes, orange-red in the middle, red below; sometimes yellow flowers.
Aloe perryi	Stem simple, scarcely rising above ground; leaves crowded and much shorter; flowers red.
India.	
Aloe officinalis (Bengal)	Stem very short; leaves crowded and succulent; reddish and orange flowers.
Aloe littoralis (Madras)	As above, a stunted variety; yellow flowers; leaves very succulent.
Aloe vera (S. India)	Stem short; leaves densely crowded; flowers yellow.
Aloe vulgaris (Bombay)	Stem 1 to 2 ft. in height; leaves green, often white spotted; flowers yellow.

Constituents.—The active principle in all the varieties of Aloe, either in the fresh or in the dried condition, is supposed to be *aloin*, which has a pronounced *cathartic* action. The other constituents are: *Emodin*, *Resin*, *Volatile Oil*, and a large percentage of water-soluble substances.

Manufacture of Aloes.—Aloes (or the dried juice) is made either (1) by spontaneous evaporation or (2) by boiling. The character, odour and perhaps the quality of the drug are varied according as the one or the other process is employed. A slow process of concentration

or spontaneous evaporation tends to crystallize *aloin* and to improve the fragrance. Moreover, in an Indian climate, with plenty of sunshine, spontaneous evaporation is easier and less costly, and with this process aloes of very good quality may be made in this country at a cost far less than that of the imported African article, which is largely re-shipped to Europe from Bombay.

Manufacture of Aloin.—Crushed aloes is dissolved in 9 or 10 times its weight of boiling water acidulated with sulphuric acid. After cooling and standing for a few hours, the clear liquid is decanted and evaporated. The concentrated liquid deposits on cooling a mass of yellow crystals, which are purified by washing and re-crystallization, yielding *aloin* in the shape of yellow acicular crystals freely soluble in hot water and alcohol, sparingly in cold water and nearly insoluble in *ether*.

Preparations.—The purgative action of *aloes* is widely utilized in the Western system of medicine, and various preparations thereof are still in use, although the number have been reduced to some extent by the latest British Pharmacopœia. The ancient Hindu physicians of India were not aware of the use of aloes, as already explained, and its later introduction into Indian medicine appears to be due to the Mohammedans, who apparently brought the knowledge from Africa, perhaps through the Greeks. Nevertheless, the ancient Hindus were expert in the use of the aloe leaf, its pulp and fresh juice, in various ways, namely, in fevers,

glandular enlargements, ophthalmia, etc., the fresh juice having also been used as a pill excipient in a preparation known as *Taruna jvarari rasa*. The preparations of the British Pharmacopœia and their doses are shown below; the medicinal use and the pharmacological action as mentioned in the last two columns are, however, based on wider and yet authenticated information :—

Preparation.	Dose.	Medicinal use.	Pharmacological action.
Aloinum (Aloin)	½ to 2 grs.	In addition to the purgative action which also heads the list of uses mentioned in Sanskrit books, there are other medicinal uses, namely, in fevers, bronchial catarrh, rheumatism, hemicrania, enlargement of spleen, liver disease, gonorrhœa, and metritis, ophthalmia, brain fag and hysteria, also to absorb inflammation and to relieve pain.	Cathartic, stomachic, tonic, demulcent, diuretic, analgesic, antipyretic, expectorant, hygroscopic, emmenagogue and anthelmintic.
Decoctum Aloes. Co.	½ to 2 ozs.		
Extract Aloes	1 to 4 grs.		
Pilula Aloes	4 to 8 grs.		
Pilula Aloes et Asafœtidæ	4 to 8 grs.		
Pilula Aloes et Ferri	4 to 8 grs.		
Pilula Aloes et Myrrhæ	4 to 8 grs.		
Tincture Aloes (omitted from the B. P. 1914.)	½ to 1 dr.		
There are almost half-a-dozen other preparations which contain *aloes* as a constituent.			

Conclusion.—The existence of botanical and commercial varieties, of adulterants, and of several other factors materially affecting the therapeutic value of a drug, renders its identification technically difficult even for an expert botanist, the problem being neither a purely botanical nor a medical one, but pharmaceutical, which is a specialized subject embracing more than one branch of *applied science*. Moreover, as the medical science is progressing and as no system of medicine can reasonably claim to be perfect, it is *extremely* advisable to invite co-operation. Further, as drug investigation and manufacture have important industrial aspects, the workers should be industrially trained. In the case of aloes it must be remembered that the aloe plant and the American Aloe (Agave), which is commonly found in India, and which is mistaken for the medicinal aloe, provide important sources of fibre of commercial value, and may yield a useful paper material. The fact is particularly mentioned, as it affords an instance which is not infrequent, and wherein scientific studies and research may be profitably combined with an attempt to develop the industries of this country.

Anacardium Orientale

(Reprinted from the Indian Medical Record, May, 1922 issue.)

Anacardium orientale (N. O. Anacardiaceæ) is so called in contradistinction to *Anacardium occidentale* otherwise known as Cashew-nut (Hijli badam), (Beng.). The other recognised names of *Anacardium orientale* are Semecarpus Anacardium, Anacardium latifolium, Marking-nut.

Vernacular names.—Bhallataka (Sans.), Bhilawa (Hind.), Bhela (Beng.), Sheran Kottai (Tam.), Jidivittulu (Tel.), Bibwa (Mar.)

Source.—Unlike the Cashew-nut tree, the marking-nut tree is a tall, deciduous one of the sub-Himalayan tract. The latter is accordingly called in Sanskrit *Shailapravaba* (*i.e.*, growing on the hills.) This tree is common in west Bengal and in Bihar, particularly in the districts of Birbhum, Sonthal Perganas, Hazaribagh, Balasore, and is generally found throughout the hotter parts of India.

Properties and uses of the Anacardiaceæ.—The natural order of Anacardiaceæ is interesting in that it yields the most important and delicious fruit of India, namely, mango (Mangifera Indica). In the British Pharmacopœia, 1885, there was only one drug (Mastiche) belonging to this natural order and although its exclusion from later editions of the B.P. has apparently divested it of all interest to the medical profession, the medicinal properties of Anacardinm, which were known to the Hindoos and to the Mahomedans from a very early period, may still find a place in modern science, if properly investigated. The parts medicinally used of Anacardium orientale are flowers, fruit and the fleshy stalk (peduncle) of the fruit. In fact it is apparent from a general review of the *Anacardiaceæ* that the plants belonging thereto yield food, medicine, oil, gum and resin, turpentine, dye, tan and useful woods.

Characters and tests.—The fruit is about 25 millimetres (1 inch) long. of the size and shape of a broad bean, or nearly heart shaped, flattish, obtuse, smooth, glossy and perfectly black. Only ripe fruits collected in winter are suitable for medicinal use. Immature fruits are light and float on water, but a mature one immediately sinks. The pericarp contains a vesicating oil which is easily soluble in ether and which blackens on exposure to the air. The juice of the pericarp mixed with a little slaked lime is used all over India for marking linen, the stain being indelible and considered superior to several imported marking inks. The mesocarp contains a brown oil which dissolves in potash with a green colour and an alcoholic solution thereof turns black with lead acetate, while the similar oil obtained from Cashew-nut yields a red colour with potash and a red precipitate with lead acetate.

Constituents.—Anacardic acid and cardol, the latter containing a vesicating principle.

Medicinal use.—The fruit and the flower are long known in India as powerful vesicants. This property is so pronounced that one of the Sanskrit names of the tree is *Arushkara* (*i.e.*, causing sores, itches or nodules). The blisters and eruptions caused are very much like lupus and leprosy and the application of juice even in a diluted form produces great erethematous and glandular swellings and redness of the skin. This fact forcibly suggests the use of the drug in the treatment of lupus, leprosy and plague, the explanation being that the most irritating toxins created by the specific

micro-organisms of these diseases are apparently neutralised by the equally strong counter-irritation caused by the drug. In the Hindu and the Mahomedan books of medicine there is mention of the use of the drug for the treatment of syphilis and leprosy, but under modern scientific methods investigations may be carried on with this drug, not only with regard to syphilis and leprosy, but also in respect of plague treatment.

Preparations.—The chief Ayurvedic preparations of Anacardium orientale, their doses and actions are tabulated below :—

Preparations.	Dose.	Medicinal use.	Pharmacological action.
Confection ...	40 to 80 grains.	As a local stimulant used for relieving rheumatic pains, leprous affections. inflammation of bones and joints, bruises and sprains. As an alterative given in scrofula, venereal diseasss, dyspepsia, skin diseases and nervous debility, and to relieve asthmatic attacks. Used also as a vermifuge; as a powerful restorative tonic which increases appetite and promotes nutrition and strength. Vapour of burning pericarp applied to cold swellings and to cure piles.	Digestive, nervine, stimulant, aphrodisiac, alterative, escharotic, and counter-irritant; analgesic, anthelmintic and antiseptic.
Decoction ...	½ to ¼ fluid drachm.		
Juice ...	Ditto.		
Medicated butter. ...	20 to 40 grains.		
Oil ...	½ to 2 minims.		
Powder ...	5 to 8 grains.		

Conclusion.—The investigation of indigenous Indian drugs would perhaps be carried on with better results

than in the past if the workers kept themselves in *close sympathetic* touch with the Indian systems of medicine and happened to be endowed with sufficient imagination and practical experience, both medical and pharmaceutical. As reported in the "Statesman" of 13th May current, an example in this direction has been set by the Assam Government by the award of two scholarships for the training of a *kaviraji* and a *unani* student in the Dibrugarh Government Medical School. This sympathetic attitude, however inconsiderable, is admirable, whereas an attitude of exclusiveness and of pretensions outside the domains to which the workers belong by actual training and previous experience may, it is feared, constitute serious impediments to obtaining satisfactory and expeditious results.

Alstonia*

(Reprinted from the Indian Medical Record, June, 1922, issue.)

Alstonia (N. O. Apocynaceæ) is official in the British Pharmacopœia, (1914), the part medicinally used being the dried bark of Alstonia scholaris (commonly known as Dita bark) which is found throughout India, being a tall and an evergreen tree, and also of Alstonia constricta which is an Australian species. There are about 28 other species of Alstonia. Neither these species nor parts other than the bark of the tree are officially recognised for medicinal purposes, although its leaves, flowers and latex (milky juice) are credited with medicinal values in India.

*[Alstonia is omitted in the B. P. (1932). This is discouraging to its use.]

Vernacular names :—Saptaparna (Sans.), Chhatim (Beng.), Chhatiun (Hind.), Satvin (Mar.), Ezhilaippalai (Tam.), Edakula-pala (Tel.).

Characters. The Sanskrit names, namely, Saptaparna (seven leafed), Vishala-tvak or Vrihattvak (having large or thick bark) are very significant and indicate the general characters of Alstonia scholaris. The bark is about $\frac{1}{8}$ to $\frac{1}{2}$ inch (three to twelve millimetres) thick, easily breaking with a short fracture, fissured, somewhat spongy in texture, sometimes with black spots, and almost odourless. Taste bitter.

The bark of Alstonia constricta is usually in curved pieces or in quills, about sixty millimetres wide and twelve millimetres thick, having slight aromatic odour and of very bitter taste.

Medicinal use. Alstonia bark, leaf, flower and latex have been in medicinal use in India, having been mentioned in early Sanskrit writings of *Charaka* and *Susruta*. The antiseptic properties of the drug were known in the days of Charaka who recommended it for the treatment of skin diseases. Experience as to its other actions and uses gradually accumulated and there was so much evidence in favour of the efficacy of the bark as an antidysenteric and as an antiperiodic that it was officially recognised by its inclusion in the Indian and the Colonial Addendum to the B. P. (1898), the antiperiodic action having been regarded to be as good as that of the best sulphate of quinine, but without the

disagreeable secondary effects which are usually associated with the use of the latter. The B. P. (1898) was revised in 1914 and as a great effort was made to attain simplicity in the latest edition by the omission therefrom of all un-uecessary drugs and apparently others of doubtful utility, the retention therein of Alstonia is an un-impeachable testimony to its usefulness for the purposes referred to, so far as present knowledge goes. If so, it is regrettable that Alstonia should have been meagrely known in Western medical practice wherein fashions and fancies in respect of particular drugs, proprietary preparations, and even empiricism, appear to be generally more in the run than an intelligent use of the recognised medicines of the British Pharmacopœia. It is admitted that Alstonia is not only antiperiodic but also tonic, combining, as it were, the virtues of quinine and nux-vomica and as such it should be largely in vogue in a scientific system of medicine. The fact, however, is that there is hardly a commercial demand for Alstonia in spite of the frightful annual ravages of malaria throughout India and of the high price of quinine. It, therefore, appears to be incumbent upon the medical profession of India *first* to rid themselves from their slavish adherence to tradition if a charge of slave mentality may be laid against them and *secondly* to bring into popular use a drug which is readily available on the spot and which occupies an honourable position in the latest edition of the B. P.

Constituents. Several researches into the chemical composition of Alstonia bark have been carried out, but the British Pharmacopœia is quite silent on the point, although ditain. ditamine, echitin, echitamine, etc., are ordinarily spoken of as the active principles of the bark.

Preparations.—The chief preparations, their doses and pharmacological action are as below :—

Nomes of preparations.	Doses.	Pharmacological action.
Infusion (of bark) ...	½ to 1 fl. oz.	Antiseptic, anthelmintic, alterative, astringent, antiperiodic, tonic and galactagogue.
Tincture (,,) ...	½ to 1 dr.	
Powder (,,) ...	3 to 5 grains	
Amritashtaka pachana (Ayurvedic)	2 to 4 ozs.	

Of the above preparations Tincture Alstonia will be convenient to use. It is made by maceration process with No. 20 powder and 60 per cent alcohol and will be much cheaper than either quinine or Tincture Cinchona made with No. 40 powder and 70 per cent alcohol and standardised to contain 1 per cenr of cinchona alkaloids.

Atropa Belladonna.

(Reprinted from the Indian Medical Record, August 1922 issue,)

Atropa Belladonna N. O. Solanaceæ) is one of the most important medicinal plants of the British

Pharmacopœia. The plant is, however, not found mentioned in Sanskrit books, having been apparently unknown to the ancient Hindoos. The plants very similar to Belladonna are known in Sanskrit as Dhatura or Dhustura which are also official in the British Pharmacopœia. Although several varieties of Dhatura are spoken of by Sanskrit medical writers, it is curious that Belladonna escaped their notice, particularly when it is remembered that the latter is a native of Western Himalayas wherein the old sanskrit writers generally lived and flourished. It is not Belladonna alone which has been overlooked by them, but there is another plant, namely, Hyoscyamus, *indigenous* to the same Himalayan region, which has been similarly overlooked. There is hardly any rational explanation for this omission unless it is assumed that both Belladonna and Hyoscyamus are later biological developments or differentiations out of *Datura*. These Solanaceous plants may therefore be considered well together and their characteristics may form interesting studies both from a biological and a pharmacological point of view according to the assumption referred to above.

There are at least three well-marked varieties of *Datura* which are mentioned by Sanskrit writers and which are tabulated below along with Belladonna and Hyoscyamus, all these being official in the British Pharmacopœia.

Solanaceous plants.	Characteristics.	Active principles.	Varnacular names.
Atropa Belladonna.	*Leaves*, brownish green, short stalked in unequal pairs, 3 to 8 inches long, broadly ovate, acute and entire.	Hyoscyamine and atropine, total alkaloids about 0.4 per cent. average, alkaloidal strength being maximum when the plant is in flower. Carelessly collected leaves yield inferior results.	No vernacular name, the plant having been unknown to the people of India. During the last war there was a large demand for Belladonna leaves and root and the plant is now better known by the English than by any Hindusthani name which is sometimes used.
	Flowers, solitary, pendulous, campanulate and purplish green.		
	Fruits, are berries, purplish or bluish black and fleshy.	Hyoscyamine and atropine. Total alkaloids about 0.3 per cent in all the varieties of Datura, Datura Stramonium is as popular as Belladonna, but Datura fastuosa which is now official in British pharmacopœia, 1914, is regarded by Hindoo writers to be more effective. All the varieties of Datura are chiefly used for antispasmodic action although their action in other respects is generally just the same as that of Belladonna except in respect of reducing secretion.	
Datura fastuosa.	*Leaves*, greyish green, with long petioles, ovate, sinuate-dentate, with large irregular pointed lobes, 7 to 8 inches long,		The ordinary vernacular names for Datura are applicable to the three varieties, no particular distinction being made by Indian writers between these varieties. Datura fastuosa is referred to in some Sanskrit books as Kanaka, when its preference to other varieties is emphasised. The other names are:— Dhutura or Unmatta (Sans.), Dhutura (Beng.), Dhatura (Hind.), Umattai (Tam.), Ummetta (Tel.), Dhotra (Mar.),
	Flowers, solitary, large trumpet-shaped tubular calyx, purple coloured or double coloured (white and purple.)		
	Fruits, are spiny capsules.		
Datura Tatula.	*Leaves*, and fruits as above. Flowers purplish white.		

Solanaceous plants.	Characteristics.	Active principles.	Vernacular names.
Datura Stramonium.	*Leaves*, and fruits as above, Flowers white.		Ummatta (Mal.), Ummattam(Can.).
Hyoscyamus niger.	*Leaves*, exstipulate varying in length but not exceeding 10 inches, triangular, ovate, sinnate, conspicuous midrib. *Flowers*, crowded. urceolate calyx, yellowish with purple veins. Fruits are two-celled.	Hyoscyamine and atropine. Total alkaloids much less—about 0.05 per cent. Action similar to above but much weaker; chiefly used as a hypnotic.	No popular vernacular name, The Sanskrit name parasika apparently indicates the foreign origin of the plant.

Pharmacological action of Belladonna.—Local anesthetic and analgesic; prevents suppuration; internally reduces secretion, checks sweating in phthisis, antidiaphoretic and sedative; narcotic, mydriatic and antispasmodic. In small doses it increases the action of purgatives. The action of Belladonna in respect of reducing secretion and particularly on motor and sensory nerves is specific and as such it differs from Datura and Hyoscyamus.

Preparations.—Both the leaf and the root are now medicinally used, no other parts being official at present. The preparations are :—

Preparations.	Doses.	Remarks.
From the leaf.		
1. Tincture Belladonna.	5 to 15 minims.	The Indian systems of medicine have much to learn from the methods employed to standardise the preparations. On the adoption of these methods, the Indian preparations of Datura and other drugs will command confidence and will not merit the strictures that are generally cast upon them out of ignorance. Indian physicians use Datura as an insecticide for curing baldness and destroying lice, also as a germicidal in the treatment of cholera. Belladonna may be similarly tried.
2. Extract Belladonna siccum.	¼ to 1 grain.	
From the root.		
3. Extract Belladonna liquid.	No dose, used as the basis for the preparation of items 4 to 7.	
4. Emplastrum Belladonna.	External-ly used.	
5. Liniment Belladonna.		
6. Suppositoria Belladonna.		
7. Unguentum Belladonna.		

Industrial uses.—In the manufacture of the alkaloids, hyoscyamine and atropine, Belladonna root is largely used, it being convenient to extract them from the root than from the leaf. The European supplies of medicinal plants having been cut off during the late war, there was a demand upon the Indian market with the result that an industry in drug cultivation is steadily growing up in this country. Recently samples of

Belladonna leaves were received from a farm at Mungpoo (Darjeeling) for assay in the laboratory of the School of Chemical Technology, Calcutta, and the results obtained so far seem to be fairly satisfactory. With more care given to the subject and under technical guidance, Indian Belladonna and Indian drugs generally will constitute valuable medicinal resources of the British Empire. So far as alkaloidal extraction is concerned, supplies of Belladonna may be supplemented by Datura which grows wild in India.

[**Atropa Belladonna** is a typical *Solanaceous* medicinal plant. The other familiar examples of this important Natural Order are:—**Solanum Dulcamara** or Nigrum—*Sans.* Kakamachi, useful in dropsy, also alterative and diuretic, active principle *Solanine*: **Solanum Indicum**—*Sans.* Brihati, root and leaves used medicinally and the fruit as a common vegetable food article; **Solanum Xanthocarpum**—*Sans.* Kantakari, useful in fever, asthma and heart disease, also expectorant and diuretic; **Capsicum Fructus**—*Hind.* Lal-mircha, stimulant and carminative, active principle *Capsaicin*; **Withania Somnifera**—*Sans.* Aswagandha, useful in consumption and senile debility, active principle *Somniferin*; **Solanum Tuberosum**—its root tuber being an important food article as *potato* and yielding starch with characteristic microscopical structures; and lastly **Nicotiana Tabacum** or Tobacco—*Hind.* Tambaku which is smoked generally throughout India, particularly by the village people and the labouring classes. The Solanaceæ group of plants is thus seen to provide useful medicines and food articles besides a favourite smoke for the *ryot*, and to be deadly poisonous at the same time.]

