CONSUMPTION AND ITS CURE BY PHYSICAL EXERCISES

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AND ITS CURE

BY PHYSICAL EXERCISES

BY

FILIP SYLVAN, M.D.

WITH TWENTY-SEVEN ILLUSTRATIONS

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PREFACE

A GREAT many medical men feel that sanatorium treatment for consumption has proved to be a failure. There is no getting away from the ugly fact that the majority of patients in the present sanatoria in practice actually become worse instead of better. It is true that many patients apparently improve, in so far that their lungs dry up; but this is a very unsatisfactory improvement, because these patients are unable to bear any little strain and are quite unfit for any ordinary work. It is clear, therefore, that something more is necessary beyond the present "open air" treatment in order to really cure consumption, and the intention of this work is to show that consumption can be cured not by

sanatorium treatment alone, and still less by injection of vaccines made up from horrible expectorations, but by a rational method of following some simple laws of nature.

It is my object in the present volume to demonstrate that the present opinion that we should fight tuberculosis by exterminating the tubercle bacillus is radically wrong and must be given up, as the bacillus is present everywhere in modern life and re-infection impossible to avoid. In my opinion, therefore, we must consider tuberculosis from an entirely new point of view, and I hope to show that only by curing the *predisposition* to consumption can we fight the disease. Accordingly in this work I explain what this predisposition is, and how we can cure it. Naturally, as my theories are original, they do not fit in with the present views of the medical authorities, and no one will expect these views to be changed immediately; but in time this change will come. Never are theories so frequently and radically changed as in the

medical profession, yet in spite of this fact old dogmas and doctrines are most persistently adhered to by medical men. Anything new is looked upon with great suspicion and contempt!

A hundred and fifty years ago the treatment of wounds and the performing of operations was considered by doctors to be beneath their dignity and was left to barbers. Then a few open-minded medical men started to study this special subject, with the result that surgery developed to such an extent that it now is looked upon as almost the highest part of medical science. In this connection let me point out that at the present time we have treatment with gymnastic exercises usually performed by persons who have been trained a few weeks (often even less) and who have no proper medical knowledge. Similarly many medical men look down upon such treatment as beneath their dignity. However, some have already taken up the special study of gymnastic

treatment, which has been used with great success for many ailments of rheumatic or gouty nature, as well as for diseases of the nervous system, for heart and circulatory disorders, etc. etc., and it is only natural that the opportunities for such treatment will be widened and the results greater as our knowledge and experience increase.

The exact effects of gymnastic treatment were formerly insufficiently or even wrongly explained. The result of the latest researches in anatomy and physiology make it possible for me to put forward the theories which I have expounded in this work. No doubt the medical authorities will regard my theories as heresy; but the results I have achieved with all the patients I have shown at the Royal Society of Medicine, both at the commencement and at the end of the treatment, are the best evidence that gymnastic treatment rightly administered is a real cure for consumption, especially as these patients were, without

exception, in advanced stages of the disease when I first introduced them to the Society. The fact that these patients now after two years are still keeping well and fit for work ought to convince even the most sceptical if he desires to be convinced at all.

F. S.

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PREFACE TO MEDICAL MEN

GENTLEMEN,

AT first sight perhaps you may find in this book what will seem to be a radical change of views to those we have so long been accustomed. But when you remember that the medical profession all agree that everything which improves the general health must help the consumptive patient, you will see that this is in reality exactly the principle which I follow throughout. We know that gymnastics, if not overdone, are good for the general health. Now then we have to find out which gymnastic exercises can be performed by consumptives in various stages of the disease without causing any overstrain. This is what I claim to have discovered, and my results show that my claim is justified.

To enable medical men, who have had no experience in prescribing gymnastic exercises, to use this book for the help of their patients I will give the following advice. You know most people want to push on faster than is actually good for them, and this is never so dangerous as in the case of consumptives. You must therefore seriously warn all patients not to do more than the amount prescribed, however easy and insignificant they may find your prescription. Let us first consider the patient in an early stage. For example, a patient has one or both apices affected, say over one apex dullness on percussion and prolonged expiration, over the other apex crepitation and a few râles. This patient should start with the first group of exercises and go on with these till the râles have disappeared and the crepitation has decreased. Then he can pass over to the second group, and continue these until the crepitation has disappeared and a slight prolonged expiration remains as the only symptom of mis-

chief. Now he can pass on to the third group.

It is best to examine the patients about every fortnight, and should, in any case, the symptoms have extended, it is clear that the patient has exercised too much or that the exercises prescribed have proved too strenuous. Then he must go back to the foregoing group, or if he has been using the first group, he must perform the exercises with less effort and for a less number of times, and also, if possible, arrange definite periods for rest during the day. Naturally the medical man must in each case prescribe rest, diet, and other means such as walking and other outdoor exercise as he deems fit and suitable. If the patient walks every day a mile or so, he might once a week take a longer walk.

Let us then consider a patient in a more advanced stage — for example, a patient who has râles over one or two lobes and crepitation with scattered râles over another lobe, and whose temperature frequently rises above 100° F.,

but who is notwithstanding fairly strong. He should start *carefully* with the first group of exercises and continue with these till his lungs are considerably improved and his temperature is fairly normal. Then he may carefully pass on to the second group, but should this during the first week or two result in any extension of the symptoms in the lungs, he must immediately go back to the first group. When râles and crepitation have disappeared, he may pass on to the third group.

For patients in still further advanced stages, it is difficult to outline any general rule to follow. It depends mostly upon how much strength the patient may have. In some cases it is advisable to let the patient do the exercises of the first group every other day, and when he feels a little stronger, do them every day.

It is very important always to remember that *it is much better to do much too little than a little too much*, while carrying out this cure. If every medical man who prescribes these

exercises for his consumptive patients watches each patient carefully, he will soon be able to judge the first time he sees a patient what exercises it will be suitable to prescribe.

Although from the foregoing instructions it might appear that this is a very simple way to cure consumption, yet all medical men will at once realise that it requires much thoughtful and conscientious care as well as experience to use these means with complete success.

Of course these exercises can be used with great benefit by anyone suffering from delicate health of any kind.

FILIP SYLVAN, M.D.

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CONTENTS

CHAPTER VII

CHAPTER VIII

CHAPTER IX

LIST OF ILLUSTRATIONS

CONSUMPTION AND ITS CURE

CHAPTER I

Historical remarks—The infectious or non-infectious nature of consumption—The cure of the predisposition to consumption more important than eradicating the tubercle bacillus

CONSUMPTION, pulmonary tuberculosis, or phthisis has been a scourge to the human race from time immemorial, and it certainly is at present a very widely prevalent disease. Its symptoms were already described with unmistakable clearness by the physicians of antiquity, specially by Hippocrates. He ascribes the affection to a suppuration of the lungs or pleuræ, and thinks that this suppuration may arise from various causes. It may proceed from the conversion of an inflammation, or of an extravasation of blood, or of an accumulation of mucus, into a suppuration; it may occur in the form of a circumscribed pus or as a diffuse infiltration, and may run either an

acute or a chronic course. Tubercles, as we understand them, were unknown to the ancients; even Galen recognised only suppuration and ulcerations of the lungs, by which portions of the organs are slaughtered off, as if by a putrefactive process, and discharged in the expectoration. Ruehle[1] mentions Franciscus Deleboe Sylvius as the first to recognise the existence of nodes, together with suppurations and ulcerations of the lungs. From the softening of these nodes cavities arise, and he speaks of larger and smaller tubercles.

In the middle of the nineteenth century Dr. James Hutchinson[2] called attention to the fact that people with weak respiration were more liable to diseases, especially to consumption, than other people. He measured the inspiratory and expiratory power of some thousands of people, and found that, although it varied much, it was in diseased cases considerably lower than in healthy persons. Unfortunately the medical world does not seem to have grasped the importance of this discovery, and it is at present practically a forgotten fact. Hutchinson was undoubtedly on the right path, but as he knew

[1] In V. Ziemssen's *Cyclopædia of the Practice of Medicine.*

[2] *Cyclopedia of Anatomy and Physiology*, vol. iv. part ii., London, 1852.

no means of strengthening the respiratory power, he did not suggest any remedy for consumption, and probably for this reason so little attention was paid to his discovery. I will speak more about his work later.