CHAULMOOGRA OIL

(Oleum Hydnocarpus Wightiana)

AND ITS USE IN THE TREATMENT OF

LEPROSY

A brief note on Chaulmoogra oil and on the treatment of Leprosy according to *Ayurveda* was submitted in 1915, by the writer while at Madras, to Professor Robert Wild, then Professor of Pharmacology, Manchester University, and a member of the British Pharmacopœia Revision Committee. The note was examined, with appreciation in 1916 by Colonel Bryson, I.M.S., Superintendent, Leprosy Hospital, Rayapuram, Madras, published in 1917 with the approval of the Director-General, Indian Medical Service, and republished in the *Antiseptic* for June, 1923.

In its issue of March 1, 1928, *the Pioneer* wrote as follows :—

STAMPING OUT LEPROSY

AN INDIAN DISCOVERY

CHAULMOOGRA OIL AS CURE

Experiments In Calcutta

"A cable from London recently published in *the Pioneer* stated "that the complete stamping out of leprosy, within the next ten years, by means of treat-

ment with oil extracted from the dried fruit of the hydnocarpus tree is predicted in the annual report of the British Empire Leprosy Relief Association.

This has prompted Dr. J. C. Ghosh of the School of Chemical Technology, Calcutta, to send us the following interesting extract from "Technical Education" (Thacker) :—

"Indian pharmacology has a great future before it, and the Indian population should welcome the way that has now been shown by the work which is being carried on at the Calcutta School of Tropical Medicine on a magnificent scale, but almost *incognito* and on a humble scale at the School of Chemical Technology, Calcutta. No better example can be given than the discovery and application of the ethyl ester of hydnocarpic acid, the active principle of chaulmoogra oil, by Sir Leonard Rogers."

"It may, however, be mentioned that apparently before Sir Leonard adopted this treatment, use of hydnocarpus oil for leprosy treatment in preference to other varieties of chaulmoogra, and the real efficacy of hydnocarpic or chaulmoogric acid as opposed to gynocardic, had been shown in Dr. J. C. Ghosh's pamphlet on "Chaulmoogra Oil" published in 1917."

The following is the text of the pamphlet:—

Leprosy in *Ayurveda* is known as *Kushtha*. The latter term, however, is of wider meaning, including as it does every form of skin disease. Eighteen varieties according to general characteristics are mentioned. Of these at least eight are not classed as

leprosy in western science, but as skin diseases under the names of ring-worm, eczema, scabies, etc. The remaining ten varieties perhaps correspond to real leprosy whether tubercular, anæsthetic, or of a mixed form. These varieties, their characteristics, and the treatment prescribed in *Ayurveda* so far as could be gathered from a certain number of standard and current Sanskrit books, are briefly tabulated under para 4. of this note. There are several Sanskrit books on medicine which are not readily available and if the present information proved useful, it would afford an incentive for further research into ancient Sanskrit learning and for the rare books to be looked into.

2. One of the standard Sanskrit books consulted for the purpose of this note is *Susruta*, the well-known ancient authority on Hindu medicine and surgery. In the 13th chapter of this book under "Treatment of diseases" there is mention of a plant called *Tuvaraka* in Sanskrit, but *Chaulmoogra* in Hindustani as well as in Persian. The passages which occur in *Susruta* in regard to "Tuvaraka" might be translated as follows :—

"The 'Tuvaraka' plants, which grow on the western sea coast of India, are constantly tossed about by the breeze arising from the waves of the sea. The seeds of these plants should be carefully collected in the rainy season while they ripen. They have to be subsequently dried, decorticated and pounded. The oil should be pressed out of these seeds in a mill just in the same way as sesamum oil, or squeezed out of a press bag similar to that used in the case of *Kusumbha*

flowers. It should be boiled over a fire to get its inherent moisture completely evaporated and then taken down from the fire and kept in a pitcher and buried for a fortnight in a heap of well-dried cow-dung. The patient in the meantime should be duly anointed, fomented and treated with cleansing remedies (i. e., emetics and purgatives). He should first wait a fortnight after the administration of the aforesaid measures and then for a further period of two days and on the next morning he should drink a potion of the oil in adequate doses (two tolas = 4/5 oz) under the auspices of favourable astral combinations in the lighted fortnight of the month. He should be made to recite, at the time of his taking the fourth dose, a *mantra* which runs as follows :—

'Cleansest and purifiest, O Thou *potent essence* of seed marrow, all the essential principles of my vital organisms. The deity who knows no decay and suffers no change and who weilds a discus, a mace and a conch-shell in his arms, commands thee on that behalf."

"The bad humours, etc., in both the upper and the lower parts of a patient's body are cleansed with the help of this oil (which should be given to the patient in the morning) while a cold gruel, unseasoned with salt and not mixed with any emollient substance (oil or clarified butter), should be given to him in the afternoon. The treatment should be repeated for five days in succession and the patient should avoid anger, etc., and live on lentil soup and boiled rice for a

fortnight. A five days' use of this oil would ensure the cure of every type of leprosy and diabetes.

"The above 'Tuvaraka' oil should be boiled and prepared with a *decoction of catechu* three times the weight of the oil and taken internally *with patience* for a month. The patient should also anoint his body with the same and then take his meals in the prescribed form. A leprosy patient as well as a diabetic one, whose voice is hoarse and eyes red and who has worm-eaten and emaciated limbs, should be given this oil *at once* to drink and to rub it over his body. Regular potions of Tuvaraka oil taken with honey and clarified butter, and with a decoction of catechu and accompanied by a diet consisting of the soup of wild fowls, would enble the user to live for a period of 200 years. A use of this oil as errhines for a period of fifty consecutive days would enable the user to witness 300 years on earth in the full enjoyment of bodily vigour and youthful glow of complexion as well as with a very powerful retentive memory."

"A regular use (in an adequate dose) of the kernel of Tuvaraka cleanses the system of the patient and affords a most *potent remedy* in cases of leprosy and diabetes."

3. According to the exhaustive and conclusive researchcs * of Dr. Power and his colleagues of the Wellcome Chemical Research Laboratories, London,

* *Vide* Journals of Chemical Society, 1904 1905, 1907 and 1910; also American Journal of Pharmacy, Nov., 1915.

† *Vide* Chemist and Druggist, dated 30-11-, 1912 p. 69.

Tuvaraka (Hydnocarpus † Wightiana) which is a native of Malabar coast in South India, yields an oil closely resembling, both in physical characters and chemical composition, the oil obtained from Taraktogenos Kurzii, but widely differing from Gynocardia Odorata oil as shown below :—

Oils.	Physical Characters.	Chemical Composition.
I. Chaulmoogra oil from Hydnocarpus Wightiana. (*Susruta*)	Soft solid at 15° c. ; optically active ; M. P. 22-23° c. ; S. G. 0.958.	Chaulmoogric acid and hydnocarpic acid of general formula $C_nH_{2n-4}O_2$, both acids being crystalline and optically active, also a relatively small proportion of palmitic acid.
II. Chaulmoogra oil from Taraktogenos Kurzii. (B. P. 1914.)	Soft solid at 15° c. ; optically active ; M. P. 22-23° c. ; S. G. 0.951.	Chaulmoogric acid and hydnocarpic acid of general formula $C_nH_{2n-4}O_2$, optically active and crystalline as above, with a relatively small proprotion of palmitic acid.

III. Chaulmoogra oil from Gynocardia Odorata. (B. P. 1898)	Liquid at 15° c.; optically inert; M. P.—; S. G. O. 925.	None of the acids of $C_nH_{2n-4}O_2$ series but a considerable proportion of palmitic acid with other fatty acids.

The medicinal properties of (I) and (II) above, which are almost identical in physical characters and in chemical constitution, would no doubt be alike, but (III) is quite a different oil and it is unfortunate that Gynocardia Odorata should have been mentioned in B.P. 1898 as one of the sources of Chaulmoogra oil. The active principle which may be of any use in leprosy is no doubt chaulmoogric acid (this being common to two different plants, one found by the ancient Hindus several centuries ago and the other by modern investigation), and not Gynocardic acid which is apparently obtained from (III) and which is not a pure acid, but a mixture of acids containing a large proportion of palmitic acid.

Another fact which seems to be obvious from the Sanskrit text is that the efficacy of Chaulmoogra oil is likely to be enhanced if taken along with a decoction of catechu. If so, Chaulmoogric acid may also be tried in combination with the active principle of catechu. It is surprising to find that pyrogallol, which is very much allied to catechol as shown below, is said to have been used by Unna in the form of an oxide with marked success in leprosy.

CATECHOL $C_6H_4(OH)_2$ PYROGALLOL $C_6H_3(OH)_3$

4. Many more interesting facts might be forthcoming from a study of Sanskrit books on medicine and I hope to make an endeavour later on to publish all Sanskrit texts on leprosy with as faithful a translation as possible. Meanwhile the following tabular information might help to elucidate, or at least to throw some light on, a few more points in connection with the treatment of leprosy.

Chief varieties of leprosy according to Ayurvedic classification.	Characteristics.	Ayurvedic Treatment.
1. Aurumvara.	Nodules resembling fruits of *Ficus Glomerata* both in size and colour; painful and accompanied by a sense of burning and itching. Hairs on nodules assume a tawny colour. *(Curable).*	(*a*) *Medicines for internal use.* Chaulmoogra oil; oil of Gurjan balsam (Dipterocarpus Turbinatus) mixed with lime water; medicated ghee (clarified butter); confections; pills; pulvis neem (*Melia Azadirachta*) flower, fruit, leaf, bark and root; tincture catechu Co. (Ayurvedic).

2. Pundarika.	In circular spots, lamellar, somewhat recalling petals of *Nymphae Lotus ;* colour whitish red except at the centre which is whitish brick-red. (*Curable*).	(*b*) *Medicines of external use.* Chaulmoogra oil ; oil of Gurjan balsam mixed with lime water as above ; chaulmoogra ointment ; liniments ; plasters ; medicated oils ; dusting powder.
3. Rishya-jihva.	Eruptions shaped as the deer's tongue ; coarse and rough to the touch ; painful ; red at the edges and dark at the centre. (*Curable*)	Under (*a*) and (*b*) over 80 preparations are described in the books consulted. These preparations comprise more than a hundred vegetable drugs, also a few mineral and animal substances.
4. Kapala.	In partly dark and partly tiled patches ; dry and rough to the touch ; accompanied by pain recalling the pricks of innumerable needles ; epidermis thin. (*Curable*)	(1) *Vegetable drugs.* Of so many drugs mentioned, the following appear to be important :—

(*Curable with difficulty*).

Note : The idea in Ayurveda as to the curability or otherwise of leprosy appears to be that as long as the disease is confined to the skin, to food secretions* before their conversion into blood, or to blood, itself, cure is possible. Even when the disease advances so far as to affect the fat,* the progress may be arrested and cure effected. But when the malady affects the bones and the marrow and is accompanied by development of worms in ulcers,

* The Sanskrit word translated here is *rasa* which perhaps refers to chyle or to secreting glands and intestines.

* Here also the meaning is not clear.

Chaulmoogra.

1. *Chaulmoogra* which is called Tuvaraka in Sanskrit as already explained, is also known in that language by another name (Kushtha Bairi) which is very significant and which means literally—a foe to leprosy. From the latter desingation combined with what has already been said about this drug, it appears to occupy the chief place in the treatment of leprosy.

Bitter group.

2. *Neem* (Melia Azadirachta). This is an equally popular and reputed Indian drug. The seeds contain a yellow fixed oil (about 10%) which is extracted by pressure. Oil anti-

	by thirst, by a feeling of heat and burning and by loss of appetite, cure is impossible. Finally death ensues when eruptions begin to burst, discharging putrid matter, followed by redness of eyes and hoarseness of voice.	septic, used internally (dose 30 minims), also externally, suitable for *hypodermic injection.*
		3 *Somraj* (Vernonia. anthelmintica). This is an Indian worm seed. Its virtue, if any, in the treatment of leprosy is due to the bitter principle which the seed contains.
		Tannin group.
5. Mandala	In white and red eruptive patches; always moist; oily; elevated, circular and confluent.	4. *Catechu.* The active constituents are catechin and catechutannic acid. Pyrocatechin or catechol is also obtained from catechu and from other vegetables containing tannins. This fact and the close relation of catechol to pyrogallol already shown in para 3 seem to support the Ayurvedic belief in the efficacy of catechu as a leprosy cure.
	(*Hardly curable*).	
6. Kakananti.	Eruptions resembling the fruits of *Abrus precatorius* dark at the centre and red elsewhere, accompanied by smarting pain; ripen and suppurate.	
	(*Incurable.*)	

		5. *Myraholan*—This too contains tannin and the remarks above apply to it as well.
		Aromatic balsam group.
Min	*Varieties.*	6. *Guggul* (Balsamodendron Mukul) is highly spoken of in Ayurveda. Its efficacy, if any, may be due to the volatile oil it contains. Similar balsams of Peru, Tolu and Styrax contain cinnamein and cinnamic acid and on investigation *Guggul* may also be found to possess the same. Cinnamon oil and cinnamates are used as internal antiseptics and the use of *Guggul* in Ayurveda suggests the trial of some *soluble cinnamate hypodermically* in the treatment of leprosy.
	Ekakoshtha.	Eruptions occupying a large space and having a fish-scale appearance ; do not sweat.
8.	Charmakushtha.	Eruptive patches as rough as the skin of an elephant ; dry ; dark and thick.
		7. *Gurjan* Balsam (Dipterocarpus tur-

		binatus) resembles *copaiba* in odour and taste. In Moore's Family Medicine Gurjan oil with lime water is recommended for leprosy. This recommendation is apparently based on Ayurvedic information.
9. Charmadala.	Eruption of a reddish hue, accompanied by itching, also by pain as intense as that of piercing with a pike, covered with large pimples, incapable of being touched without giving severe pain and in which the flesh becomes putrid and falls off.	(ii) *Mineral drugs.* 1. Arsenium Sulphide (red) $As_2 S_3$. 2. Arsenious Sulphide (yellow) $As_2 S_2$. 3. Mercury (purified) and Sulphur (purified) mixed by trituration. 4. Copper. 5. Iron. (iii) *Animal excreta.* Cow's urine strongly recommended for internal as well as for external use in leprosy. (iv) *Other remedies.* Alkalies; five cleansing methods

		(emetics ; purgatives ; enema ; sternutation; fomentation). *Conclusion.* 1. Use Chaulmoogra oil from seeds of Taraktogenos Kurzii or Hydnocarpus Wightiana. 2. Use Antileprol, a purified form (ethyl ester)of Chaulmoogra oil. (This could be made locally.) 3. Use a *soluble salt of chaulmoogric acid* (sodium chaulmoograte or magnesium chaulmoograte). 4. In conjunction with Chaulmoogric ointment, one or more of the following may be tried internally, externally, or hypodermically :— (*a*) Pyrogallol Oxide (pyraloxin) ; (*b*) Neem oil ; (*c*) Sodium cinnamate ; (*d*) Nuclein in an alkaline
10. Kitim.	Eruptions of a dark colour, dry and rough to the touch as if ulcerated.	

		solution ; (*e*) Donovan's solution ; Fowler's solution ; (*f*) Gurjan oil made into an emulsion with lime water ; (*g*) Cow's urine ; (*h*) an ointment made with pyraloxin — 3 parts, neem oil — 3 parts, zinc Chaulmoograte 4 parts, and prepared suet— 90 parts.

5. Of the above, item (g)-*cow's urine*—calls for some remarks. Whatever people might think of it as a therapeutic agent, the truth might be as follows :—

Under the Ayurvedic treatment of Leprosy, Chaulmoogra is no doubt considered to be a potent remedy, but other drugs as well are recommended for use in conjunction with Chaulmoogra. Both Chaulmoogra oil and cow's urine are prescribed for internal as well as for external use. While the oil contains some acids as its constituents, the urine has some sodium and ammonium salts in solution and it would not be surprising if, on administration to the patient, the acids of the one were brought into contact with the alkali radicals of the other and salts formed. These sodium and ammonium salts being soluble, they will readily diffuse through the patient's blood and are likely to act as if a soluble salt of Chaulmoogra acids were administered to the patient

Whether there is any truth in the above or not might be tested by placing two patients under treatment and comparing the results of two modes of treatment (ancient and modern). It is thought that the internal and the external administration of Chaulmoogra oil followed by a hypodermic injection of a soluble salt of *Chaulmoogric acid* would be more effective and quicker in action than the injection alone.

6. There is another feature, namely, the use of fatty food in leprosy and other diseases, which is very characteristic of Ayurvedic treatment. Western physicians now prescribe fatty food in cases of tuberculosis, but the ancient Hindus went further. They not only prescribed butter which is more easily digestible than any other fatty food, but laid down a number of preparations of medicated *ghee* (clarified butter) which were apparently intended to keep up the health of the patient at a high level without taxing the digestive, functions, perhaps also to increase phagocytosis. The latter object might now be attained by the hypodermic use of sodium cinnamate or of nuclein which are credited with the virtue of increasing white blood corpuscles.

7. The last striking point, as already noticed, is the addition of a *decoction of catechu* to the Chaulmoogra oil before use. Perhaps an astringent active principle in combination with the oil accelerates the effect. It is understood that the lepra bacillus is fatty. If the astringent combines with the albumen of the bacillus and deprives it of its fat, the effect is obvious. But how the same recipe of Chaulmoogra oil with a decoc-

tion of catechu acts also in the case of *diabetes*, (*vide* the Sanskrit text referred to in para 2) remains to be explained and may be investigated.

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** (Originally published in the "Pharmaceutical Journal", Lonuon, July 21, 1928, pp. 54-55) and republished with further information in the "Indian and Eastern Chemist" for April, 1938.*

*"PSORALIA CORYLIFOLA"

(Reprinted from the "Antiseptic", Madras, July 1930).

In the August 1928 issue of the "Antiseptic" an article on the treatment of Leucoderma with *Psoralia Corylifolia* was first published with the result that it roused an amount of interest in the subject and several inquiries were received. Despite the particulars furnished in the article and in replies to enquires, an impression gained ground in some quarters that *Psoralia Corylifolia* was claimed to be a specific for Leucoderma. This was an entirely erroneous impression. Moreover, the article contributed was by a pharmacist and not by a medical man, and the subject was dealt with from a pharmaceutical point of view alone. It, therefore, seems necessary to re-state some of the facts connected with *Psoralia Corylifolia* and to ask that those, who are using the drug, as issued by the School of Chemical Technology, P. 154, Lake Road, Calcutta, may be good enough to send to the School a report on their trial.

The facts briefly re-stated are as follows :—

Psoralia Corylifolia, which commonly grows in the Deccan, but generally throughout India, from the Himalayas to Ceylon, is known by various vernacular names. These more or less allied names are derived

from Sanskrit *Vakuchi*. There is, however, another plant, *Vernonia Anthelmintica*, which is also called *Vakuchi* in Sanskrit. This fact, as also the existence of apparently therapeutically inert varieties of *Psoralia Corylifolia*, render it difficult to identify the plant and to determine its efficacy in the treatment of *Leucoderma*, a dreaded skin disease hitherto considered incurable.

Both *Psoralia Corylifolia* and *Vernonia Anthelmintica* were known in India for centuries past as remedies for various skin diseases including *Lucoderma*. There was, however, no precise information and the designation of more than one plant as *Bauchee* resulted in confusion.

There is another factor which adds to the confusion. In Sanskrit literature Leucoderma is known as "white leprosy." No doubt leucoderma is depigmented skin, but it is not leprosy as understood in modern science. Moreover, the treatment in either case is not the same. The basis of leucoderma treatment under modern scientific methods is still chiefly *Psoralia Corylifolia*. But unless sufficient care is taken at the outset to use the *right drug in the right way*, there are less chances of success. This aspect of the question was discussed in an article which the School of Chemical Technology, Calcutta, published in the "Pharmaceutical Journal", London, July 21, 1928 issue, p. p. 54-55, in the "Antiseptic," Madras, August 1928 issue, p. p. 473-77, and in the "Indian and Eastern Druggist," London, October 1928 issue, pp 232-33. Patients from London and elsewhere wrote to the Calcutta School of

Chemical Technology, asking for supplies of oil from the seeds of *Psoralia Corylifolia* and their requisitions were complied with. It was never expected that the result would be uniformly encouraging in each and every case, and this was clearly pointed out in the article referred to. Portions from that article may well be reproduced here for the information of those who have used the oil either with effect or without effect, and they may be reminded that in several cases a *prolonged* use of the oil with *patience* and *intelligence* is absolutely necessary, although there may be a few fortunate cases of rapid recovery from the use of the very first ounce of the oil as already reported to this School. The general experience is perhaps one of slow but permanent progress by the application of *Oleum Psoralia Corylifolia* as just reported by the medical officer, Mwanza Hospital, Tanganyika Territory, East Africa, who has asked for a fresh supply of the oil. The facts to which particular attention is invited are :—

(1) *Psoralia Corylifolia* seeds are sweet scented—a fact indicated by its chief Sanskrit name *Sugandha* (lit. "scented"), their agreeable aromatic odour resembling that of the *bael* fruit, whereas *Vernonia Anthelmintica* seeds are not scented. There are other distinguishing features as well, namely,

Psoralia Corylifolia	Vernonia Anthelmintica
N. O. Leguminosæ. *Leaves* cordate, both sides conspicuously d o t t e d with black dots.	No. Compositæ. *Leaves* acuminate.
Seeds dark-brown or brownish black, kidney shaped, flat, oblong, about 2 m.m. long and aromatic.	*Seeds* black or d a r k brown, covered with whitish scattered hairs, cylindrical, tapering towards the base and with about ten paler longitudinal ribs.
Oil thick, reddish-brown, with an agreeable aromatic adour.	*Oil* dark-brown and strong smelling. S. G.....O. 916° at 100° F.
S. G.....0.910 at 100° F.	