In 1865 Villemin found through his experiments that tuberculosis could be transmitted from a diseased animal to a healthy one by the injection of a small quantity of tuberculous or caseous substance into the healthy animal. The fact that these experiments were successful resulted in the theory that tuberculosis was an infectious disease. At first this theory was much doubted, but after Robert Koch had discovered the tubercle bacillus in 1881 the theory that tuberculosis is an infectious disease has been generally adopted.

In later years the majority of writers on consumption consider a certain predisposition to pulmonary tuberculosis necessary in order to contract the disease. But nobody ever gave any exact explanation as to what this predisposition was; some writers simply state that its nature is unknown. For example, Dr. Horder[1] writes: "The essence of this predisposition is at present unknown to us. The solution of a considerable part of the problem

[1] *Practitioner*, London, January 1913.

of tuberculosis prevention would follow the discovery of the nature of the metabolic or other defect underlying this difference in the tissues of the tuberculous or non-tuberculous."

Dr. Rufenacht Walters[1] expresses a similar opinion in the following words: "Tuberculosis results from the presence in the body of the living tubercle bacillus, at a time when the body is incapable of properly defending itself, and may be found in almost any part of the body, although the lungs are more commonly affected than any other part."

Bandelier and Roepke[2] mention that lowering of the blood pressure is considered by many authors as a very early sign of pulmonary tuberculosis, and that sluggishness of the circulation gives the chief impetus to the occurrence of this disease.

The latest view as to the conditions under which the tubercle bacillus cause tuberculosis tends to give more importance to the individual predisposition and less to the actual virulence of the bacilli. Dr. Walter Carr[3] says on this point: "An interesting question is which of the

[1] *A Clinical System of Tuberculosis*, London, 1913.

[2] *The Sanatorium Treatment of Pulmonary Tuberculosis*, London, 1909.

[3] *Practitioner*, London, January 1913.

two types of bacilli, the human or the bovine, is the more virulent to man. To this question we cannot at present give a definite answer. It has just been stated that the Royal Commissioners found that in chimpanzees and monkeys the two kinds of bacilli give rise to lesions of apparently similar character and virulence. There are, however, so many other factors to be thought of in connection with tuberculous infection that the actual virulence of the bacilli concerned is perhaps a less important point than might at first be expected. We have to consider also the size, the frequency of its repetition, and the resistant power of the organism at the particular time when infection occurs."

At post-mortem examinations tubercular lesions are found in almost every human body. The statistics vary from 60 per cent. to 97 per cent. As a far smaller percentage of the population have had tuberculosis it seems to show that a great number of people have, at some period of their life, had a slight attack of tuberculosis without being aware of it. It may be well to assume, that if a person is ill, he may be prone to infection of tubercle bacillus, but if he has not a PREDISPOSITION to tuberculosis, when he recovers from his illness the tubercular lesion heals up by itself. If, on the contrary, he had

such a predisposition, tuberculosis would develop.

The question whether tuberculosis is infectious, or in what way it is infectious, is a very important one. In saying that pulmonary tuberculosis is infectious, medical men have frightened the general public to such an extent that frequently a consumptive has great difficulty in finding a lodging. We must consider and decide whether there is any danger for a healthy person to live in the same house as a consumptive. Villemin's experiments, in my opinion, are not sufficient to prove the infectious nature of tuberculosis. If we inject any kind of poison into the body it will cause illness, but the question is, whether tuberculosis can be transmitted in the ordinary course of present-day life. Before the tubercle bacillus was discovered, the question was judged only by practical experience, and consumption was then never considered to be infectious. Persons who are most exposed to infection, as nurses and attendants in sanatoria and consumption hospitals, very rarely contract the disease, whereas other people, who live in the country and rarely come in contact with consumptives, do develop the disease.

As I said before, all writers agree that a predisposition is necessary to acquire the disease,

consequently an ordinary healthy person cannot become infected, and, therefore, the danger for him to live in the same house as a consumptive patient is *nil.* If some one has a predisposition it is very likely that he will become infected if he lives together with a consumptive patient. The whole problem of tuberculosis concentrates, therefore, upon the predisposition. When we know what constitutes the predisposition, and how to remedy it, we shall possess the best means of both preventing and curing this dreaded disease. By curing the predisposition we make the soil unsuitable for the tubercle bacillus and we prevent an infection, and also if the infection has already taken place the bacilli will perish naturally.

That the cure of the predisposition is more important than any remedy with which we might kill the tubercle bacilli is quite obvious, for the following reason. Let us assume that a remedy could be found which would kill all the tubercle bacilli in the body. After this the patient would still be prone to a fresh infection, which is sure to take place in a short time, as it is quite unthinkable that we could stamp out the tubercle bacillus altogether. But if the predisposition is cured, the tubercle bacilli present in the body will perish, and as the soil would then

have become unsuitable the tubercle bacillus is harmless to the patient, and no new infection could take place. If the tubercle bacillus would enter the body of such a patient, it would perish without doing any harm, just as it would in the body of any other healthy human being.

CHAPTER II

Consumption a disease of civilisation—The fight against the "White Plague"—The value to the nation of a cure for consumption

It has been stated that consumption is unknown among savages until they come in touch with civilisation, and then sometimes the death-rate from tuberculosis is exceptionally high. We are told that the death-rate from consumption among the Red Indian Reserve of the Canadian North-West Territories approaches 25 per cent. of the total death-rate, in spite of the fact that these people live in one of the finest climates in the world, at the foot of the Rocky Mountains. This fact is surprising to many writers, but if we remember the causes of a predisposition to consumption it is easily understood. The Red Indians were a hunting and fighting race, used to a great amount of physical exercise. Civilisation has forced upon them a considerable change of life. They are compelled to lead a life which is sedentary compared to that of their

forefathers, and a sedentary life, as I describe fully in another place, is an important cause of predisposition to consumption.

As tuberculosis has followed civilisation, so civilisation should bring some remedy to counteract the ravages of tuberculosis among all civilised people. This I am glad to say can be done, and my object in writing this present work is to point out how this remedy may be universally introduced and correctly employed.

The Swede, Per Henrik Ling, has given us a scientific system of exercises which make it possible for us to perform, with very little expenditure of time, the amount of exercise necessary to influence the respiration and circulation to such an extent that they can be kept in full efficiency. Ling's Gymnastic System is, therefore, the finest preventive of tuberculosis, and at the same time a part of his system, which has been called "Medical Gymnastics," is an efficient cure for the disease when it has once developed.

Cornet, investigating the death-rate among certain religious orders, found that nearly 63 per cent. was due to tuberculosis. This author came to the conclusion that in such sisterhoods where confinement and bad ventilation are

marked features, and where opportunities for infection are great, a healthy girl who enters the sisterhood at 17, dies twenty-one years earlier than her sister who remains outside the convent; that such an inmate in her 25th year has the same expectation of life as a woman outside the convent has at the age of 45, and that a nun of 33 must be classed with any other woman whose age is 62.

Nuns have hardly any exercise sufficient to accelerate respiration or influence circulation, and consequently these important functions easily deteriorate and prepare a predisposition to consumption.

During the present generation, a great campaign against this "White Plague" has been started in every civilised country. Royal Commissions have been working, collecting statistics of doubtful value and finding out some unimportant details regarding the human and bovine types of the tubercle bacillus. International and national committees and associations have spent much work and vast sums without any noticeable benefit to the sufferers from tuberculosis.

Surely if so great a number of intelligent people in all civilised countries have done such an enormous work for the relief of tuber-

culosis without any success worth mentioning, there must be something wrong in their methods of working. In my opinion the reason of this state of affairs is the false assumption that the tubercle bacillus is the cause of consumption, instead of, as I am endeavouring to show, the result of the disease. Therefore, to gain any success we must fight the predisposition to consumption and not the tubercle bacillus.