(2) Confusion, and consequently inefficacy, arises from seeds of entirely different plants being known as *Bauchi* and inferior varieties of *Psoralia Corylifolia* are often used with unsatisfactory and negative results. Further, the action of *Psoralia Corylifolia* often needs to be accelerated by *subsidiary measures*, such as emetine injection, internal use of some intestinal antiseptic, etc., according to the requirements of a case, and in all cases patients must either report progress, or remain under observation of a local doctor, for the treatment to be successful. These are important facts and may be carefully noted.

(3) In the event of the drug prescribed being of the required *strength* and *purity*, (as is the case with the oil issued by the School of Chemical Technology, Calcutta), the results observed are generally satisfactory, particularly when patients strictly follow instructions with patience and intelligence. The oil of *Psoralia Corylifolia* has an irritant action, its effect on leucoderma being specific. The skin becomes red, which varies in intensity according to individual tolerance and idiosyncrasy, the melanoblasts are stimulated, leading to pigment formation, and finally pigment is diffused into the de-pigmented leucoderma patches. Some patients get frightened at the first indication of irritation and discontinue applying the oil and some develop no irritation at all. In any case the patient should exercise intelligence and try to keep up the effect by either reducing or increasing the frequency of application, which normally consists of gently rubbing the oil over the affected part twice or thrice a day. It is sometimes necessary to dilute the oil with olive oil to suit individual tolerance and to apply an emollient as a soothing agent. With attention to these details progress is generally assured, although it is not claimed that a specific cure for *leucoderma* has been arrived at in the sense in which *salvarsan* is understood and used for syphilis.

Samples of oil from seeds of *Psoralia Corylifolia* were exhibited at the stall of the School of Chemical Technology during the Calcutta Exhibition of 1923, and from the way visitors to the stall were scared away

by pictures representing different stages of *leucoderma*, it appeared that both *leprosy* and *leucoderma* were repugnant to all communities. Doubtless it will be doing a real service to science and to humanity if this School, which is very much interested in indigenous drugs investigation, is kept kindly informed of the results obtained by patients from the use of *Psoralia Corylifolia* oil, as supplied by the School. It is earnestly hoped that this request will not be lost sight of.

Leucoderma is called (though erroneously) "white leprosy" in Hindu medicine, there being several varieties of leprosy under that system of treatment, and although this ancient system, as it stands at present, generally lacks in what we call scientific procedure and precision, it is still described by several European scholars "as a marvel to the modern scientific investigator" (g. v. p. 122) and provides, in many instances, materials of considerable value, as well as facts of close observation. Several of them have been scientifically tested and found to be of real value, for instance, modern medical science has so far failed to find better remedies than those of Indian origin for the treatment of either nodular leprosy or leucoderma, the medieine used in either case being entirely Indian in origin and in conception, and the knowledge handed down from at least 1,500 B. C. forms the basis of modern investigatoin not only in regard to leprosy, but also in several other dirctions.

In its last annual report the British Empire

Leprosy Relief Association predicted that leprosy would be completely stamped out within the next ten years by means of treatment with oil extracted from the dried fruit of Hydnocarpus tree which grows on the Malabar Coast. It was announced that arrangements had been made for a deputation of doctors from all parts of India to undergo a course of training in the diagnosis and treatment of leprosy in Calcutta, thereby widely diffusing knowledge of the subject. A similar propaganda seems necessary for stamping out leucoderma by treatment with oil obtained from the seeds of *Psoralia Corylifolia*, the sufferers from this disease being presumably no less numerous and no less widely distributed than leprous patients.

The remedy for leprosy is popularly known as *Chaulmoogra*. In his pamphlet issud on the subject in 1917 the writer first indentified *Chaulmoogra* with *Hydnocarpus* from a chemical consideration of the oil extracted therefrom (*The Pioneer*, March 1st, 1928, p. 97), all previous leprosy work having proceeded on *Gynocardia Odorata* and *Taraktogenos Kurzii*, as mentioned in the British Pharmacopœia (1898 and 1914) under *Chaulmoogra*. There is a similar misunderstanding in regard to *Psoralia Corylifolia* which may have definitely proved to be as efficacious for leucoderma treatment as *Chaulmoogra* (*Hydnocarpus Wightiana*) for leprosy. Both of these drugs are ancient Indian remedies and the misunderstanding arises from inaccurate identification, a fact which is often overlooked.

RECENT ADVANCES IN PHARMACOLOGY

(Reprinted from the "Indian Medical Record", Calcutta, April 1930.)

India's Contribution to Progress

Delivering recently the Sir George Birdwood Memorial Lecture on "An Outline of the History of Medicine in India," Captain P. Johnston Saint of the Wellcome Historical Medical Museum, London, declared that "the materia medica of the ancient Hindus is a marvel to the modern scientific investigator and that it was freely borrowed from by both Greeks and Romans." In this materia medica are described drugs belonging to the animal, vegetable and mineral kingdoms. Not only is the list of these drugs a long one, but the literature dealing with their properties, actions, uses, and methods of examination, is stupendous. There is no doubt that medical science and pharmacology attained an enormously high level in ancient India. Circumstances, political and religious, however, intervened, and during the course of centuries the science in India underwent a tremendous downfall. Fragments of old Indian knowledge found their way into other countries and the drugs of the British Pharmacopœia are still mostly Indian in origin. Ancient knowledge in India having decayed and fallen into disuse, it is being gradually replaced by newer knowledge, and in some instances old ideas are being re-affirmed with the strength of modern scientific light.

Pharmacology, as at present understood, is primarily the study of the action of a drug, or a chemical, upon a healthy animal body or tissue. In other words, pharmacological action is synonymous with physiological action. In 1868 the researches of Crum Brown and Fraser first endeavoured to correlate the chemical constitution of a drug with its pharmacological action, thereby laying the foundation of a rational system of pharmacology. They were followed by other investigators, namely, Brunton and Cash, Kendrick and Dewar, Beaumetz and Bardel, Salkowski and Neubery, Nenski and Schulzens, Ehrlich and Emil Fischer, and it was gradually felt that it would not be impossible to adapt means to an end by determining pharmacological action, on general principles, from a study of chemical composition, and thus to reduce empiric medication to a thing of the past. Indeed, remarkable advances in rational pharmacology have been made during the last 50 years and a large industry has been established in the production of synthetic drugs, the action of which is more or less accurately predicted from their chemical constitution, notable examples whereof being *Salvarsan* of Japan and Europe, and *Urea-Stibamine* (Brahmachari) of India. Yet much remains still to be done as the practical position, so far as treatment with drugs is concerned, is not still materially changed. This may not be due to any aversion on the part of medical practitioners to scientific methods, but the facts established of chemical constitution with corresponding pharmacological action

are perhaps not yet large enough to support any superstructure of a general or theoretical nature. More progress ought to have been possible but for certain difficulties which are chiefly of two kinds, the *first* relating to the drug itself and the *second* to the organism on which the drug is designed to act.

It is not possible in a short paper to go into details of the difficulties referred to. A passing reference may, however, be made to them. It is well known that various physical properties, such as solubility and volatility, influence the action of a drug. Closely allied to solubility is *ionisation* which plays an important part in physiological activity. There are other factors, namely, the bye-effects and the vitamins of a drug, its dosage, and finally our ignorance of the chemistry and reactivity of the living cells, all these giving rise to complications.

Evidently the subject of correlating the chemical constitution of a drug with its physiological action is beset with difficulties. Consequently, progress in rational Pharmacology has been a slow one. It was, however, known since the dawn of medicine that certain drugs exerted definite physiological reactions either on the heart, the kidney, the brain, the eye, or the uterus. This knowledge was gradually extended with the advance in knowledge of Physiology. It is now a well-known fact that the protoplasm of the cells, forming the different tissues of the animal body, varies in its chemical and physical composition according to the function of the organ in which those cells are found.

It is also noticed that once a drug finds its way into the circulating body fluid, it is carried by the blood to the different tissues or glands upon which it produces its characteristic effects, and although it is still difficult to explain why a drug exercises its peculiar selective power, there is no doubt that the action is purely chemical. The determination of these special reactions between drugs and protoplasms is just as much a study in qualitative analysis as an observation of the reaction of drugs to ordinary chemical reagents. In fact, elaborate methods have, during recent years, been devised to demonstrate in the *vitro* what occurs in the *vivo*, establishing the selective power of drugs over particular tissues and organs and constituting a large branch of modern practical Pharmacology. The physiological reactions are, however, not only qualitative but also quantitative. These facts have been taken advantage of to introduce physiological (biological) testing which, in many instances. offers a more certain means of identifying and adjusting the strength of medicinal substances than a chemical analysis. Within its limited range of application, physiological testing is extremely useful and forms an important branch of practical Pharmacology. Sir J. C. Bose has extended the application of physiological testing to plants and a revolution in medical treatment is anticipated from success in the direction, inasmuch as the plant is a more trustworthy witness than a human being for investigations on the fundamental action of drugs, and the results will, in due course, be a worthy

gift for India to offer to the world for alleviation of human sufferings.

It is unfortunate that, in spite of the importance and possibilities of physiological testing, the method has not yet (till 1930) been recognised by the British Pharmacopœia which still mainly relies on chemical methods for tests of purity, strength and identification of drugs. When the 1898 edition of the B. P. was under revision, it was expected that the new edition (1914) would include physiological tests. Owing, however, to certain drawbacks, *e.g.*, the evidence of physiological activity in certain cases, even when drugs are therapeutically inert, chemical tests are more relied upon than physiological testing, and it would be more in the fitness of things if the medical profession in general paid more attention to the chemical basis of Pharmacology than is customary at present under the stress of their professional training and work. Unlike in India, the pharmaceutical profession of the West is fully alive to the importance of both chemical and physiological standardisation of drugs, and along with inorganic, organic, and physical chemistry, biological chemistry is compulsory in pharmaceutical training there. India, however, is still lamentably far behind, there being as yet no trace of pharmaceutical training in this country except to a very limited extent in Madras. Neither is there any public demand for pure and standardised drugs.

Pharmacology has ordinarily a wider meaning than

what is implied by the study of physiological reactions of drugs and covers the whole ground of Materia Medica, their preparation, identification and administration. It will, therefore, be interesting to allude even briefly to what is being gained from contacts of Indian with Western Pharmacology. Until recently, Indian Pharmacology, in spite of its glorious past, used to be generally looked down upon, and it ordinarily conveyed (to the uninformed) an impression of a jumble of hereditary remedies. This impression was so deep rooted that it was a long struggle everywhere in India for the indigenous systems of medicine to obtain any financial assistance from public funds for the encouragement of Indian drugs. Thanks, however, to the broad-mindedness of Sir Pardey Lukis, the late Director-General, Indian Medical Service, indian systems of medicine, both *Unani* (Mohamedan Medicine) and *Ayurvedic* (Hindu Medicine), are being gradually recognised. It is true that the basic principles, namely, the *Tridosha* theory of the Indian system of medicine, as ordinarily understood, cannot be reconciled with the Western spirit of direct, practical, and demonstrable methods of clinical examination and of diagnosis based thereon. But this apparent vital divergence apart, there are sufficient points of agreement between the Indian and the Western systems of medicine, and both may thrive side by side with neighbourly feelings towards each other and with exchange of knowledge to the mutual advantage. The rational system of Pharmacology and other exact

methods, which are already referred to as outstanding achievements of modern Pharmacology, are unique features of the West and may well be grafted on to the East which will no doubt be enriched and vitalised thereby, while the lore of empiric wisdom obtaining in this country may be put to the crucial tests of science and assimilated by the West.

More than 50% drugs recognised in the British Pharmacopœia are derived from India (q. v. pp. 12021) and countries adjoining and Indian Pharmacology, if properly investigated, can contribute more largely to the stock of Western knowledge. Extraction of plant alkaloids and the vast field of scientific knowledge as to their chemical constitution are recent advances in Pharmacology through Western science, and as the East and the West converge on this subject of alkaloids, most of the drugs being indigenous to India, a good deal of progress is possible if Indian Pharmacology is moulded on Western lines. There is, however, more faith in this country in fresh decoctions than in alkaloids and with the increase of our knowledge as to the working of cell protoplasm in the light of cell chemistry, vitamine theory, and other aspects, we shall have yet to learn which way the truth lies. Nevertheless, the study of the chemical constitution of alkaloids, and their artificial production in some instances with definite pharmacological reactions, are great achievements of modern pharmacology and India will doubtless be wiser by pursuing alkaloidal investigations and assays.

Apart from drugs, as ordinarily understood, there are in Pharmacology other spheres, which are no less important than those already mentioned. Dieting, fasting, cleanliness, and immunisation are at least best preventive measures, if not entirely curative, and as such they attracted a good deal of attention in ancient Indian Pharmacology, which still stands unsurpassed in the wisdom underlying its regulations in regard to dieting and fasting. Cleanliness, however, has a particular western aspect, and immunisation has been very largely developed by modern science. It is true that bactrotherapy and the modern practice of immunisation are often carried to an excess either from ignorance or through overzeal. But there is no doubt that the subject is a fast developing one, comprising a tremendously wide field of sera, vaccines, antitoxins, autovaccines and other biological products, and immense improvements are reasonably expected in the near future, which will ultimately control mortality to a large extent, prolonging health and vigour, promoting rejuvenation and making life worth living.

CHAPTER III

Economic Aspect-Indigenous Drugs

Chapters I and II chiefly represent the scientific

aspect of the indigenous drugs of India. The economic aspect, which is referred to *inter alia* in preceding chapters, is better shown in this chapter under the following extracts from the editorial columns of the *Lancet* and other leading journals :—

Extract (editorial) from the "LANCET,"

Dated London, the 22nd February, 1919 **(Pages 307-8)**

THE INDIGENOUS DRUGS OF INDIA

"In a leading article in the *Lancet* of December 28th, 1918, we referred to a movement begun by the Government of Bombay in the direction of establishing a pharmacological laboratory and research institute for the investigation of drugs, and more particularly the indigenous drugs of India. We have recently received a copy of a pamphlet written by Mr. J. C. Ghosh, pharmaceutical chemist in the Government Medical Stores, Madras, and published by Messrs. Butterworth and Co. (India) of Calcutta, which deals with the scientific cultivation and manufacture of indigenous drugs in India, with suggestions for the development of new industries. The resources of the country are evident when the writer points out in a list of drugs recognised by the British Pharmacopœia that 50 per cent of the drugs are indigenous to India and Ceylon, and that nearly the whole of the rest could be cultivated.*** Mr. Ghosh has done a good service in showing in what valuable directions developments could be made to go.***

Extract from

"THE JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY"

London, March, 1919.

"Mr. Ghosh advocates a systematic and scientific cultivation of B. P. vegetable drugs, properly trained manufacturing pharmacists working in collaboration with drug growers. He also advocates the establishment in India of alkaloid manufacture as an industry, either under Government control or by private enterprise.***

Extract (editorial) *from the* "Indian Medical Record," *Calcutta, April, 1919.* ***

The *Indian Medical Gazette* had an editorial on the pamphlet in *the March, 1919,* issue which writes :—

"We have before us a very useful pamphlet by Dr. J. C. Ghose, B.Sc. (Manchester), F. C. S., in which he makes a plea for the study of the indigenous drugs of India and for their scientific cultivation and manufacture in India.

"He ably pleads for an investigation of the chemical and histological characters of such indigenous drugs as may be found useful. This procedure, he tells us, will protect the public from the frauds now practised upon them by irresponsible manufacturers, will protect the indigenous Indian drugs from falling into disrepute, and will finally protect and develop an industry which offers promise of possibilities of great development,

but which, in a large majority of cases, is still, unfortunately, left in the hands of untrained and unscrupulous men."

In the issue of 25th March 1919, the "Statesman," in a long editorial, reviewed the whole pamphlet, endorsing, from first to last, the views expressed therein by Mr. Ghose and concluding in the following words :—

"In most civilised countries to-day there is a 'Food and Drugs Act' which aims at the prevention of adulteration. British manufacturers, who are subject to the penalties of an Act of this nature, compete on unfair terms with Indian Manufacturers who are under no such restrictions." * * *

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* * Gone through the book with great interest.
* * * Your suggestions are excellent.

R. N. CHOPRA, MAJOR, I.M.S.
Pharmacological Laboratory, Tropical School of Medicine, Calcutta.

June, 1926.

Economic Aspect (contd.)

MARKET FACILITIES

The following information in regard to the DRUG TRADE thankfully extracted from the "Statesman", Calcutta, and the Times Trade Supplement, October,

1933, is likely to be interesting and informative to the people who propose to specialise themselves in the line. :—

LONDON, THE WORLD DRUG CENTRE

The outstanding position of London as the world centre for drugs of all descriptions is to no small extent due to geographical and other conditions.

Side by side with the growth of London as a port, the City became increasingly important as a centre of the world's trade in commodities of all kinds. Mincing Lane, the London Commercial Sale Rooms, the General Produce Brokers' Association of London, and the separate associations concerned, respectively, with rubber, tea, coffee, cocoa, sugar, copra, jute, hemp, &c., are connected the world over with market for -not only in the United Kingdom, but also in Continental and more distant countries.

These favourable circumstances have been developed commercially by the London brokers and merchants throughout centuries of continuous trading, assisted by the enterprise of British shipping, which trades from and to London with every port of importance in the world. That the Metropolis has for so long been the financial and insurance centre of the world, affording the most advantageous trading arrangements, is another factor which has gone to make London pre-eminent as the foremost international centre of commerce.

Bills of exchange on London are the currency of

the merchanting world. The great docks, quays and warehouses of the port of London are second to none, capable of receiving the largest cargo vessels afloat, and handling, storing and dispatching merchandise in an efficient and economical manner.

Various influences have contributed to London's predominance as a port for the shipping of the whole world. Naturally these influences also tended to make Thames-side a busy mart for the commodities of both hemispheres. Gradually a powerful structure was formed on which was based the existing unrivalled organization of merchants, dealers and brokers, including staffs of experts with intimate knowledge of every merchantable commodity. Easily accessible for seller and buyer are warehouses and sheds with floors for unloading and sorting which enable all kinds of produce, from elephant tusks to pepper pods, to be displayed, sampled, graded, prepared, rendered more marketable, and repacked.

From the earliest days of the sailing ships inward cargoes in rich variety were attracted to the port, which proved a highly advantageous centre, from which outward cargoes and parcels could be easily and rapidly dispatched to the various ports of entry on the Continent of Europe. For all these reasons Thames-side has become a great importing and re-exporting centre for the wold's raw produce. A volume could be written about Mincing Lane and its multifarious operations, but space permits mention of a few only of its activities.

Favourable Position

It is not the purpose of this article to deal at length with the historical side of the London drug markets, but a review of the position as it is to-day will perhaps be the better appreciated if prefaced by a brief outline of the trade during past centuries. Although records indicate that London was something of a world centre for the reception and distribution of general merchandise from very early days, it is certain that during the reign of Queen Elizabeth, when considerable improvements were made in the riverside quays on the Thames, particularly on the north bank of the Port of London, overseas trading was of more than ordinary importance. Mincing Lane and Mark Lane, which at that time ran right down to the river, and the surrounding area, soon became the commercial centre dealing with the merchandise unloaded and loaded at the near-by quays. By the eighteenth century the district was almost entirely populated by merchants and brokers, who were doing a thriving business under favourable conditions. The Navigation and Trade Acts of the seventeenth and eighteenth centuries helped to increase London's commerce by reserving the trade of the Colonies to the English merchants. Indian and Chinese trade was a monopoly of the East India Company and was concentraded in London. It was the common habit at that time for most of the business to be transacted in the many coffee houses that existed in the City,

but in 1675 the reigning monarch, Charles II, sought to suppress them and many were closed down.

Early in the eighteenth century the need was felt for a recognized centre and meeting place for brokers and merchants, and in 1811 the first London Commercial Sale Rooms were founded. The venture had rather a chequered career and was for some years more or less a failure, becoming known as "Marten's folly." Later, with the break-up of some of the old Eastern trading monopolies, business broadened out and improved, and gradually "The Rooms" became the recognized centre for selling and buying. Throughout the nineteenth century the Mincing Lane trade continued to thrive, and it was during the latter part of this century that London became the recognized mart of the world for general merchandise, including all descriptions of drugs. At first extensions were made to the old building, but eventually, in 1890, the present structure was erected for the purpose of providing sale rooms for the use of the considerable number of firms engaged in buying and selling, importing and re-exporting the varied range of products landed at London from every part of the world.