At present a great fight is carried on with the object of eradicating the tubercle bacillus and so preventing tuberculosis. Let me at once say that this is a quite hopeless task. It is quite impossible to extinguish the tubercle bacillus, but even if it were possible, I doubt that it would be desirable. Nothing in the world exists without a purpose, and the tubercle bacillus has a very important purpose in connection with the human race. It is harmless to strong and healthy people; it is only the weak or those whose health has been lowered to whom it is an enemy. By carrying off delicate and weak people and leaving the strong, the tubercle bacillus is an important agent in keeping the standard of our race at a high level. In trying to eradicate the tubercle bacillus and introducing sanatorium treatment the medical profession is artificially keeping alive hundreds of thousands of

weaklings without doing anything to strengthen them. The inevitable result is a lowering of the standard of our race, whereas the gymnastic treatment strengthens the consumptive patients and is consequently not only a cure for consumption but also, as the patients usually continue the exercises after they have been cured, it is a valuable means to raise the standard of our race.

It has been said that poverty causes consumption and that consumption causes poverty. I believe the former is sometimes the case, but the latter certainly very frequently. Consumption is a very chronic disease, and as there was no cure for it, the patient usually spent all his money on worthless remedies, of which sanatorium treatment is one of the most expensive, and when the help of his friends was exhausted he and his family were stranded in misery. Now the community must take care of him and his family. The care of consumptives constitutes a heavy drain upon friendly societies, charitable societies, as well as upon the taxpayers.

How costly consumptive patients are to friendly societies can be seen from the following figures. Mr. Russel,[1] secretary to the

[1] Latham and Carland, *The Conquest of Consumption.*

Court Princess Royal No. 3395, has given information about his court. During ten years eighteen members died, five from consumption and thirteen from other causes. In these cases sick pay had been given as follows:

	Total.		Average per Member.	
	Days.	Amount.	Days.	Amount.
		£		£
To the five consumptives	987	105	197	21
To the thirteen who died from other causes . . .	822	91	63	7

Statistics from the Hearts of Oak Benefit Society show the relative cost to the Society as follows:

The average sickness cost of the consumptive members for the ten years under review was 58·38 weeks, representing .	£41	12	9
The average sickness cost of all the other members for the same period, 34·97 weeks, representing	23	18	9

During the year 1904 the deaths from all causes were 2110; of these 377 (18 per cent.) were due to consumption, at an average age of

40 years. Again, of the total (2100) 673 occurred under 40 years of age. Thirty-three per cent. were certified as suffering from tuberculosis. It is mostly during the prime of life, when they have others dependent upon them, that people are attacked by consumption. This makes the social side of the question so important. The expenses of the Poor Law Guardians for consumptives and their families amount to millions of pounds yearly. This enormous expense is put on the ratepayer. The State is spending millions on sanatoria and the maintenance of insured persons in these institutions, and it is suggested that the State should spend further vast sums for the same purpose. All this money must be provided by the already heavily burdened ratepayers. It is not the rule to suggest savings to the State, but I hope no one will object if I suggest that we can save all this expense. When gymnastic treatment has been generally introduced, it will reduce the public expenditure for consumptives to a quite insignificant amount; it will reduce the cost of consumptives to friendly societies to a fraction of what it is at present. The majority of consumptives would not need to stop work, and therefore sick pay would rarely have to be given, and the average cost for the treatment

would only come to a small portion of the present average sick pay.

If we add to this large saving of expenses the value of the work which the consumptives could do if they underwent gymnastic treatment instead of being locked up in sanatoria, we come to the conclusion that the general introduction of gymnastic treatment for consumption would result in a direct gain to the nation of at least a dozen million pounds per annum, besides the considerable improvement of the race which also would follow, and which would be worth much more still.

CHAPTER III

The predisposition to consumption—Three different features —*Weak respiration* a preliminary symptom—Vital capacity and inspiratory power important for diagnosis —Causes of weak respiration—*Deficient circulation*— Stagnant lymph-fluid a good soil for tubercle bacillus— The temperature of consumptives—Effect of exercise upon the body temperature—Effect of overstrain— *Deficient nutrition*

WRITERS on tuberculosis have generally much neglected the important question of predisposition. After mentioning that it is necessary for the development of the disease, they usually add a few words about the defensive forces of the body, without saying what these defensive forces may be. The present writer[1] is the first who tried to give a scientific explanation as to what the predisposition to consumption really is.