Modern Warehouses

The majority of the drugs arriving at London are landed at the lower docks, a good proportion of the arrivals being discharged from in-coming vessels lower down the river, and brought in by lighters. London and St. Katherine Docks are situated in adjoining

areas facing the Upper Pool of the river; near-by are the Tower of London and the Royal Mint. The combined area of the two docks is about 130 acres, with a water area of over fourty-five acres and rather more than four miles of quays. Travelling cranes are provided on all quays, close to which are huge and seemingly endless transit sheds; connected with the sheds by means of bridges and automatic conveyors are the warehouses. The up-to-date warehouses are fitted with the latest appliances, and each is devoted to the storage of a special class of merchandise. Nowhere else in the world is there such a variety of goods stored, including drugs of all descriptions, spices, gums, barks, roots, leaves, iodine, mercury, essential oils, essences, etc. In the course of a tour through these huge stores (which would take some hours), one views the natural raw products of practically all the manufacturing industries, drawn from every part of the world.

Each of the warehouses at London and St. Katherine Docks is in charge of a foreman who has had a life's experience of the goods in his care, and is an acknowledged expert in grading, sampling, packing, etc. The floors cover an area of over seventy-six acres with ample room in each store provided for "working" new arrivals. One will note quantities of agar, packed in big bales bound with iron bands and wooden battens; they have arrived from Kobe or Yokohama. Belladonna from European and other sources in bags, follows next. Buchu leaves, from Cape Town,

packed in bales, are stacked up; each bale is sampled. There are many cases of cardamoms (which are later opened and bulked together according to grade) from India and Ceylon. Cascara sagrada, grown on the sides of the canyons extending from the Rocky Mountains westwards to the Pacific, is shipped from Harbour Grace Tacoma and Seattle. Bombay cuttle-fish bone, packed in large cases with straw lining, is a frequent arrival. Ergot from Oporto and other sources, in cases and bags, is an everyday feature. Galls from Persia and China are to be seen in good quantity, as is Hydrastis shipped from Seattle, packed in bales. Huge quantities of Senna leaves from Port Sudan, Bombay and Tuticorin, in bales, of which average samples are drawn, are on view. Insect flowers from Japan, contained in bales, come in with almost each ship from that country. Jalap in bags, from Vera Cruz; Juniper berries from Leghorn; Kola nuts from West Indies; Liquorice root and juice in cases and bales from Italy, Persia, Anatolia and many other sources; Nux vomica from Cochin; Orange peel from Tripoli and Valencia.

Produce of many Lands

Stramonium seed from Marseilles and other ports; senega root from Vancouver and New York; squill from Algiers; strophanthus from Beira; ipecac root from Singapore; turmeric from Madras and Bombay; peppers from Colombo, Alleppy, Cochin, Tellicherry, Saigon, Siam, Muntok and the isles of the Indian

seas ; olibanum from Bombay ; bees-wax from most parts of the world ; carnauba wax from Brazil ; ginger from Jamaica, Africa, Calicut and Bombay ; cinchona bark from Java, Bombay, Calisaya and St. Thomas, packed in packets and bales; and cloves from Zanzibar, Penang and Seychelles, are just a few of the drug products which are stored in the warehouses of the London and St. Katherine Docks. Senna from Port Sudan and Tuticorin is an important commodity. Huge quantities in pressed-packed bales and the better grades in cases are dealt with. The cases of Alexandrian are opened and sorted to quality, each pile being sampled. Honey, packed in tins, in cases, and in barrels, arrives from many parts of the world, including Jamaica, California, Cuba, India, New Zealand and Australia and other parts of the Empire. One pound samples are drawn from each barrel, and a percentage of the cases are opened to obtain an average sample. Chamomiles from Belgium and other European sources ; calumba root from Mozambique and the East Indies ; dragon's blood that was gathered in the Asiatic islands, Borneo and Sumatra ; poppy heads grown in Asia and Europe ; coca leaves from Peru and Chile ; and saffron from various countries of Southern Europe, are all well represented in bulk quantities, ready to meet world requirements. Another prominent commodity is tragacanth, which is shipped from Persia and Turkey, packed in bags and cases ; enormous quantities of this article are dealt with. Gum acacia from Port Sudan, Madagascar, India, etc., is

an article which regularly arrives at London in considerable volume. Each bale of cinnamon as it arrives is stripped open to ascertain that the "quills" are of consistent quality throughout. A walk through the warehouses at the docks is a veritable tour of the world of drugs. Materia medica from every British colony and every corner of the earth are received here, handled by an experienced staff and stored ready for dispatch to home consumers and to all parts of the world.

While the venue of London's international commercial activities has not changed to any appreciable extent during the past century, except to become much more extensive, the general methods of trading have undergone varying phases, brought about by altered world conditions and usages. The hub of the drug markets is Mincing Lane, Mark Lane and the surrounding area, just as it was two to three hundred years ago. The methods of trading, however, have of recent years, and particularly since the war, undergone many changes and not always to the advantage of London. Prior to 1914 practically all the drugs arriving at London, i.e, the bulk of the world's productions, were sent on consignment and mostly for sale by public auction. The predominant position of British shipping, coupled with the financial facilities, were sufficient inducements to most foreign shippers to use London as a centre for sales and purchases.

Post-war changes

Following the war the position gradually changed

and direct shipments to a number of Continental ports were on the increase. Despite this loss London continued to be by far the most important centre for drugs of all descriptions, and, during recent years, there has been evidence that shippers and buyers are beginning to realize that London offers many advantages lacking elsewhere, and are returning to their former habits of selling and buying in this market. For some years shippers have been disinclined to send much of their goods to this market on consignment. Uncertain conditions, fluctuating exchange rates, and the general fall in commodity values, have all been factors which have tended to make shippers endeavour to sell their goods outright prior to shipment and, moreover, to sell direct to America and the Continent, rather than use London as a distributing centre.

Owing to their character and wide range of qualities certain drugs, such as cardamoms, vanilloes, isinglass, tragacanth, castor, etc., are still periodically consigned for sale on the London market, but a large number of other commodities are now mostly sold outright by the shippers prior to dispatch. This is reflected in the somewhat limited volume of goods offered at the drug auctions, compared with the huge quantities catalogued some years ago. Of recent years buyers, who formerly would have hesitated to purchase even on sample, have almost habitually purchased their requirements "forward." The result has been that some of the shipments were unsatisfactory. The importance, from the buyer's point of view, of being

able to inspect either a dock-drawn sample, or the goods themselves, and be certain of their condition after they have been landed here, does not need to be emphasized. After a prolonged trial of the system of buying-forward, during which time it is doubtful if it has proved economical, whereas it has certainly proved unsatisfactory in very many instances, there are signs that buyers are gradually moving back to the former methods of dealing through the brokers and merchants who did the goods, and who are in a position to satisfy them on the question of quality and meet their particular requirement.

India's Contribution to World Drug Trade

India is intimately connected with the London drug trade. For many years India has been the source from which large quantities of drugs, some of which are regarded as indispensable, are exported to London and other parts. In this connection Indian Senna is world famous; the export of this drug in certain years has amounted to 100,000 cwt. Another drug which is exported in large quantities is India opiuum for the production of alkaloids and the galenical preparation, into which the drug enters. Nuxvomica, the source of strychnine and brucine, goes chiefly from the Malabar coast, while castor oil is yet another valuable drug, supplies of which are obtained from India. The country also supplies cardamoms, chiratta, catechu, capsicum, turmeric, marshmallow and ginger. Other products of Indian origin

frequently handled by the pharmacist are cinchona, aconite, areca nut, kino, aloes, bael fruit, dill, cumin, citronella, lemon-grass oil, sandalwood oil, ammoniacum, jalap, senna, aniseed, rhubarb, gambier, gambofe, coto, artemisia maritima, santonica, datura, euphorbia, berberis, ajowan, hemidesmus and canella. Again, it is to India that the Western world looks for large supplies of oil seeds and vegetable oils. In addition, enormous quantities of such oils as cocoanut, groundnut, mustard, linseed, cotton seed, rape and sesame are exported. Other Indian drugs, of which large supplies reach Europe, are spices. The quantity of pepper exported from India amounts to approximately 12,000,000lbs. per annum, and of ginger, above 8,000,000lbs. are exported each year. Other spices produced and exported in varying quantities are cinnamon, coriander, cummin and cloves. Further, there are dye-stuffs, tans, rice, pulses, tea, jute, cotton, hides, skins, shellac, gums, resins, rubber and mineral oils, which are largely exported in connection with drug trade and allied products.

Tea Trade

As regards tea it may be mentioned that while much Indian and Ceylon tea is auctioned in Calcutta and Colombo for export direct to the United States, Australia, New Zealand, or the Near East, London is still the chief centre of the trade, not only because the United Kingdom is the world's largest consumer of tea, but also because her re-export trade in that

commodity is very large—say, 70,000,000lbs. valued at £4,500,000, in a year. Latterly trade with Germany has declined. A recent estimate gave two-thirds as the proportion of the world's tea crop marketed through London.

Spice Trade

The tendency in the spice trade for shipment to be made direct instead of through London is also noticeable in the business in drugs and medicinal gums from the East. Increasing quantities now go direct to the United States. Every two months, however, public auctions are still held at the London Commercial Sale Rooms, the retailer being supplied through the dealers or whlesale druggists.

The huge export trade of India in drugs, dyes, etc., as summarised above, is worth crores of rupees, and as the business suffers heavily owing to the employment of illiterate and unscrupulous collectors and dealers, resultlng in depreciation of value even to the extent of 50% or more in some cases, it is for serious consideration whether we should not take *immediate* steps to develop the business on *scientific* lines by introducing forthwith pharmaceutical education (q. v. pp. 5, 12, 32-33, 46-48 and 54-64).

LISTS OF VEGETABLE DRUGS

in Nine Languages

Lists (a), (b) and (c)

APPENDIX I

(*a*) List, in nine languages, of vegetable drugs and (1914), jointly or separately. The present (1932) nearly sixty drugs having been omitted in the new fair idea of the drugs which are generally known as interesting in that it shows how far these *official* drugs the percentage, which is referred to earlier in the basis of this list.

Note :—The B. P. drugs, which have no correspond- those parts of India which the vernaculars represent, or are medicine. Drugs marked with an asterisk, etc., contain to which particular attention is drawn. Those marked the Lists (a), (b) and (c) is given a specific item number, against an item number, although spread over 16 columns

The B.P. drugs are classified here under heads such as arrangement as indicated under each list.

Roots

Item No.	Year of the B. P. edition	NAME OF	
		English	Sanskrit
1	1898 & 1914	‡ Aconite	Vatsanabha, Ativisha
2	,, ,,	‡ Belladonna	...
3	,, ,,	Calumba	
4	,, ,,	θ Dandelion, or Tara- xacum	...
5	,, ,,	Gentian	...
6	1898	Hemidesmus	Ananta, Sariba
7	1898 & 1914	θ Horse radish	Sthulamulaka
8	,, ,,	‡ Ipecacuanha	...
9	,, ,,	§ Jalap	Tritrit, Triputa
10	,, ,,	Krameria	...

authorised (*official*) in the British Pharmacopœia (1898) edition of the B. P. introduced considerable changes, edition. This list (*a*) as it stands, however, gives a British Pharmacopœial drugs. This list is also are indigenous to Innia and to adjoining countries, book (Chapter I, pp. 12 & 21), being calculated on the

ing Indian Vernacular names, are either unknown in not mentioned in Sauskrit and other Indian books on the active principles mentioned in the foot-note (pp. 162-63) with θ are omitted in the B. P. (1932). Each drug in so that the names and other characteristics of the drug in four pages, may be seen distinctly at a glance.
Roots, Barks, etc. Non-B. P. drugs follow a different

Roots

DRUG IN

Tamil	Telugu	Canarese	Malayam
Vasanabi	Vasanabhi, Ativisha	Vasanabi, Ativasa	Vasanabi
...	...	...	...
Kalambaver	...	...	...
...	...	...	...
...	...	...	...
Nannari	Sugandhi-pala	Karibanta	Soğãde
Mulangi	Mulangi	Mulangi	Muththa
...	...	Nelanaringa	Nilanarakam
Shivadai	Tegada	Tigade	Tigade, Trikal-fia, Chivaka-vera
...	...	...	...

Item No.	Year of the B. P. edition.	Name of	
		English	Sanskrit
11	1898 & 1914	Liquorice (Glycyrrhizæ)	Yashti-madhuram
12	1898	Pareira	...
13	1898 & 1914	Pyrethrum	...
14	„ „	§ Scammony	...
15	„ „	Senega	...
16	1898	Sarsaparilla	...
17	„	Sassafras	...

Roots

Item No.	Name of Drug In			Natural Order
	Bengali	Hindusthani	Mahrathi	
1	Kath.bish	Mithabish Bish	Bachanag,	Ranunculaceæ
2	...	Lachhmina, Lachhmine	...	Solanaceæ
3	Kalamba	...	Kadugath	Menispermaceæ
4	...	Dudal, Baran, Kanphul	...	Compositæ
5	...	Pakhanved	...	Gentianeæ
6	Anantamul	Anantamul	Dudhasali	Asclepiadeæ
7	Gharamula	Muli	Mura	Cruciferæ
8	...	...	Tripani	Rubiaceæ
9	Teori	Jalapa	...	Convolvulaceæ
10	...	...	...	Polygaleæ
11	Jashthi madhu	Mulhatti	Jesthimadh	Leguminosæ
12	...	...	...	Menispermaceæ
13	...	...	Akalkara	Compositæ

DRUG IN

Tamil	Telugu	Canarese	Malayam
Atimadhuram	Yashti-madhu-kam	Jesta-madhu	Eratimadhura
...	...	...	...
...	...	...	...
...	...	...	...
Mamuda	...	...	...
...	...	...	...
...	...	...	...

Roots

Habitat	Active principle	Therapeutic use
Britain, India (Himalayas)	Aconitine	Diaphoretic, and local Anodyne.
Britain, Germany, India	Hyosciamine, Atropine	Narcotic, Mydriatic, Antispasmodic.
Eastern Africa	Calumbin	Bitter tonic
Britain, India	Taraxacin	Diuretic, Laxative, Hepatic stimulant, Tonic.
Germany, etc.	Gentiopicrin	Bitter tonic, Laxative.
India	Coumarin	Diaphoretic, Alterative,
Britain	Sinigrin	Stimulant and Diuretic.
Brazil, Johore	Emetine	Expectorant, Emetic, Diaphoretic, Anti-dysenteric
Mexico, Jamaica, India	Jalapin	Cathartic.
Brazil, Peru, Bolivia	Krameria-tannic Acid	Astringent
Britain, Persia	Glycyrhizin	Mild cathartic
Brazil	Berberine	Anodyne
Persia, Africa, India (Kashmir)	Pyrethrine	Sialagogue

Item No.	Name of Drug in			Natural Order
	Bengali	Hindusthani	Mahrathi	
14	...	Sukh-munia	...	Couvolvulaceæ
15	...	Mahmudah	...	Polygaleæ
16	Salsa	Salss	...	Smilaceœ
17	...	...	...	Laurineœ

Rhizomes

Item No.	Year of the B. P. edition	Name of	
		English	Sanskrit
18	1898 & 1914	Arnica	...
19	„ „	0 Couch Grass	Durba, Granthila
20	1898	Cimicifuga	...
21	1998 & 1914	Colchicum	...
22	„ „	0 Gelsemlum	...
23	„ „	* Ginger	Shunthi
24	„ „	0 Hydrastis	...
25	1914	0 Kava	...
26	1898 & 1914	Male Fern	...
27	„ „	§ Podophyllum	...
28	„ „	Rhubarb	...
29	1898	gumbul	...
30	1914	0 Picrorhiza Kurroa	Katuka
31	1898 & 1914	squill 0 Indian squill	Vana plandam
32	„ „	serpentary	...
33	„ „	Turmeric	Haridra
34	„ „	Valerian 0 „ (Indian)	Balakam

Habitat	Active principle	Therapeutic use
Syria, Asia Minor	Resin and gum Scammorin	Cathartic
America	Senegri	Expectorant
Central America	Sarsa saponin	Alternative, diuretic
North America	Volatile oil	Diaphoretic

Rhizomes

DRUG IN

Tamil	Telugu	Canarese	Malayam
...	...	...	...
Anugu	Durbha	Garikae	Karuka-pallu
...	...	...	...
...	...	...	...
...	...	...	...
Shukku	Sonti	Shunti	Chukka
...	...	...	...
...	...	...	...
...	...	...	...
...	...	...	...
Variyattu	Nattu reval chinni	Reval chini	...
...	...	...	...
Katuka-veyani	Katuk rohini	Kudar Katuki	Kutki
Nari vengayam	Adavitella gadda	Kadu belluti	Kantena
...	...	...	...
Manjal	Pasupu	Arasina	Manjal
...	...	Nandibattal	...

Item No.	Name of Drug In			Natural order.
	Bengali	Hindusthani	Marhathi	
18	...	...	...	Compositæ
19	Durba	Durba	Durba	Gramineæ
20	...	...	...	Ranunculaceæ
21	...	Suranjan	...	Liliaceæ
22	...	...	...	Loganiaceæ
23	Shunt	Scnt	Sunt	Scitaminæ
24	...	...	...	Ranunculaceæ
25	...	...	Kav	Piperaceæ
26	...	...	...	Filicineæ
27	...	Papra, Papri	...	Berberideæ
28	Revan chini	Revand chini	Lakadi reva chini	Polygonaceæ
29	...	Sumbul	...	Umbelliferæ
30	Katki	Katki	Kadu	Scrophularicæ
31	Banpiaj	Junglipiyaj	Bhui Kanda	Liliaceæ
32	...	...	...	Aristolochiaceæ
33	Halud	Haldi	Halad	Scitamineæ
34	Bala	Tagar	Tagaragan-thoda, Tagar	Valerianeæ

Habitat	Active Principle	Therapeutic use
Central & S. Europe	Arnicin	Anodyne
Europe, Asia, etc.	Triticin	Diuretic, styptic
Canada & U. S. A.	Cimicifugin	Tonic, Expectorant, Anti-rheumatic
Britain, etc.	Colchicine	Diuretic & Purgative
United States	Gelsiminine	Anodyne in Neuralgia & sick headache
Jamaica, India, etc.	Gingerol	Carminative
America (N. E.)	Hydrastine	Bitter tonic & spinal stimulant
Sandwich Islands	Acrid resin	Spinal depressant
Britain	Filicic acid	Vermifuge
N. India	Podophylli Resin	Cathartic and Hepatic stimulant
Tibet, China	Emodin	Cathartic
Turkestan	Yellow oil, resin etc.	Antispasmodic & Nervine stimulant
India (Himalayas)	Picrorhizin	Antiperiodic, Anti-dysenteric & Tonic
Mediterranean coasts	Scillitoxin	Expectorant
United States	Volatile oil	Diaphoretic
India, China	Curcumin	Colouring agent & condiment, also analgesic & antiseptic (mild)
England & India (Himalayas)	Volatile oil	Antispasmodic, Hypnotic

Barks

Item No.	Year of the B. P. edition	Name of		
		English	Sanskrit	Tamil
35	1898 & 1914	ϕ Alstonia	Sapta parna	Ezhilaippalai
36	„ „	Cascara Sagrada	...	...
37	„ „	ϕ Cascarilla	...	...
38	„ „	‡ Cinchona	...	...
39	„ „	ϕ Cotton root	Karpas	Paruthi
40	„ „	* Cinnamon	Tvak	Lowanga Pattai
41	1898	Cuspariæ	...	...
42	„	Mezerei	...	...
43	1898 & 1914	ϕ Euonymus	...	...
44	„ „	ϕ Oliver	...	...
45	„ „	Quillaia	...	...
46	„ „	ϕ Viburnum	...	...
47	„ „	Wild Cherry	...	...
48	1898	Pomegranate	Dadimba	Madloi

Leaves

49	1898 & 1914	ϕ Betel	Tambul	Vettilai
50	„ „	Buchu	...	...
51	„ „	‡ Belladonna	...	...
52	„ „	ϕ Bearberry	...	...
53	„ „	* Cajuput	...	Kijapute
54	„ „	ϕ Cherry laurel	...	...
55	1898	Coca	...	...
56	1898 & 1914	‡ ϕ Datura	Unmatta	Umattai
57	„	Digitalis	...	...
58	„	* Eucalyptus	...	...
59	„	* Gaultheria	...	...
60	„	ϕ Grindelia	...	...
61	„	‡ Hyoscyamus	Parasika	Kurasani-omam

Barks

DRUG IN

Telugu	Canarese	Malayalam
Aritaku	Erhakul	Erilam palam
...	...	...
...	...	...
...	...	...
Patti Dalchinichakka	Hatti Dalchin	Karuparutti Lowangapatta
...	...	...
...	...	...
...	...	...
...	...	...
...	...	...
...	...	...
...	...	...
Danimba	...	...

Leaves

Tamalapaku	Villyadele	Vettila
...	...	...
...	...	...
...	...	...
...	...	...
...	...	...
...	...	...
Dhaturamu	Ummattam	Ummattam
...	...	...
...	...	...
...	...	...
...	...	...
Kurshamani vamam	...	...

Barks

Item No.	Naee of Drug In			Natural Order
	Bengali	Hindusthani	Marhathi	
35	Chhhatin	Chhatian	Satvin	Apocynaceæ
36	...	...	...	Rhamneæ
37	...	...	...	Euphorbiaceæ
38	...	...	...	Rubiaceæ
39	Kapas	Rui	Kapus	Malvaceæ
40	Darchini	Dalchini	Dalchini	Laurineæ
41	...	...	...	Rutaceæ
42	...	...	...	Thymelaceæ
43	...	...	...	Celastrineæ
44	...	...	...	Laurineæ
45	...	...	...	Rosaceæ
46	...	...	...	Caprifoliaceæ
47	...	...	...	Rosaceæ
48	Dalim	Anar	Dattidwa	Lythrarieæ

Leaves

49	Pan	Pan	Pan	Piperaceæ
50	...	Bakku	...	Rutaceæ
51	...	Angur Shefa	...	Solanaceæ
52	...	...	...	Ericaceæ
53	Cajuputi	Kayaputi	Kayakuti	Myrtaceæ
54	...	...	...	Rosaceæ
55	...	...	...	Linaceæ
56	Dhutura	Safed dhatura	Dhutra	Solanaceæ
57	...	...	...	Scrophularneæ
58	...	...	...	Myrtaceæ
59	...	...	...	Ericaceæ
60	...	...	...	Compositæ
61	Khorasani-ajowanpata	Khurasani-ajwan kepatta	Khorasani	Solanaceæ

Barks

Habitat	Active principle	Therapeutic use
India, Philiphine Islands	Ditamine	Astringent, antiperiodic, etc.
North California	Bitter substance	Cathartic
Bahama Islands	Cascarillin	Aromatic bitter tonic
Peru, Bolivia, Java, India	Quinine, cincnidine, etc.	Antiperiodic, antipyretic, antizymotic, tonic
India	Acid resin	Emmenagogue
Ceylon	Volatile oil	Carminative and stomachic
Venezuela	Volatile oil, etc.	Bitter tonic
Britain	Mezerein	Local irritant
United States	Euonymin	Cathartic
New South Wales	Volatile oil	Carminative
Chili & Peru	Sapotoxin	Expectorant
United States	Valerianic acid	Uterine sedative
North America	Hydrocyanic acid	Sedative
S. Europe, etc.	Alkaloids and tannic acid	Vermifuge

Leaves

India, Ceylon	Volatile oil	Sialagogue
Cape Colony	,, ,,	Diuretic
Britain, Germany & India(Himalayas)	Hycscyamine	Anodyne
Britain, etc.	Arbutin	Diuretic
East & West Indies	Volatile oil	Antispasmodic
Britain, etc.	Laurocerasin	Sedative
Bolivia, Peru	Cocaine	Tonic & restorative
India	Hyoscine	Antispasmodic
England etc.	Digitoxin	Cardiac tonic
Australia, India	Volatile oil	Antiseptic
United States, India	Methyl salicylate	Anodyne
North America	Volatile oil	Antispasmodic
Britain, Germany & India	Hyoscyamine	Anodyne, sedative, narcotic

Leaves

Item No.	Year of the B. P. edition.	NAME OF		
		English	Sanskrit	Tamil
62	1898 & 1914	Hamamelis	...	...
63	1898	Jaborandi	...	...
64	,,	* Peppermint	...	...
65	1898 & 1914	* Spearmint	...	...
66	,,	‡ Stramonium	Unmatta	Umattai
67	,,	Senna	Swarnamukhi	Nilavirai
68	,,	Tea	...	...

Flowers

69	1898 & 1914	θ Arnica	...	...
70	,,	θ *Chamomile	...	Shimai Chaman tippu
71	,, ,,	* Cloves	Lavanga	Krambu, Lavangam
72	1898	Crocus (Saffron)	Kumkum	...
73	1898 & 1914	θ Cusso	...	...
74	,, ,,	* Lavandula	...	...
75	,, ,,	* Orange	Nagaranga	Kamala parham, Kichili
76	,, ,,	θ Red poppy	Rakta posta	Shigappu-Kasakasa
77	,, ,,	θ * Rose	...	Rojappu
78	,, ,,	* Rosemary	...	...
79	1898	Sambuci (Elder)	...	...

Leaves

DRUG IN

Telugu	Canarese	Malayalam
...	...	...
...	...	...
...	...	...
...	...	...
Dhaturamu	Ummattam	Ummattam
Sonamukiaku	Nelavareke	Sonamukhi
...	...	...

Flowers

...	...	...
...	...	...
Lavangam	Lavanga	Karambu
Kumkum pubu	Kunkun	...
...	...	...
...	...	...
Kamala pandu	Kittalehannu	Madhura-naranga
...	...	...
Golabi puvvu	Golabi kuvu	Paninirpu
...	...	...
...	...	...

Leaves

Item No.	Name of Drug in			Natural Order
	Bengali	Hindusthani	Mahrathi	
62	...	...	...	Hamamelidæ
63	...	...	...	Rutaceæ
64	...	...	...	Labiataæ
65	...	...	...	„
66	Dhatura	Dhatura	Dhutra	Solanaceæ
67	Sonamukhi	Sonnamukhi	Sonna-mukhi	Leguminosæ
68	Cha	...	...	...

Flowers

69	...	...	...	Compositæ
70	Babunaphul	Babunake phul	Babuna	„
71	Labanga	Long	Lavang	Myrtaceæ
72	Jafran	Keshar	Kumkam	Iridaceæ
73	...	...	...	Rosaceæ
74	...	...	...	Labiatæ
75	Kamala-nebu	Naringi Kamla	Kamla, Santra, Naring	Rutaceæ
76	Lalposta	Lalpost	Jungli mndrika	Papaveraceæ
77	Golap	Gulab	Gulab	Rosaceæ
78	...	...	...	Labiatæ
79	...	...	...	Caprifoliaceæ

Leaves

Habitat	Active principle	Therapeutic use
United States	Tannin and Volatile oil	Astringent and styptic
Pernambuko	Pilocarpine	Diaphoretic
England and U. S. A.	Volatile oil	Carminative
England, India, etc.	,, Hyoscyamine, etc.	,, Antispasmodic
Alexandra and India	Senna-emodine, etc.	Cathartic
China, India	Caffeine	Stimulant

Flowers

Europe	Volatile oil and Arnicin	Used as a lotion for bruises
Britain, etc.	Volatile oil	Aromatic stimulant
Zanzibar. Penang, etc.	,,	Carminative
Kashmir (India)	Crocin	Antispasmodic, stimulant
Abyssinia	Kosotoxin	Anthelmintic
England, etc.	Volatile oil	Carminative
Southern Europe and India	,,	Aromatic bitter
England	Rhœadic acid	Colouring agent
Southern Europe, India, etc.	Volatile oil	Odorant, astringent
Britain, etc.	,,	Stimulant and Rubifacient
Britain	,,	Cosmetic

Fruits

Item No.	Year of the B. P. edition.	Name of		
		English	Sanskrit	Tamil
80	1898 & 1914	* Ajowan	Jamani	Omam
81	„ „	* Anethi	Satapushpa	Satakuppi virai
82	„ „	θ * Anisi	...	...
83	„ „	θ Bael	Bilva, Sriphal	Bilvam
84	„ „	* Caraway	Sthula jirakam	Perinjirakam
85	„ „	Capsicum	...	Melagoy
86	„ „	* Coriander	Dhanyaka	Kottu-malli virai
87	„ „	* Cardamom	Ela	Elakay
88	„ „	θ Cassia	Suvarnaka, Arogwadha	Konnai
89	„ „	Colocynth	Indravaruni	Pædicari
90	„ „	θ * Cubebs	Sugandha-maricha	Val milaku
91	1898	Cocculus indicus	Kakaphala	Khai-kolli virai
92	1898	Elaterium	...	...
93	1898 & 1914	θ Embelia	Bidanga	Vayu-vilangam
94	„ „	* Fenne	Madhurika	Sombu
95	„ „	Figs	Audambara	Attiparham
96	„ „	* Juniper	...	...
97	„ „	* Lemon peel	Matulunga, Jambira	Kodi-alimicham

Note.—* contain essential oils. ‡ contain alkaloids.

These active principles (essential oils, alkaloids, worked up by a co-operation of capitalists with

DRUG IN

Telugu	Canarese	Malayalam
Omamu	Oma	Omam
Stakuppi vittulu	Sabbanga	Shata-kuppu
Kuppi	Sopu-jira	...
Bilvamu	Belapatri	Koovalam
Jilakara	Jeerige	Perin-jirakam
Mirapakaya	Kempu-menasu	Parangimulaka
Kotimiri	Kottumbari	Kottampali
Elakaya	Elakki	Elatari
Raela	Kakkemam	Kouna
Paperabudama	Havu-mekkai	Pai kummati
Toka-miriyalu	Gandha-menasu	Val milaku
Kakamari	Kakamari	...
...	...	...
Vayu-vilangan	Vayu-vilange	Vidalari
Sopu	Bade-soapu	Kartu-sata kuppu
Attipandu	Atti	Atti-parham
...	Suchi-patra	...
Jambiram	Gaja-nimbe, Nembakai	Madal narakam

† contain fixed oils. § contain resin.

etc.,) are of great commercial value and remain to be technical chemists *either now or never*.

Fruits

Item No.	Name of Drug In			Natural Order
	Bengali	Hindusthani	Marhathi	
80	Jowan	Ajvan	Ajwan, Ova	Umbelliferæ
81	Sulpha	Sowa	Sova	„
82	...	Anisoon	Badi shop	„
83	Bail	Bail	Bael	Rutaceæ
84	Bilatijira	Bilati-zirah	Jire	Umbelliferæ
85	Lalmarich, Lanka	Lal-mircha	Mirchi	Solanaceæ
86	Dhane	Dhania	Dhane	Umbelliferæ
87	Chhota-Elach	Chhota-elachi	Velchi	Scitamineæ
88	Sundali, Banar-lathi	Amaltas	Bahava-garmala	Leguminosæ
89	Indrayan, Makal	Indrayan	Indrayan	Cucurbitaceæ
90	Kabab-Chini	Kabab-Chini	Kankola, Tadamiri	Piperaceæ
91	Kakamari	Kakamari	Karwi	Menispermaceæ
92	...	Katri Indrayan	...	Cucurbitaceæ
93	Bidanga	Baberang	Vivarang	Myrsineæ
94	Mauri	Saunf	Badi-shoppa	Umbelliferæ
95	Jajna-dumur	Gular	Anjir	Urticaceæ
96	...	...	...	Coniferæ
97	Tabanebu, Goranebu	Jambira	Mahalung	Rutaceæ

Fruits

Habitat	Active Principle	Therapeutic use
India, Persia, etc.	Thymol	Carminative
England, India, etc.	Volatile oil	,,
China, Russia, etc.	,,	,,
India	Mucilage and pectin	Astringent
India and Ceylon	Volatile oil	Carminative
Zanzibar, India, etc.	Capsicin	Stimulant
Russia, India, etc.	Volatile oil	Antispasmodic
India and Ceylon	,,	Antispasmodic, carminative
India	Sugar, pectin	Laxative
India and Levant	Colocynthin	Cathartic
Java, etc.	Volatile oil	Diuretic and urinary disinfeetant
India	Picrotoxin	Anthelmintic
England, Malta, Persia	Elaterin	Purgative
East Indies, India, etc.	Embelic acid	Anthelmitic
France, Indis	Volatile oil	Carminative
Smyrna, etc.	Grape-sugar	Laxative
Northern Europe	Volatile oil	Diuretic
Europe, India	,,	Aromatic, Anti-scorbutic

Fruits

Item No.	Year of the B. P. edition	NAME OF		
		English	Sanskrit	Tamil
98	1898 & 1914	θ Myrobalam	Hareetaki	Kadukkai
99	„ „	† Olive	...	...
100	„ „	* Orange peel	Nagaranga	Kichili
101	„ „	Pepper	Maricham	Milagu
102	„ „	Prunes	...	...
103	1898	Pimento	...	...
104	„	Rasins	Drakha	Kodimondi
105	1898 & 1914	Tamarind	Tintiri, Amlika	Puli

Seeds

106	1898 & 1914	θ † Almond	Badama	Vadam-kottai
107	1898	Calabar	...	...
108	1898 & 1914	† Castor	Erandam	Amanak-virai
109	„ „	† Chaulmoogra	Tuvaraka	Neradimuttu
110	„ „	† Croton	Jayapala	Naervalam
111	„ „	θ Ispaghula	Seetabeeja	*Ishappukol-virai
112	„ „	† Groundnut	Buchanaka	Vaerkadalai
113	„ „	θ § Kaladana	Shyamalabeeja	Kodikakka-tan
114	„ „	† Linseed	Atasi	Alasi

Fruits

DRUG IN

Telugu	Canarese	Malayalam
Karkkaya	Anilekayi	Kaduk-kai
...	...	...
Nagarangamu	Kittale-sippe	Madhura naranga
Miriyalu	Volle-menasu	Kuru-Mulaka
...	Uluhannu	...
...	...	...
Drakha	Drakha	...
Chintapandu	Hunasehanun	Puli

Seeds

Badam vittulu	Badamu	Badam
...	...	...
Amudalu	Haralu	Chittamanakku
Neradivittulu	...	Marattikaya
Naepalvaema	Japalabeeja	Naervalam
Isapagalvittulu	Isavagolu	...
Vairushanagalu	Nelakadali	Nelakatala
Kolli-vittulu	...	...
Atasi	Alashi	Kasavu

Fruits

Item No.	Name of Drug in			Natural Order
	Bengali	Hindusthani	Mahrathi	
98	Hareetaki	Harh	Herada	Combretaceæ
99	Jalpai	...	...	Oleaceæ
100	Kamala nebu	Naringi, Kamla	Santra	Rutaceæ
101	Gol marich	Kalimirchi	Kalamire	Piperaceæ
102	...	...	...	Rosaceæ
103	...	...	...	Myrtaceæ
104	Kismish	Kismis	Drakha	Ampelideæ
105	Tentul	Amli	Chinch	Leguminosæ

Seeds

106	Badam	Badam	Badam	Rosaceæ
107	...	...	...	Leguminosæ
108	Bharanda	Arand	Erandi	Euphorbiaceæ
109	Chaul-moogra	Chaulmoogra	Shalmogra	Bixineæ
110	Jaipal	Jamalgota	Jeyaphal	Euphorbiaceæ
111	Isufghul	Issupgal	Isapghul	Plantagineæ
112	Badam	Mungphali	Bhuimug	Leguminosæ
113	Kaladana	Kaladana	Kaladana	Convolvulaceæ
114	Tisi, Mosina	Tisi	Alasi	Lineæ

Fruits

Habitat	Active principle	Therapeutic use
India	Tannic acid	Astringent, cathartic
Italy, Spain	Olein	Laxative
Spain, India	Volatile oil	Anti-scorbutic, Aromatic, Tonic
East Indies and India	Volatile	Carminative
France	Sugar	Laxative
West Indies, etc.	Volatile oil	Aromatic stimulant
Kashmir	Grape	Grape sugar, Demulcent, nutrient, laxative
India, East and West Indies	Tartaric acid	Laxative

Seeds

Persia and Southern Europe	Fixed oil	Nutrient
Western Africa	Physostigmie	Myotic
India	Ricinolein	Cathartic
India	Fixed oil and Chaul-moogric acid	Nutrient and Anti-leprous
India and England	Crotonoleic acid	Cathartic
India and Persia	Mucilage	Demulcent
India, China, etc.	Fixed oil and olein	„
India	Jalapin	Cathartic
India and Britain	Fixed oil and macilage	Demulcent

Seeds

Item No.	Year of the B. P. edition.	NAME OF		
		English	Sanskrit	Tamil
115	1898 & 1914	Melon Pumpkin	Punyalata, Kushmanda	Pooshani kai
116	„ „	† Mustard	Sarsapa	Kadugu
117	„ „	‡ Nux Vomica	Vishamusti, Vishatinduka	Yetti Kottai
118	„ „	* Nutmeg	Jatiphalam	Jadikai
119	„ „	† Sesamum	Tila	Ellu
120	„ „	θ Stavesacre	...	...
121	„ „	‡ Stramonium	Unmatta	Umattai
122	„ „	Strophanthus	...	...
123	„ „	† Theobroma (Cocoa)	...	...

Entire Plants

124	1898 & 1914	θ Broom Tops	...	...
125	„ „	θ Cannabis	Siddhapatri	Kanja
126	„ „	θ Chirata	Kiratatikta	Nela-vembu
127	„ „	Lemon grass	Bhutrina	Karpoorpul
128	1898	Hemlock	...	...
129	1898 & 1914	Lobelia	...	...

Miscellaneous

(Wood, Gums, Resin, etc.)

130	1898	θ Araroba	...	...
131	1898 & 1914	θ Guaiacum	...	...

Seeds

DRUG IN

Telugu	Canarese	Malayalam
Gummdikai	Kumbalakaye	Matanga
Avalu	Sasive	Kaduka
Musti-vlttulu, Mushini pikaa	Kasarka-namara	Kanjiram
Jajkaya	Jajikai	Jatika
Nuvuloo	Uru-ellu	Karuellu
...	...	...
Dhaturamu	Ummattam	Ummattam
...	...	...
...	...	...

Entire Plants

...	...	...
Ganjayi	Bhangi	Kanchabhu
Nelavemu	Kiriyatu	Kiriyat
Nimmagaddi	Majjigeputtu	Chayapul
...	...	...
...	...	...

Miscellaneous (Wood, Gums, Resin, etc.)

...	...	...
...	...	

Seeds

Item No.	Name of Drug In			Natural Order
	Bengali	Hindusthani	Marhathi	
115	Bilati Kumra	Mitha Kumra	Dangar	Cucurbitaceæ
116	Sarisha	Sarsun	Sarsha, Mohari	Cruciferæ
117	Kuchila	Kuchla	Kuchala	Logaminaceæ
118	Jaephal	Jaephal	Jayaphal	Myristicaceæ
119	Til	Til	Til	Pedalineæ
120	...	...	...	Ranunculaceæ
121	Dhatura	Dhatura	Dhutura	Solanaceæ
122	...	...	...	Apocynaceæ
123	...	...	...	Sterculiaceæ

Entire Plants

124	...	...	...	Leguminosæ
125	Ganja	Ganja	Bhanga	Urticaceæ
126	Chireta	Charaytah	Kirayit	Gentianeæ
127	Gandha Vena	Gandha trena	Gavati-chaha	Gramineæ
128	...	...	...	Umbelliferæ
129	...	...	...	Lobeliaceæ

Mfscellaneous (Wood, Gums, Resin, etc.)

130	...	...	...	Leguminosæ
131	...	...	...	Zygophyllaceæ

Seeds

Habitat	Active principle	Therapeutic use
India and Levant	Acrid resin	Anthelmintic
England, Holland, India, etc.	Fixed oil and Sinigrin	Stimulant, rubifacient and condiment
India	Strychnine	Tonic and stimulant
Moluccas, etc.	Volatile oil	Carminative
India, China, etc.	Olein	Demulcent
Asia Minor	Delphinine	Parasiticide
England, India, etc.	Hyoscyamine	Narcotic and Antispasmodic
East Africa	Strophanthin	Cardiac tonic
Ceylon, America, etc.	Stearin, Theobromine, etc.	Neutrient and Diuretic

Entire Plants

England	Scoparin	Diuretic
India	Cannabin	Anodyne aud Narcotic
India	Chiratin	Bitter tonic
Indla	Volatile oil and Citral	Carminative
Europe	Coniine	Sedative
South America	Lobaline	Antispasmodic

Miscellaneous (Wood, Gums, Resin, etc.)

Brazil	Chrysarobin	Anthelmintic (cures ring worm)
West Indies	Resin	Diaphoretic, anti-syphilitic & alterative

Miscellaneous

(Wood, Gums, Resin, etc.)

Item No.	Year of the B. P. edition	NAME OF		
		English	Sanskrit	Tamil
132	1898 & 1914	θ Logwood	...	...
133	„ „	Quassia	...	Koshia
134	„ „	* Sandal wood	Chandanam	Chandana Kattai
135	„ „	Acacia Gummi	Vabboola	Karu vaelam gondu
136	„ „	Aloes	Kumarie	Kattalai
137	„ „	θ Ammoniacum	...	...
138	„ „	Asafetida	Hingu	Perungayam
139	„ „	Balsam of Peru	...	...
140	„ „	Balsam of Tolu	...	...
141	„ „	Benzoin	...	...
142	„ „	θ Buteæ, Bengal kino	Pitasala	Vengai maram
143	„ „	Camphor	Karpuram	Sudam, Karpuram
144	„ „	Catechu	Khadira	Voadalam, Kattha
145	„ „	* Copaiba	...	...
146	„ „	Ergot	...	...
147	1898	Galbanum	Javashira	...
148	1898 & 1914	θ Galls	Majuphalam	Mochakai
149	1898	Gamboge	Tapinja, Tamola	Makki Maram
150	„	Indigo	Nila	Nilam

Miscellaneous
(Wood, Gums, Resin etc.)

DRUG IN

Telugu	Canarese	Malayalam
...	...	...
Koshia	Koshia	Koshia
Gandapuchakka	Shrigandhamara	Chandanamaram
Nallatumma	Karijali	Karuvælum
Kalabanda	Kathaligida	Kathavala
...	...	...
Inguva	Hingu	Perungayam
...	...	...
...	...	...
...	...	...
Peddagi	Hanemara	...
Karpuram	Karpura	Kalpuram
Kachu	Khadira, Kachu	Khadiram
...	...	...
...	...	...
...	...	...
Mashikai	Maiphala	Mashikai
Reval chinapal	Jarige pulimara	Kurukapuli
Nilamandu	Nili	...

Miscellaneous

(Wood, Gums, Resin, etc.)

Item No.	Name of Drug in			Natural Order
	Bengali	Hindusthani	Mahrathi	
132	...	...	...	Leguminosæ
133	Koshia	Koshia	Koshia	Simarubaceæ
134	Chandana	Chandal	Sofed chandan	Santalaceæ
135	Babla	Babul	Babul	Leguminosæ
136	Ghrita Kumari	Gheekavar	Pivalaboel	Liliacecæ
137	...	...	...	Umbelliferæ
138	Hing	Hing	Hing	„
139	...	...	...	Leguminosæ
140	...	...	...	„
141	Laban	Laban	Kavadiaud	Styraceæ
142	Pitsal	...	Bibla	Leguminosæ
143	Karpur	Kappur	Kapur	Laurineæ
144	Khayer	Kattha	Katth	Leguminosæ
145	...	...	...	„
146	...	...	...	Pyrenomycetes, Gramineæ
147	Gandha biraja	Gaoshir	...	Umbelliferæ
148	Majuphal	Muphal, Maju	Mayaphal	Cupuliferæ
149	Tamal	Tamal	Tamal	Guttiferæ
150	Nil	Neel	Nili	Leguminosæ

Miscellaneous

(Wood, Gums, Resin, etc.)

Habitat	Active Principle	Therapeutic use
Jamaica, etc.	Hæmatoxylin	Astringent
,,	Picrasmin	Bitter tonic
India	Volatile oil and Santalol	Genito urinary disinfectant
India, Arabia, Africa, etc.	Arabic acid	Demulcent
Africa, West Indies, etc.	Aloin	Cathartic
Persia	Resin, gum	Expectorant
Persia and Afghanistan	Resin, gum	Nervine stimulant
Central America	Cinnamein	Expectorant
New Granada	,,	,,
Siam and Sumatra	Benzoic acid	,,
India	Kino-tanic acid	Astringent
Formosa, Japan and China	Cymene	Antispasmodic, stimulant
India	Catechu tannica cid	Astringent
South America	Volatile oil and resin	Expectorant and urinary stimulant
Russia, etc.	Ergotoxine	Emmenagogue and Oxytocic
Asia Minor, etc.	Gum-resin and Volatile oil	Stimulant, Antispasmodic and Expectorant
Persia, etc.	Gallic acid	Astringent
Siam, etc.	Gum-resin	Cathartic
India	Blue pigment	Antiseptic

Miscellaneous

(Wood, Gum, Resin, etc.)

Item No.	Year of the B. P. edition.	NAME OF		
		English	Sanskrit	Tamil
151	1898 & 1914	θ Kino	Pitasala	Vergai-maram
152	„ „	Myrrh	Bolam	Vellaip-palam
153	„ „	‡ Opium	Ohiphena	Abini
154	„ „	§ * Pine	Sarala druma	...
155	„ „	Red Sanders	Rakta chanda-nam	Sibhanda Chanddam
156	„ „	θ Sappan	Pattanga	Parthangi
157	„ „	Storax	Silhaka	Neri-ariship-pal
158	„ „	Tragacanth	...	...

(b) Drugs originally included in the Indian and quently omitted in the B. P. (1914). List of such

Item No.	Year of the B. P. Addendum	NAME OF 1. C. A. DRUG		
		Latin	Sanskrit	Tamil
159	1901	Acacia cortex	Vabboola	Karuvalam
160	„	Acalypha Indica	Muktabarshi	Kuppaimeni
161	„	Adhatoda vasica	Basaka	Aghadoda, Adatodai
162	„	Andrographis paniculata	Maha-tikta ; Kalmegh Alui (Bengali)	...
163	„	Hygrophila spinosa	Kokilaksha ; Kulekhara	Nirmulli
164	„	Aristolochia Indica	Arkamula	Perin-marinchi

Miscellaneous

(Wood, Gum, Resin, etc.)

DRUG IN

Telugu	Canarese	Malayalam
Peddagi	Hanemara	...
Balimtra	Rakhtabol	...
Abhini	Affimu	Apeen, karapu
...	Pitadaru	...
Erachandanam	Rakhta chandana	...
Bakaru chekka Shila rasan	Sappanga Shilaras	Chappanam Shilaras
...	...	...

Colonial Addendum (1901) to the B.P. (1898), but subse-
drugs in nine languages and their brief descriptions.

IN NINE LANGUAGES

Telugu	Canarese	Malayalam
Nallatumma	Karijali	Karuvalum
Kuppai chetti	Kuppi	...
Adasarang	Adsoga	Aduthta
...	...	...
Nirugobbi	Kulugolike	Bikham
Ishvaraveru	...	...

Miscellaneous

(Wood, Gum, Resin, etc.)

Item No.	Name of Drug in			Natural Order
	Bengali	Hindusthani	Mahrathi	
151	Pitsal	...	Bibla	Leguminosæ
152	Gandhabol	Bol	Bola	Burseraceæ
153	Afing	Afin	Aphu	Papaveraceæ
154	Kelugachh	...	Divdar	Coniferæ
155	Rakhta-chandana	Lal channan	Rakhta-chandanam	Leguminosæ
156	Bakam	Patang	Patang	„
157	Shilaras	Shilaras	Rashamala	Hamamelideæ
158	...	Katira	...	Leguminosæ

Arranged generally according to Natural Order.

Item No.	Name of I. C. A. Drug In		Natural Order	Habitat
	Hindusthani	Mahrathi		
159	Babul	Babul	Leguminosæ	India, Arabia, etc.
160	Kupi	Khoidi	Euphorbiaceæ	India
161	Basa, Arusha	Ardusho	Acanthaceæ	„
162	...	...	„	„
163	Talam-kham, Kuliakanta	Ekharo	„	„
164	Ishormul	Sapasand	Aristolochiaceæ	„

Miscellaneous

(Wood, Gum, Resin, etc.)

Habitat	Active principle	Therapeutic use
India	Kino-tannic acid	Astringent
Arabia, Africa	Gum-resin	Expectorant
India, Turkey, etc.	Morphine	Anodyne, Hæmostatic, Narcotic
Central Europe, Mexico, etc.	Resin, volatile oil	Deodorant
India, Ceylon, etc.	Santalin	Colouring agent
India	Sappanin	Astringent (used as a dye)
Asia Minor	Cinnamic acid	Expectorant
„ „ Persia	Traganthin	Demulcent

Starred items are also used as articles of diet.

Part used	Active principle	Therapeutic use
Bark (dried)	Tannin	Astringent ; powdered bark used as a cure for spleen
Fresh or dried herb	Acalyphine	Expectorant and laxative
Fresh or dried leaves	Vasicine	Expectorant, anti-spasmodic and alterative
Entire plant (dried)	Bitter principle	Bitter tonic, useful in infantile liver
Dried herb	Mucilage and Potassium salts	Diuretic
Dried stem and root	Aristolochine and volatile oil	Alterative and diaphoretic

Item No.	Year of the B. P. Addendum	NAME OF I. C. A. DRUG		
		Latin	Sanskrit	Tamil
165	1901	Azadi-rachta Indica	Nimba	Vappam
166	„	Berberis Aristata	Daru haridra	Mara manjil
167	„	Calotropis Procera	Arka, Alarka	Erukka,
168	„	Tylophora Asthmatica	Antri	Nay-palai
169	„	Cambogia (Gamboge)	...	...
170	„	Cissampelos Pareira	Ambastha, Brihatikta	Ponmu-tootai
171	„	Coscinium Fenestratum	...	Mara-manjal
172	„	Tinospora cordifolia	Guruchi, Gulancha	Shindi-kodi
173	„	Toddalia Aculeata	Kanchana, Dahana	Milaka-ranai
174	„	Turpentnum Ipomea	Tribrit	Shivadai

(c) Important non-B. P. drugs and their brief

Note. Therapeutic activity is not always associa-

absence of such an active principle, may be clinically

Item No.	Name of Drug in Bengali	Latin	Sanskrit	Tamil
175	Apamarga	Achyranthes Aspera	Apamarga	Nayurivi
176	* Kantanate	Amarantus Spinosus	Marisha	Mulluk karai
177	Arjun	Terminalia Arjuna	Arjuna, Kakubha	Vellai maru-da maram

IM NINE LANGUAGES

Telugu	Canarese	Malayalam
Vepa chetta	Bedbevu	Kadu Nimb
Manipasupu	Mardarsira	Daruhat
Jilleda	Yakke	...
Verri-pala	Adumuttada	Valli-pala
...	...	...
Pata	P'advali	...
...	Dodamara darsina	...
Tippa tige	Amrad balli	Gathbal
Konda-kashinda	...	Kaka toddali
Tegada	Tigadi kepuligadi	Chivaka-vera

descriptions with names in nine languages. Arranged
ted with the presence of a determinable active princi-
tried before final rejection. Drugs, which are starred,

Telugu	Canarese	Malayalam
Ducchinike	Uttaranc	Katalata
Dugalkura	...	...
Tella maddi chettu	Torabillimitti.	...

Item No.	Name of I. C. A. Drug In		Natural Order	Habitat
	Hindusthani	Mahrathi		
165	Nimb	Limbado, Nimb	Meliaceæ	India
166	Dar-halad, Rasod	Daru-hald	Berberideæ	Himalayas, Ceylon
167	Mandar, Ak	Akra, Rui	Asclepiadeæ	India
168	Antamul	Pitkarai	„	„
169	...	...	Guttiferæ	Siam
170	Harjori	Paharmul	Menispermaceæ	India
171	Jhar-ki-haldi	...	„	India and Ceylon
172	Giloe	Guloe	„	India
173	Kanch, Dahan	Limri	Rutaceæ	India and Ceylon
174	Nisot	Nishottar	Convolvulaceæ	„

alphabetically and according to Natural Order.

ple. This happens to be the case in several notable are also used as food articles.

Item No.	Hindusthani	Mahrathi	Natural Order	Habitat
175	Chirchira, Onga	Abara	Amarantaceæ	India
176	Marsha	Bhaji, Kantamel	„	„
177	Arjun, Kauha	Shardhol	Combretaceæ	„

Part used	Active principle	Therapeutic use
Bark, root, leaves, flowers, fruit and oil of seeds	Resin and margosine	Bitter-astringent, antiseptic and alterative
Dried stem	Berberine	Antiperiodic ; used as an external application over eye lids in conjunctivitis
Root, bark, leaves, flowers, milky juice	Acrid resin	Tonic, emetic and analgesic
Dried leaves	Tylophorine	Expectorant, emetic, and antidysenteric
Gum-resin	Resin and Gum	Diuretic, purgative
Dried root	Berberine	Diuretic and bitter tonic
Dried stem	"	Bitter tonic
"	"	Antiperiodic, tonic, diuretic and alterative
Dried root bark	Bitter principle	Bitter tonic
Dried root and stem	Turpethin	Purgative

drugs. Drugs which may be ignored owing to the

Part used	Active principle	Therapeutic use
Entire herb	Potash	Astringent, diuretic, alterative
Entire herb and root	unknown	Demulcent, astringent and diuretic
Dried bark	Tannin and calcium carbonate	A very useful heart tonic

(C) Important

Item No.	Name of Drug in Bengali	Latin	Sanskrit	Tamil
178	Amlaki	Phyllanthus Emblica	Amlaka, Dhatri	Nellikai
179	Bahera	Terminalia Belerica	Bivitaka	Thani
180	Aswatha	Ficus Religiosa	Aswatha	Arasai maram
181	* Udumbara	Ficus carica Glomerata	Udumbara	Athi param
182	Ashoka	Saraca Indica	Ashoka	Ashogam
183	Aparajita	Clitoria Ternatea	Girikarnika	Kakkanan-kodi
184	Jayanti	Sesbania, Ægyptiaca	Jayanti	Champai
185	Kulattha	Dolichos biflorus	Kulattha	Kollu
186	* Methi	Trigonella Foenumgraecum	Ajamada	Vendayam
187	Nata	Cæsalpinia Bonducella	Puti-Karanja	Kazhar Shikkay
188	Palash	Butea Frondosa	Palasha	Murukkan parshan
189	Parijata	Erythrina Indica	Parijata, Palidha, Mandara	Kaliyana, Murukku
190	Aswagandha	Withania Somnifera	Aswagandha	Amkulang-kalang
191	Brihati	Solanum Indicum	Brihati, Bartaku	Pappara-mulli
192	Kantikari	Solanum xanthocarpum	Kantakari	Kandam-kattiri
193	Ayapana	Eupatarium Ayapana	Bisalwa-karani	Ayapani
194	Bhringaraj	Eclipta Alba	Bhringaraja	Kaikeshi

non—B. P. drugs (Contd.)

Telugu	Canarese	Malayalam
Userkay	Nelli	Nellika
Tandrakaya	Tari-kayi	Thanika
Raichettu	Arali	...
Baruchetta	Atti	Umbara
...	Asoka	...
Dintana	Karnike	Gokarni
Somanti	Karijinauge	...
Wulawalla	Kultekalaya	...
Mentula	Menthya	...
Gack-chakeya	Gajagakayi	...
Mafuka chettu	Muttaga	...
Badchipa-chettu	Paravaladamara	...
Pillianga	Asandu	Askand
Tellamulaka	Gulla	Cheru chunta
Nelamulaka, Vakudu	Nellagullu	Kantam-kattiri
Ayapani	...	...
Guntakalagam	Garaga	Cajenneum

(C) Important

Item No.	Hindusthani	Mahrathi	Natural Order	Habitat
178	Amra, Amala	Ambla, Avalkati	Euphorbiaceæ	India
179	Bahera	Vatiela	Combretaceæ	,,
180	Peepal	Peepala	Urticaceæ	,,
181	Gular	Umbara	,,	,,
182	Ashogi	Ashoka	Leguminoseæ	,,
183	Neeli-kayal	Gokaran	,,	,,
184	Jaki	Shivari	,,	,,
185	Kulthi	Kulthi	,,	,,
186	Methi	Methi	,,	,,
187	Kat-karanj	Gajri	,,	,,
188	Dhak	Palasha	,,	,,
189	Pangra	Pangara	,,	,,
190	Asgandh	Askand	Solanaceæ	,,
191	Barhanta	Mothi-ringani	,,	,,
192	Laghu-khatai, Kateri,	Kanta-ringani	,,	,,
193	Ayapan	Ayapan	Compositæ	,,
194	Bhangra	Maka	,,	,,

non—B. P. drugs (contd.)

Part used	Active Principle	Therapeutic use
Fruit	Gallic acid, etc.	Astringent, diuretic, laxative, & antiseptic
Fruit	Gells-tannic acid, etc.	Astringent, tonic and laxative
Bark	Tannin	Antiperiodic, astringent, antiseptic
Fruit	„	Astringent, laxative, carminative and stomachic, anti-diabetic
Bark	Tannin and catacha	Astringent, useful in uterine affections
Dried root and fresh leaves	A bitter resin. etc.	Antiperiodic, laxative and diurectic
Seeds and leaves	Fixed oil, resin, etc. in seeds	Seeds astringent, given in diarrhœa ; leaves used as a poultice to relieve pain, inflammation, or to promote suppuration
Pod	Starch, oil used and phosphoric acid	Astringent, diuretic ; used in urinary and uterine aflections
Entire norb a seed	Choline and Trigonelline	Carminative and tonic, used as a food & medicine
Seeds	Bitter principle	Antiperiodic, tonic, anthelmintic
Flowers, leaves, seeds and gum	Kino-tannic acid	Astringent, anthelminntic, useful in Leucorrhœa
Leaves and bark	Erytherina	Anthelmintic, alterative and emmenagogue
Root	Somniferin, resin and fat	Tonic, alterative ; useful in consumption, dropsy and senile debility
Root and fruit	An alkaloid and fully acids	Diaphoretic, diuretic and expectorant
Entire herb	An alkaloid and an organic acid	Carminative, expectorant and diuretic, useful in fever, asthma and heart disease
„	Volatile oil	Styptic, useful in hæmoptysis
„	Ecliptine	Tonic and alterative ; useful in enlargement of liver and spleen ; used to dye hairs black

(C) Important

Item No.	Name of Drug in Bengali	Latin	Sanskrit	Tamil
195	Kukur Sungha	Blumea Densiflora	Kukkurudru	...
196	Nagadamani	Artemisia Vulgaris, Maritima	Javaniya, Grathi-parna	Machi-pattiri
197	Somraj	Vernonia Anthelmintica	Somraji	Kattu Shiragam
198	Hingcha	Enhydra Fluctans	Hila mochika	...
199	Bryonia	Bryonia alba or dioica	Baja, Shiva-linga	...
200	* Patole	Trichosanthes dioica	Patola	Kattup-pepudal
201	Telakucha	Cephalandra Indica	Vimba	Kovai
202	* Uchchhe	Memordica charantia	Karavella	Pava-kai
203	Karabi (white flowered)	Nerium odorum	Karabira	Alari
204	Kurchi	Holarrhena Anti-dysenterica	Kutaja	Kulappalai
205	Kadamba (wild cinchona)	Anthocephalus cadamba	Kadamba	Vella-kadamba
206	Khet papra	Oldenlandia corymbosa	Khetra-parpata	Parpadagam
207	* Gaadhabha-dule	Pacederia Fœtida	Parsarani	...
208	Shimul	Bombax Malabaricum	Salmali	Mooha-ras

non—B. P. drugs (Contd.)

Telugu	Canarese	Malayalam
...	...	...
Machipatri	Uruvalu	Timnetripachaha
Adavijilakarn	Kaddu jirage	...
...	Helencha	...
...	Loingatondi	Nohoemaka
Chyadpotta	Kahipadbal	Padavalam
...	Tonde-konde	...
Kakarachettu	...	...
Ganneru	Kanigila	Alari
Amkudu	Kadamuraka	...
Kadambe	Kadavolamara	...
Verinella vemu	Kakasabatrasige	...
Gontemgoru chettu	...	...
Mocha-ras	Mocha-ras	Mul-ilava maram

(C) Important

Item No.	Hindusthani	Mahrathi	Natural Order	Habitat
195	Kuksonda	...	Compcsitae	India
196	Kirmala	Kirmaniova	,,	Kashmir & other Himalayan regions
197	Bakuchi	Babchi	,,	India
198	Hurhul	...	,,	,,
199	Ghargunaru	Kavale-chedola	Cucurbitaceæ	Europe & India
200	Palwal	Ranpanwal	,,	India
201	Kunduri	Ran-tandla	,,	,,
202	Karela	Karala	,,	,,
203	Kaner	Kaner	Apocynaceæ	,,
204	Kura	Pandharakuda	,,	,,
205	Kadamb	Kadamb	Rubiaceæ	,,
206	Pip-papra	Khet-papara	,,	,,
207	Gandhali	Hiranud	,,	,,
208	Semul	Sauri	Malvaceæ	,,

non—B. P. drugs (Contd.)

Part used	Active principle	Therapeutic use
Leaves	Volatile oil	Anthelmintic
Flower heads	Santonin	,,
Seeds	Vernonine & resin	Anthelmintic aad stomachic
Leaves	Unknown	Used as a bitter vegetable, laxative and tonic
Root	Bryonin	Cathartic, expectorant; seeds used in uterine affections
Entire plant	Bitter principle	Antiperiodic, laxative
Leaves and root	An alkaloid & resin	Anti-diabetic
Fruit	Bitter principle	Tonic and stomachic
Root	Nerisdorcin	Antiseptic ; useful as an external application to chancres
Fresh bark and seeds	Kurchicine, Kurchine and conessine	Antiperiodic ; bark very useful in bacillary dysentery
Bark	Cinchotannic acid, a red oxidised product of the nature of cinchona red	Tonic and febrifuge
Entire nerb	An alkaloid and a chloride	Antiperiodic, particularly useful in remittent fever
,,	Volatile oil and alkaloid	Alterative, antispasmodic, useful in dysentery, rheumatism and gout
Root of young tree	Unknown	Astringent, alterative, restorative, very useful as a brain tonic

(C) Important

Item No.	Name of Drug in Bengali	Latin	Sanskrit	Tamil
209	Bhindi	Hibiscus cancellatus	Dindisha	Vendaikkay
210	Berela (white)	Sida cordifolia	Bala	Malaitangi
211	Biranga	Embelia Ribes	Bidanga	Vayu-vilang
212	Mustaka, Mutha	Cyperus Rotundas	Mustaka	Korayatra
213	Bidari	Ipomæa Digitata	Vidari ; Bhumi-kushmanda	Nelli-kumbalu
214	* Papaya	Carica Papaya	...	Pappali-maram
215	* Punarnava (white)	Trianthema Monogyna	Sveta Punarnava	Sharunnay
216	Findubar, Nishinda	Vitex Incisa	Nirgundi	Sirunochi, Biliyanochi
217	* Shephalika	Nyctanthes Arbortristis	Shephalika	Manja-pu
218	Satamuli	Asparagus Racemosus	Satabari	...
219	Gokshura	Tribulus Terrestris	Gokshura	Nerunji
220	Bach	Acorus calamus	Bacha	Bashambu
221	Ulatkambal	Abroma Augusta	Uchchata	...
222	Hatisur	Heliotropium Indicum	Hastishunda	Tet-koduki
223	Barun	Cratæva religiosa	Baruna	Mabilingam
224	Tulasi	Ocymum Sanctum	Tulasi	Tulasi
225	Brahmi	Gratiola Monniera	Brahmi	Bimi
226	Thankuni, Thalkuri	Hydrocotyle Asiatica	Manduka parni	Ballari keri

non—B. P. drugs (Contd.)

Telugu	Canarese	Malayalam
Bendakaya	Bendekai	...
Chitimutti	Birelli	...
Vayu-vilang	Vayu-bilaga	...
Tungamusta	Musta	...
Matti-paltiga	Nelagumbala	Palmodekka
Bapaiapandu	Parangi	Papayam
Galjeroo	Biliadu	...
Nirubabitti, Tellabvili	...	...
Poghada	Harsing	...
Eduumatti-tengachalla	Hargaji	...
Pallerumullu	Negalugida	...
Bash	...	...
...	...	...
Telumani	...	Teliyanni
Urumalli	Nirvala	...
Tulasi	...	...
Shamba michettu	...	...
Manduka brahmi	Ondelaga	...

(C) Important

Item No.	Hindusthani	Mahrathi	Natural Order	Habitat
209	Bhindi	Bhenda	Malvaceæ	India
210	Bariara	Chikana	,,	,,
211	Vayuvirang	Vavadinga	Myrsineæ	,,
212	Motha	Motha	Cyparaceæ	,,
213	Bilaikand	Bhui-kohola	Convolvulaceæ	,,
214	Papiya	Papai	Passifloreæ	,,
215	Bish-khopra	Vishkhapra	Ficoideæ	,,
216	...	...	Verbenaceæ	,,
217	Siharu	Partaka	Oleaceæ	,,
218	Satabar	Satabari	Liliaceæ	,,
219	Gokhra	Gokhru	Zygophylleæ	,,
220	Khorasani Bach	Bekhanda	Aroideæ	,,
221	...	...	Sterculiaceæ	,,
222	Hatishura	Bhurundi	Borragineæ	,,
223	Baruna	Vayavamna	Capparideæ	,,
224	Tulsi	Tulasi	Labiatæ	,,
225	Brahmi	Brahmi	Umbelliferæ	,,
226	Chareti	...	,,	,,

non—B. P. drugs (contd.)

Part used	Active Principle	Therapeutic use
Fruit	Pectin and mucilage	Demulcent and diuretic
Root	Asparagin	Bitter tonic, febrifuge, demulcent and diuretic
Berries	Embelic acid	Anthelmintic, alterative, tonic and laxative
Root tuber	...	Diaphoretic, diuretic, stimulant
Root tuber	Sugar, starch and resin	Tonic, alterative, demulcent and lactagogue
Fruit and milky juice	Papain	Anthelmintic, laxative and digestive ; useful in piles and dyspepsia
Entire herb, particularly root	A glucoside	Diuretic, very useful in dropsy
Leaves	Volatile oil	Alterative, anodyne
"	Alkaloid and an astringent principle	Antiseptic, Antiperiodic
Root	Saccharine matter	Tonic and diuretic ; used in seminal debility
Fruit and root	An alkaloid and resin	Diuretic, increases flow of urine ; useful in urinary disorders
Dried stem	Volatile oil	Stimulant, diuretic
Fresh root	Unknown	Emmenagogue and uterine tonic, regulating menstrual flow
Entire herb	...	Used as a local application to boils, sores and the stings of insects
Bark	Saponin	Stomachic, diuretic
Leaves, root and seeds, preferably leaves (black variety)	Yellowish green oil	Anti malarial and anticatarrhal ; antiperiodic, expectorant, stimulant, and carminative
Entire herb	An alkaloid, etc.	Diuretic, aperient and tonic ; useful in nervous debility
"	Vellarin	Alterative, tonic and diuretic

SUMMARY

According to the foregoing lists (a), (b) and (c) the vegetable drugs, which are *official* in one or more of the B. P. editions since 1898, number over 150, and about 75 are *non-official, i.e.* outside the British Pharmacopœia. A good deal of scientific work is on record in regard to both 158 B. P. and 75 non-B.P. drugs. List (c) mentions only a few out of a very large number of available drugs, and as most of them are either indigenous to, or could be cultivated in, India, there are enough materials in the country to provide the basis of an authoritative Indian Pharmacopœia and to constitute resources to yield sufficient *scientific* medicine to meet general requirements. It is true that scientific researches during the past 50 years have produced several *imported* medicines which are irreplaceable when foreign supplies are cut off and that the medical profession and patients are put to considerable inconvenience to find substitutes. These facts are reasons enough for hard researches to be undertaken by Indian scientists (chemists, botanists and pharmacologists), and for the Indian drugs to be brought into more general use than they are at present. Further, if pages 142-144 dealing with India's contribution to world drug trade are looked into, it will be seen *at once* how immensely the western pharmacopœias are dependent on India for the supply of their *materia medica* and how important and pressing is the need for developing indigenous Indian drugs on approved lines.

APPENDIX II

Useful Prescriptions

Simple medicines, as recommended by a few physicians of repute, Indian and European, and as are readily obtainable at a trifling cost, are special features of these prescriptions. Consequently, mofussil and other people, who, in view of their poverty and ignorance, must either be given cheap and easily available medical aid on **scientific** lines, or left uncared for, will doubtless find these prescriptions particularly useful. It will be remembered that in this country thousands are reported to die without any medical treatment worth the name provided for them. Further, **malaria, typhoid, cholera, diarrhœa, dysentery** and **tuberculosis** claim the largest toll of mortality in India, **malaria** alone being responsible for over a million deaths annually. There are other prevailing diseases arising from bronchial affections, skin troubles, etc. The Appendices here convey a lot of information at a glance in regard to all these diseases. These Appendices, as also the suggestions made throughout the book, would be more appreciated if, as suggested by the writer in his "Automatic Rural Reconstruction," there were Welfare Associations in local areas, urban and rural, to popularise ideas on better and healthful living. The information furnished will, however, be found helpful in all circumstances if the people referred to keep themselves familiar with it. This simple

procedure will save such people from falling into the clutches of quacks and of alluring advertisements. If timely action is taken according to the directions given herein, not only will there be a reasonable chance of **immediate** relief forthcoming, but many complications, as also a good deal of avoidable sufferings and loss of life, may be obviated so far as emergencies arise from **neglect** under the following heads :—

(1) FEVER

Treatment : Fresh air, rest, regulated diet, fasting, use of simple diaphoretics, of cold both, ice bag, sponging, purgatives, bitter principles, and of medicines to eliminate, neutralise, or otherwise destroy the poison which causes the fever, are usual lines of treatment. One or more of these methods may be adopted with discretion in cases of emergency pending arrival of regular medical aid, or under circumstances where no medical advice is obtainable owing to poverty and other causes.

Fresh air is one of Nature's best weapons to combat infection, while the patient should be free from worries and must have absolute physical and mental **rest**.

Diet must be nutritive to increase a patient's resisting power and be easily digestible, liquid diet being preferred particularly in Typhoid. But ordinarily fasting (for a few days) in the first stage is a better course of treatment to begin with (q.v. p. 129).

Diaphoretics are medicines which stimulate sweat glands, thereby resulting in remission of fever.

The following are simple and harmless diaphoretics, (A) and (B) of which may be safely taken every 3 hours in case of need. This is possible only if there is a drug store with a compounder on the spot, or if the people concerned are educated enough to keep a supply of neccessary medicines and to undertake dispensing. (C) is a simple remedy and may be used without any outside help. The quantities shown under diaphoretics and under other prescriptions here are for one adult dose. For children the dose is either half, one-fourth, one-eighth or one-sixteenth according to age, namely, $\frac{1}{16}$ th. for one year, $\frac{1}{8}$ th. for two years, $\frac{1}{4}$ th. for 4 years, and $\frac{1}{2}$ for 12 years. Each dose is to be taken every 3 hours in empty stomach unless otherwise directed.

Diaphoretics

(A)		(B)	
℞		℞	
Potash Acetate	gr. xv	Sodii Bicarb	gr. xv
Sodii Bicarb	gr. xv	Liq. Ammon Acetate	ʒ ii
Liq. Ammon Acetate	ʒ ii	Spirit Ammon Aromat	♏ xv
Aqua ad	ʒ i	Aqua ad	ʒ i

℞ (C)

Allyl Co. (S. C. T.).....m xxx (30 drops or half a drachm in an ounce of water). This preparation of the School of Chemical Technology, Calcutta, may be kept in every home and readily used every 3 hours until remission of fever. Medicines marked (S. C. T.) are obtainable from this School at 4, Satyen Dutt Road, Kalighat P. O., Calcutta.

Cold Bath

Cold Bath is rendered necessary when a patient is in a dangerous condition owing to durance of high fever (temperature 103° F and above). The remedy is to be administered carefully in a closed room, the doors and windows being opened only after the patient has been covered up *warm* immediately after bath or sponging. Ice bag, or simply ice in a towel, or a piece of cloth soaked in plain water with or without Lavender water, Eaude-Cologne, etc., may be applied to the patient's head to give him relief and to reduce temperature. In fact, cold water cure is regarded in some quarters as the quickest and most permanent means of relief for a number of ailments. Broken bones, aches, neurasthenia, constipation, dyspepsia, skin complaints, and even sexual diseases are known to be cured by cold water treatment.

Purgatives

There are various medicines which increase or quicken evacuations from the bowels. Some people require *mild*, while others require *strong*, purgatives. Only those, which are easily available and simple enough, are mentioned below :—

(1) Castor Oil ..... one ounce. (This may be made inodorous by addition of lemon or ginger juice, or a mixture of gum acacia mucilage with some flavoring agent, e.g., Tr. Zingiberis, Tr. Card.

Co., or a drop of Cinnamon Oil).

(2) Paraffin Liquid. Two teaspoonfuls.

(3) Pulvis Glycyrrhizæ Co. (B. P.)60 to 120 grains.

(4) Confectio Rosæ (B. P.) [commonly known as **Gulcand** and ordinarily obtainable from a spice shop]. One tola (180 grains), more or less, as necessary.

(5) Confectio Sennæ (B. P.) 60 to 120 grains.

(6) Bael fruit (roasted if unripe, or ripe). One tablespoonful of pulp only.

(7) Ispaghul seeds (available at a spice or a grocer's shop). 60 to 120 grains.

(8) Infusion of powder of embelic, chebulic and beleric myrobalans; these three fruits are known together as **triphala.** One dose consisting of 3 to 8 fruits (pulp only).

(9) Anti-dyspepsia pills (S. C. T.). Two pills at bed time.

(10) Prunes, figs, or raisins boiled with milk. One ounce of fruit with 8 ounces of milk. To be taken at bed time.

Besides **diaphoretics** and **purgatives** there are certain other remedies which are usually **briefly** expressed by technical terms. They are not readily understandable unless they are explained. As for the sake of brevity, such terms often occur in this book, particularly in Appendices I and II, the readers will find it convenient to refer, as necessary, to the following explanation :—

Alkalies or **Antacids** are those which neutralise, or counteract the action of acids, and which have the

power of checking alkaline secretions or increasing acid secretions.

Alterative—a class of medicines which produce a change, curing disease, the reason whereof being not yet understood, nor demonstrable.

Anæsthetic—a drug producing insensibility to external impressions, such as caused by chloroform, cocaine, etc.

Analgesic or **Anodyne**—a medicine that relieves pain.

Anthelmintic, Vermifuge, or **Vermicide**—an agent that destroys or expels worms.

Antiparasitic—a destroyer of minute parasitic organisms.

Antiperiodic—a remedy, such as quinine, which destroys the periodicity of diseases like **ague** which recur at periodic intervals.

Antiphlogistic—a medicine to allay inflammation.

Antipyretic or **Febrifuge**—anything which reduces the temperature in fevers, either by destroying the poison which causes the fever, or by lessening the cause of heat production.

Antiseptic, Germicide, Bactericide, Disinfectant or **Deodorant**—(1) refers to medicines which inhibit the growth of putrifying, or disease producing, germs; (2), (3) & (4) are actual destroyers of such germs, and (5) are those which remove fetid smells and evaporations. When the germs mentioned are present in intestines, the **antiseptics** acting thereon are known as **intestinal antiseptics.**

Antispasmodic—a remedy for spasms or convulsions. When by stimulating the bowels, this remedy causes the expulsion of gas and relieves colic, it is known as a **carminative or an aromatic.**

Aperient, Cathartic, Evacuant, Cholagogue, Hydragogue, or **Laxative** are different forms of purgative, either mild or strong.

Astringent—a medicine that causes contraction of fibre or condensation of tissues, mostly by precipitation of albumin and gelatin.

Amœba—a jelly like living unit mass flowing out in all directions and thus having an endless varying form. **Dysentery** is either amœbic or bacillary according as it is caused by presence of amœba or bacilli.

Cardiac—a disease of the heart, or belonging to the heart.

Cholagogue—a stimulant of the liver.

Counter-Irritant, Rubifacient, or **Vesicant**—a remedy which causes redness of the skin, produces inflammation and ends in a blister.

Demulcent or **Emollient**—a protective and a soothing agent by virtue of its oily nature.

Diuretic—a medicine which promotes the discharge of urine.

Emetic—anything that causes the evacuation of the stomach contents.

Emmenagogue—a medicine intended to restore, or to bring on for the first time, the menses.

Escharotic or **Caustic**—a substance which kills the life of the tissue to which it is applied, generally by withdrawing its moisture.

Expectorant—a medicine which assists the expulsion from the throat, breast, or lungs the phlegm and the bronchial mucus.

Hæmostatic—a drug which checks hæmorrhage.

Hypnotic, Soporific—a medicine inducing sleep without causing any cerebral excitement (see **Narcotic.**)

Mydriatic / **Myotic**—a remedy causing **dilatation** / contraction of the pupil.

Narcotic—a substance producing sleep by its action upon the cerebrum.

Oxytocic—an agent inducing labour pain, stimulating uterine muscle and producing uterine contraction.

Restorative—a food or a medicine that restores to the blood the substance which it is supposed to be deficient in.

Sedative or **Depressant**—a medicine which depresses the spinal cord, the circulatory system, or the action of the nerve centre.

Sialagogue—a drug which increases the secretion of saliva.

Stimulant—a medicine that excites the spinal cord, the liver functions, the intestines, the circulatory system, the stomach, or the skin.

Stomachic—an agent promoting digestion and increasing the appetite.

Styptic—anything which arrests bleeding.

Tonic—a medicine which improves the tone of the part on which it acts.

Cinchona, Quinine, Atebrin, Plasmoquine are regarded as the best medicines for Malaria. As, however, they are expensive, other medicines may be used as substitutes. Common herbs containing bitter principles and belonging botanically along with **Cinchona** to the same Natural Order, namely, "Rubiaceæ," are abundant in India. Some bitter herbs, such as leaves of **Patola, Sephalika, Hingcha** and **Neem,** are used as vegetable food articles. Bitters, which are generally antiperiodic, are :—

	Name of Drug (vide Appd. I)	Latin name Appendix I, pages——)	Part used	Natural order	Preparation and Dose
1	Chiratta	Swertia Chirata	Entire plant	Gentianeæ	Take of the first five drugs equal parts, in all two *tolas*, (360 grains), and prepare a decoction with a pound of water reduced to one-fourth over a gentle fire in an earthen pot and taken in four equally divided doses during 24 hours. The simplest form is a decoction of **Patola** leaf
2	Khetpapra	Oldenlandia Corymbosa	,,	Rubiaceæ	
3	Katki	Picrorhiza Kurroa	Root	Scrophulariaceæ	
4	Mutha	Cyperus Rotundus	Root tuber	Cyperaceæ	
5	Neem	Azadirachta Indica	Bark	Meliaceæ	
6	Nishinda	Vitex Negundo	,,	Verbenaceæ	

	Name of Drug (vide Appd. I)	Latin name Appendix I, pages etc.)	Part used	Natural Order	Preparation and Dose
7	Bael	Ægle Marmelos	Bark	Rutaceæ	(180 grains) with an equal weight of coriander seeds prepared as above and taken in two equal doses. An elaborate and more effective preparation is a decoction of all the 16 drugs in equal parts (total weight 360 grains), the dose being as above, namely, one dose in the morning and the other in the evening. This preparation is similar to Warburg's Tincture in which nearly 20 drugs are used. As regards the efficiency of fresh decertions, please see pages 15, 16, 80, 128.
8	Kadamba	Anthocephalus Cadamba	,,	Rubiaceæ	
9	Kantikari	Solanum Xanthocarpum	Entire plant	Solanaceæ	
10	Am	Mangifera Indica	Bark	Anacardiaceæ	
11	Jam	Eugenia Jambolana	,,	Myrtaceæ	
12	Chhatim	Alstonia Scholaris	,,	Apocynaceæ	
13	Anantamul	Hemidesmus Indicus	Root	Asclepiadeæ	
14	Bakash	Adhatoda Vasica	Bark	Acanthaceæ	
15	Patola	Trichosanthes Dioica	Entire plant	Cucurbitaceæ	
16	Nata	Cæsalpinia Bonducella	Stem (growing end)	Leguminosæ	

℞

Malaria (contd.)

Ammon Carb	gr v
Tinct. Cinchona Co	ʒss
Aqua Choloroform ad	ʒi

(Three times a day)

℞

Tinct. Cinchona	ʒiii
Spt. Chloroform	ʒi
Acid Nitro-Hydrochlor (dil.)	ʒi
Syrup Aurantii ad	ʒi

(One teaspoonful in a little water before food)

Tonic

(during convalescence after remission of malarial fever)

℞

(a)

Quinine Hydrochlor	gr ii
Tinct. Ferri Perchlor	mx
Tinct. Nux vom	mv
Glycerin	ʒi
Aqua ad	ʒi

(Two hours after food twice daily)

℞

(b)

Quinine Hydrochlor	gr ii
Acid Hydrochlor (dil)	m v
Ammon Chloride	gr v
Liqr. Arsenicalis Hydrochlor	m ii
Tinct Nux Vom	m v
,, Aurantii	ʒ ss.
Aqua Cinnamon ad	ʒ i

(Two hours after food twice daily)

(3) Influenza

℞

Sodii Bicarb	gr v
,, Benzoas	gr v
Liqr. Ammon Acetate	ʒ ii
Spt. Ammon Aromat	m xv
Glyco Thymolin	ʒ ss
Syrup Tolu	ʒ ss
Vinum Ipecac	m v
Aqua Chloroform ad	ʒ i

(4) Cough Mixture

℞

Potash Iodide	gr ii
Ammon Chloride	gr v
Spt. Ammon Aromat	m xx
,, Chloroform	m xv
Tinct. Nux vom	m v
Syrup Tolu	ʒ ss.
Glyco Thymolin	ʒ ss.
Aqua ad	ʒ i

(4a) Whooping Cough

Potash Iodide	gr i
Sodii Benzoas	gr iii
Spt. Ammon Aromat	m x
Pertussin	ʒ i
Aqua ad	℥ i

(5a) Typhoid

Acid Hydrochlor (dil)	m v
Oil Cinnamomi	m ii
Mucilage Acacia	q s.
Syrup Aurantii	ʒ ss.
Aqua ad	℥ i

(5b)

Liqr. Hydrarg Perchlor.	ʒ ss.
Acid Hydrochlor (dil)	m x
Aqua Chloroform ad	℥ i

(6) Indigestion

℞

Spt. Ammon Aromat	m xx
,, Chloroform	m xv
Sodii Bicarb	gr x
Tinct. Card Co.	ʒ ss
Aqua Menth Pip ad	℥ i

(7) Diarrhœa & Cholera

℞

Anti-Cholera Drops (S.C.T.) m iv with half an ounce of water every 15 to 30 minutes till relief. For children one or two drops in a little water (teaspoon)

(8) Dysentery

℞

Castor Oil	℥ i
to be followed by	
Salol	gr iv
Sodii Bicarb	gr v
Pulv Ipecac Co	gr v

(9a) Dyspepsia

Anti-dyspepsia pills (S.C.T.). Two pills at bed time

(9b)

℞

Acid Nitro-Hydrochlor (dil)	m x
Tinct. Nux vomica	m iv
Infusion Chiretta ad	℥ i

(Twice after food)

(10) Gastric Ulcer

℞

Sodii Bicarb	gr x
Mag Carb	gr v
Bismuth Carb	gr v
Mucilage Acacia	q. s.
Tinct. Card Co.	♏ xx
Syrup Zingiberis	ʒ ss
Aqua Menth Pip. ad	℥ i

(2 hours after food)

(10a) Gastric Pain

℞

Sodii Bicarb	gr xv
Spt. Ammon Aromat	♏ xx
Tinct. Card Co	♏ xx
Liqr. Morphia	ʒ ss.
Aqua Menth Pip ad	℥ i

(One dose every 2 hours until relief. Generally two doses suffice)

(11a) Rheumatism

℞

Allyl Co. (S.C.T.)	♏ xv

(Thrice daily with half an ounce of water)

℞

(b) Potash Iodide	gr v
,, Bicarb	gr v
Sodii Salicylas	gr v
Spt. Ammon Aromat	♏ xx
Aqua Chloroform ad	℥ i

(Thrice daily)

(11c)

℞

Sodii Bicarb	gr x
,, Salicylas	gr x
Spt. Ammon Aromat	♏ xx
Aqua Chloroform	℥ i

(Thrice daily)

(12) Gout

℞

Vinum Colchici	♏ x
Mag Sulph	ʒ i
Potash Acetate	gr xx
Aqua Chloroform ad	℥ i

(Thrice daily)

(13) Kidney Trouble

℞

Potash Acetate	gr xv
Potash Bicarb	gr xv
Tinct. Hyoscyamus	♏ xl
Infusion Buchu ad	℥ i

(Thrice daily)

14 Kidney Trouble with Renal Colic and passage of gravel.

The following indigenous drugs are very useful for this trouble and are strongly recommended, simple diet without spices, curd, lentils and greens being followed during the course of taeatment :—

Name of Drug (vide Appd. I	Latin name.	Part used	Natural Order.	Preparation & Dose.
Gokshura	Tribulus Terrestris	Fruit	Zygophyl-leae	A compound decoction (one dose) is prepared with equal parts of these four drugs (total weight two tolas or 360 grains), boiled over a gentle fire in an earthen pot with a pound of water till the water is reduced to one-fourth (4 ounces) and taken with a little honey while tepid warm. Two doses, one in the morning in empty stomach and the other in the evening. The preparation relieves the trouble and increases the flow of urine with free passage of gravel.
Barun	Crataeva Religiosa	Bark	Caparideae	
Shunti	Zingiber	Rhizome (dried)	Scitaminæ	
Eranda	Ricinus communis	Leaves	Euphorbia-ceæ	

(15) Kidney disease cum Anæmia

℞

Liqr. Ferri Acetatis	♏ x
,, Ammon Acetate	ʒ ii
Potash Acetate	gr xx
Aqua Chloroform ad	℥ i

(16) Anæmia

℞

Ferri Sulph	gr ii
Sodii Bicarb	gr i
Pulv. Myrrh	gr ss
Syrup	q. s.

(17) Anæmia after Malaria

See page 205 under Tonic

(18) Tuberculosis

(Early stage)

To stop blood spitting use either (b) or (c) as simple remedies, or send for a qualified doctor as necessary.

℞

(a)

Calcium Chloride	gr xv
Allyl Co (S. C. T.)	♏ x
Aqua Chloroform ad	℥ i

(Thrice daily)

(b)

℞

Durba (couch grass, freshly expressed juice)	ʒ iii
Sugar-candy	ʒ iii

(3 times a day.)

(c)

℞

Calcium Chloride	gr xv
Tr. Camphor Co.	♏ xx
Extract Hamamelis Liqd.	♏ x
Aqua Chloroform ad	℥ i

(d)

℞

Pulv. Veg. Levis (S.C.T.)	gr v

(19) Pleurisy

℞

Calcium Lactate	gr x
Pot. Iodide	gr iii
Tr. Bryonia	♏ ii
Syrup Tolu	ʒss.

For external application

Lint. Terebinth	ʒ vi
,, Ammonia	ʒ vi
Ol. Eucalyptus ad	℥ ii
Aqua Chloroform ad	℥ i

(20) Asthma

℞

Allyl Co. (S.C.T) m xv
with half an ounce of water (thrice daily)

℞

Potash Bromide gr x
„ Iodide gr v
Tinct. Comphor Co. m xx
„ Lobelia Ætheria m xv
Aqua Chloroform ad ʒ i.

℞

Pulv. Veg. Levis (S.C.T) gr v

(21) Heart disease & Dropsy

℞

Pulv. Digitalis gr i
„ Scillæ gr i
Pilula Hydrargyri gr i
Extract Hyoscyami q.s.

℞

Terminalia Arjuna bark
(*vide* Appd. I,) gr 360
(Two tolas)
Milk ʒ iv
Aqua ʒ xii

Boil gently to four ounces in an earthen pot, strain; one such dose to be taken thrice daily.

(22) Deranged Liver

℞

Hydrargyrum c Creta gr i
Pulv. Ipecac Co. gr i
Extract Gentian Co. qs.

℞

Deranged Liver (Children)
Hydrargyrum c Creta gr ½
Pulv. Rhei gr ii
Sodii Bicarb gr ii

℞

(23) Sore Throat

℞

For external use
Acid Tannic ʒ iss.
Glycerin ʒ i

℞

For external use
Tinct. Ferri Perchlor ʒ ss.
Glycerin ʒ ss.

℞

To gargle with an equal part of warter
Sodii Bicarb ʒ ii
Potash Chlorate ʒ ii
Sodii Chloride ʒ ii
Borax ʒ ii
Tr. Lavendulæ Co. ʒ ii
Aqua ad ʒ viii

(24) Tonsilitis

℞

For external use.

Tinct. Ferri Perchlor	ʒ ss
Glycerin	ʒ ss

℞

For external use.

Iodum	gr x
Potash Iodide	ʒ ss
Glycerin	ʒ i

℞

To gargle

Sodium Chloride (Common salt)	ʒ i
Aqua (hot)	qs.

Gargle (useful both for Sore Throat and Tonsilitis)

(25) Antiseptic Gargle

(a)

℞

Hydrarg Perchlor	gr i
Acid Hydrochlor dil	♏ xxiv
Glycerin	ʒ ii
Aqua ad	℥ viii

(b)

℞

Potash Chlorate	ʒ iv
Glycerin	℥i
Aqua ad	℥ xii

(c)

℞

Liqr. Pot Permanganas	ʒ ii
Aqua ad	℥ xii

(26) Sedative

℞

Potash Bromide	gr xv
Aqua ad	℥ i

(Thrice daily)

(27) Stimulant

℞

Spirit Ammon Aromat	♏ xx
,, Chloroform	♏ xx
,, Ætheris	♏ xx
Rum	ʒ ss
Aqua Menth Pip ad	℥ i

(Thrice daily)

(28) Inhalations (Antiseptic)

℞

Formalin 40%	ʒ ss.
Chloroform	ʒ ss.
Menthol	gr x
Ol. Pini	℥ ss.
,, Eucalyptus	ʒ ii
Tinct. Iodi	ʒ ss
Spirit Rectificatus	℥ i

(Use cotton wool soaked with above solution)

℞

Tinct. Benzoin co. ʒ i

(Use hot water kettle. The vopour is to be inhaled).

(29) Boils, acne, pimples, cuts and wounds.

℞

Hazela (S.C.T.) ʒ i

For external use.

℞

Antiseptic Solution (S.C.T.) ʒ i

For external use.

(30) Leucoderma

℞

Ol. Psoralia corylifolia (S.C.T.) ʒ i

For external use.

(31) Leprosy

℞

Ol. Hydnocarpus co. (A) & (B), (S.C.T.) ♏ v (each)

(Thrice daily with sugar or honey)

(32) Nausea & Vamitting

℞

Bismuth Carb gr v

Sodii Bicarb gr v

Mag Carb gr x

Acid Hydrocyanic dil ♏ i

Aqua Menth Pip. ad ʒ i

(33) Acidity

℞

Bismuth Carb gr x

Sodii Bicarb gr x

Mucilage Tragacanth qs.

Mistura Creta ad ʒ i

Two hours after food

(34) Piles

℞

Myrobalans (Pulp only) gr xxx

Treacle (old) qs.

(35) Worm

℞

Hydrargyri Subchloride gr i

Santonin gr iv

To be taken early morning in empty stomach

(36) Tape Worm

℞

Extract Filicis Liqd. ʒ iss

Mucilage Acacia qs.

Aqua Chloroform ad ʒ i

Note : Extract Filicis Liqd. may be taken better with fresh egg rubbed up than with mucilage and Aqua Chloroform as above.

(37) Earache

For external use as ear drops.

℞

Menthol	gr x
Acid Carbolic	m x
Tinct. Opii	ʒ ii
Glycerin ad	ʒ iv

(38) Sore Eye

Conjunctivitis (acute)

For external use as eye drops.

℞

Argentii Nitras	gr ii
Aqua Destillata	ʒ i

As above

℞

Atropinæ Sulph	gr iii
Aqua Destillata	ʒ i

℞

Argyrol	gr xx
Aqua Destillata	ʒ i

To prevent the sticking of the eyes

℞

Boric Ointment (30 grains to ounce) or Yellow Ointment at bed time.

Conjunctivitis (mild)

For external use as eye drops.

℞

Acidum Boricum	gr viii
Zinci Sulphas	gr ii
Aqua Destillata	ʒ i

As above

℞

Cocaine Hydrochlor	gr v
Aqua Destillata	ʒ i

As above

(39) Toothache

℞

(a)

Ol. Caryophylum	ʒ ss
Menthol	gr v
Spirit Ætheris	ʒ i ss
Spirit Chloroform ad	ʒ iv

To be applied, with soaked cotton wool, to the affected part.

℞

(b)

Acid Carbolic	ʒ i
Tinct. Iodine in Rectified Spirit	ʒ i
Chloroform	m x
Aqua ad	ʒ xx

Gargle.

℞
(c)

Sodium Chloride (common salt)	ʒ i
Aqua (hot)	q.s.

Gargle

(40) Scabies (Itch)

For external application

℞

Zinc Oxide	ʒ i
Sulphur Sublimata	ʒ i
Beta Naphthol	gr xx
Vaseline ad	℥ i

(41) Psoriasis

For external application

Acid Salicylic	gr xv
Hydrarg Ammon	gr x
Liquor Carbonis Detergens	ʒ i
Laloline	ʒ iii
Paraffin Molle alba ad	℥ i

To be applied.

(42) Eczema

For external application

Zinc Sulph	℥ iii
Sulphurated Potash	℥ iii
Aqua Destillata	℥ iii

Dissolve the zinc sulphate in 1½ oz. of distilled water and filter after trituration. Dissolve Sulphurated potash in balance of distilled water and filter after trituration. Mix the two solutions by slowly pouring the solution of zinc sulphate into the solution of sulphurated potash and then add the mixed solution to the following solution previously made by disolving

Phenol	ʒ i
Resorcin	ʒ i
Acid Salicylic	ʒ i

in

Spirit Rectificatus to make up ℥ vi solution.

(43) Baldness

[VAC-CURIN (S.C.T.)]

A little to be rubbed well into the hair roots of the affected part every alternate night.

Note :—Regular medical advice should always be obtained as far as possible.

Appendix III

Pharmaceutical Machinery & Equipment for a Drug Factory

Machine, etc.	Makers	No.	Work performed	Nature of power
Steam Pan, copper, and Still combined, with Vacuum pump, 25 gallons	Bennet, Sons & Shears, Ld., 43, Shoe lane, London, E. C. 4.	1	Evaporation, etc., under reduced pressure, & recovery of alcohol	Steam heated (6 H.P. engine, vertical boiler). Pump by electric power.
Steam pan, copper, 25 gallons	Llumley & Co., manufacturers, London.	1	Evaporation of liquid extracts, plasters, etc.	Steam heated (6 H.P. engine, vertical boiler)
Tincture Press, large	Follows & Bates, Ld. Manchester	1	Tincture manufacture	Hand
Percolators, copper, 25 gallons, with cover	Walter Locke & Co., Ld., Calcutta.	2	"	"
" " with cover & filter bags, 40 gallons	Do.	6	"	"

Machine, etc.	Makers	No.	Work performhd	Nature of power
Percolators, aluminium, 15 gallons.	Madras Aluminium Co.	2	Tincture manufacture	Hand
Percolators, glass,		2	"	"
Jars, earthenware, Pegu, 60-400 lbs		30	"	"
" " English				
" aluminium, 100-200 lbs		12	"	"
Water still, copper, and condenser	Bennet, Sons & Shears, Ld., 43, Shoe Lane, London, E. C. 4.	1	Distilled water	Steam heated (6 H.P. engine, vertical boiler)
Still, 20 gallons, earthenware, and condenser	Stiff, Lambeth, London.	1	Spirit Ætheris Nitrosi	Do.

Machine, etc.	Makers	No.	Work performed	Nature of power
Still, copper, 30 gallons	Locally made with imported component parts	1	Distilling Spt. Ammon Aromat	Steam heated (6 H.P. engine, vertical boiler
Drying Table	Locally made	1	Preparation of Paraffin paper, drying quinine, roots, etc.	"
Boiling vat, 30 gallons, with steam coil	"	1	Evaporation of solutions for crystallisation	"
Steam bath, enamelled iron pan	Llumley & Co. London	1	Evaporating Liq. Ferri Perchlor	"
Bottle washing machine	"	1	Washing and cleaning bottles	"

Machine, etc.	Makers	No.	Work performed	Nature of power
Delphin Filter	Delphin Filter Co., Vienna	I	Filtration of Syrup, Tincture, etc.	Hand
Pans, evaporating, copper, steam jacketted, 20-50 gallons	Llumley & Co., manufacturers, London	5	Making extracts, melting wax, etc., & boiling generally	Steam heated (6 H.P. engine, vertical boiler)
Stirring gear for one pan	Locally made	1	"	"
Pans, evaporating, iron, steam jacketted	"	2	"	"
Evaporating tables, copper, steam jacketted	"	2	For evaporating tinctures, infusions, etc., into extracts	"
Ointment mill, steam jacketted, with cast iron edge runners	"	1	Ointment manufacture	"

Machine, etc.	Makers	No.	Work performed	Nature of power
Ointment mill (Ball mill)	J.W. Pinder, London	1	Mixing ointments & Hydrarg ō creta	Electric (2 B. H. P.)
Enamelled iron pan, steam jacketted, with stirring gear	Llumley & Co., manufacturers, London	1	Ointment manufacture (defecating fat, wax, etc)	Steam heated (6 H.P, engine, vertical boiler)
Steam bath pan, iron	Locally made	1	Melting ointments	Steam heated (6 H.P. engine, vertical boiler)
Copper stills & worms	"	8	Distillation of water, volatile oils, etc.	"
Kneading & mixing machine	Werner & Pfleidere (through Bennet, Sons & Shears Ld.,) 43, Shoe Lane, London, E.C. 4.	1	Mixing pill mass	Electric

Machine, etc.	Makers	No.	Work performed	Nature of power
Pill rounding machine	G. W. Niblett, London	1	Pill manufacture	Electric
Pill coaters	Bennet, Sons & Shears Ld., 43, Shoe Lane, London, E.C. 4.	2	"	"
Piping press	J. W. Pindar, London	1	"	"
Rotary cutter (5 prs. cutter)	"	1	"	"
Drying closet (low temperature)	Locally made	1	Drying pills, antiseptic gauze, etc.	Steam heated
Pill, Lozenge, Collapsible Tube, etc., machine	Arthur Colton Coy., Detroit, U. S. A.	1 each	For making pills, etc.	Electric

Machine, etc.	Makers	No.	Work performed	Nature of power
Tablet machine, Stoke's	F.J. Stokes machine Coy., Philadelphia, U. S. A.	1	Tablet manufacture (100 per minute)	Hand
Tablet machine, express rotary, Buckley's patent	Allen & Hanburys Ld., London	1	" (900—1000 per minute	Electric (4 B. H. P.)
Granulating machine for above	"	1	For granulating materials for tablets	"
Disintegrator	Christy & Norris, Chelmsford, London	1	Powdering drugs except resinous ones	Electric motor (8 B. H. P.)
Rapid mixer for powders, Gardner's "Rapid" Sifter & mixer	Wms. Gardner & Sons, Engineers, Bristol Road, Gloucester	1	Mixing Powder (1cwt. per hour)	Electric

Machine, etc.	Makers	No.	Work performed	Nature of power
Rapid mixer, for 150 lbs of powder	Follows & Bates Ltd. Manchester	1	Mixing powders and for mixing in lubricants with granulated materials for tablets	Electric
Edge runner, stone		1	For powdering resinous drugs	"
" " iron		1	For powdering bricks, etc.	"
Bottle filling machine		1		Hand
Corking machine, automatic feed		1		Hand
Ball mill	F. J. Stokes machine Coy :, Philadelphia U. S. A.	1	Mixing mercuric powder, etc.	Electric (2 B. H. P.)

Machine, etc.	Makers	No.	Work performed	Nature of power
Centrifugal machine	Local	1	Drying Nitrate of Potash crystals, etc.	Hand
Pestle & mortar, marble		5	Mixing ointment, etc.	Hand
Pestle & mortar, wedgewood, of sizes		4	Mixing	Hand
Pans, copper		4	Evaporation	Steam
Balance, Chemical	Local or imported	1	Analytical work	Hand
Nitrometer, Allen's		1	Testing Spirit Ætheris Nitrosi	Hand
Measure, copper, 2, 3, & 4 gallons		As reqd.		

Machine, etc.	Makers	No.	Work performed	Nature of power
Measure, glass, pint		As. reqd.		
" " 2 lbs		"		
Earthenware Jars, Pegu		"		
" " English		"		
Stopd. glass " mixing and measuring		"		
Hydrometer, Sykes		1set	Testing Spirit strength	
Funnels, glass		As reqd.		
" copper		"		
Flasks, glass		"		
Receiver		"		
Desiccator, glass		"		
Beakers		"		

Basins, porcelain
Blow Lamp
Blow Pipe
Burettes
Camel Hair Brush
Conical Flask, 100 C.C.
Clamp
Condenser
Cork borer
Crucibles
Distillation Flask
Drying oven
Filter paper
Gas Burner
Glass rod stirrer
„ tubing
Iron triangle
Litmus paper
Laboratory sink
Reagent Bottles
Rubber Tubing
Pipettes
Primus Stove
Specific Gravity Bottles
Spatula
Spirit Lamp
Test Tubes
„ „ holder
Triangular File
Weighing dish
Weighing bottles
Watch glass
Burette Stand
Burette Clip
Condenser Stand
Funnel Stand
Pipette Stand
Tripod Stand
Separating Funnel, glass
Vats, copper
" tin
Calorimeter
Microscope
Polarimeter (Polariscope)
Refractometer
Spectroscope
Thermometer

Note :—A column showing "approximate cost" is purposely omitted, as the price shown will be misleading under existing war time conditions.

Pharmaceutical Machinery (Contd.)

Machine	Maker
Drug Crushing Machine Levigating Mill for ointments	Richmond & Chandlers, Manchester
Drum Sieve with revolving sifting frame	Joseph Baker & Sons, London
Colton's Pharmaceutical Machines :—	Arthur Colton, Detroit, Michigan, U. S. A.
Pill Machinery	London Agents :—
Gelatin Pill Coater Granulating Machine Wilkinson Pill Coating Machine	Johns J. Griffin & Sons, Ltd., Kingsway, London, W. C.
"Eureka" Tablet Machine Tablet Machine (Single) Sugar Coating Machine	F. J. Stokes Machine Coy:, Philadelphia, U. S. A. London Agents :— Thompson & Capper Ltd., Manufacturing Chemists, Manesty Buildings, College Lane, Liverpool.
Mineral Water Machine	Barnett & Foster, "Niagra Works" 26, Eagle Wharf Road, London, N.
Autoclaves Distilling Apparatus Enamelled iron pans Evaporating pans Extraction Apparatus Essential Oil Stills Filter Presses Ointment Mills Tablet Machines Tincture Press Vacuum Pans „ Stills	Bennett, Sons & Shears, Ltd. 43-44, Shoe Lane, London, E. C. 4.

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