The predisposition to consumption may be said to present three different features :

[1] Sylvar, "Pulmonary Tuberculosis and Medical Gymnastics," *Med. Press and Circ.*, London, 1912.

1. Deficient respiration.
2. Deficient circulation and deficient regulation of the body temperature.
3. Deficient nutrition.

These three features are usually present in every case of consumption, but not always to the same extent. In some cases deficient respiration is more prominent, in others deficient circulation. These features are present and can be perceived long before any auscultatory signs of consumption appear, consequently early attention to these points would make it possible to prevent the disease.

One of the most important symptoms of consumption is shortness of breath. This is caused by weak respiration—the patient has not the power to breathe deeply.

The first to notice that weak respiration is a foregoing symptom of pulmonary tuberculosis was Hutchinson.[1] He made the observation that people whose respiratory capacity and power had decreased, later on developed consumption. He was the first to systematically measure the vital capacity and the inspiratory and expiratory power. He found these factors to vary very much in different healthy persons, and therefore no exact figure could be given as

[1] *Cyclopedia of Anatomy and Physiology*, London, 1849–52.

to what these measurements in a healthy person should be. He gives the inspiratory power to 1·5 to 7 inches mercury, and the expiratory power to 2–10 inches. The vital capacity he gives to vary between 80 and 464 cubic inches.

Hutchinson says the vital capacity is influenced by five circumstances: by height, by position, by weight, by age, and by disease. He mentions a remarkable instance of the effect of disease upon the vital capacity in the case of a man named Freeman, who came from America in 1842, trained for a prize fight. He was then examined in his best condition. He fought his battle and during the subsequent two years lived a rambling and dissolute life. In November 1844, exactly two years afterwards, he came to London in ill-health. At this time there was no auscultatory evidence of phthisis pulmonalis, but the following difference appeared in his vital capacity:

	Vital Capacity—Cubic Inches.	Inspiratory Power.	Expiratory Power.
November 1842 .	434	5·0	6 5
November 1844 .	390	4·0	5·0
December 1844 .	360	3·5	4·0
December 1844 .	320	—	—

In October 1845 he died at the Winchester Hospital, and Mr. Paul, surgeon to that charity, stated that Freeman died of extreme exhaustion and debility. He had been expectorating pus, and his lungs were studded throughout with tubercles.

Hutchinson gives statistics of the vital capacity in persons of different height, age, etc., and how great a decline should arouse suspicion of disease. This is, however, a very difficult point to decide. The vital capacity varies so much in normal persons that only a very considerable deficiency should arouse suspicion. Hutchinson considers 16 per cent. deficiency to be suspicious. In my opinion it is impossible to give any distinct figure. However, a decided decrease in the vital capacity is always a sign of approaching disease. On the other hand, increase of the vital capacity is one of the most valuable signs of improvement, and it is frequently the first sign which can be ascertained.

In my own experience I have found the vital capacity and the inspiratory power to be valuable symptoms for the exact diagnosis of doubtful cases. The vital capacity and the inspiratory power are always decreased in cases of consumption. In my experience it is an exception if a consumptive patient's inspiratory power is higher than about 30 millimetres mercury; of

course how high the inspiratory power *ought* to be in a patient depends upon his constitution, his general strength, etc., and must be judged accordingly. I have found the expiratory power, as a rule, to be less decreased than the inspiratory power in consumptive patients. This is quite natural when we remember that the inspiration is an active movement produced by the inspiratory muscles, whereas the expiration is merely a passive movement; only the forced expiration is an active movement produced principally by the abdominal muscles. A decreased expiratory power would consequently mean a decrease of the general muscular strength. It is, therefore, of only comparatively little importance for the diagnosis of consumption. A weak inspiratory power means that as the patient has to make an effort to breathe deeply, he consequently always breathes superficially. The lungs expand only partially when a patient breathes superficially, and certain parts are not employed at all, and when any organ is not used it is sure to deteriorate.

It is surprising that these extremely important facts are never mentioned nowadays by writers on tuberculosis, and it is inconceivable that the medical profession can totally neglect these most important symptoms of consumption.

The effect of disease upon respiration was well known to Boerhaave and Morgagni as early as the sixteenth century. They considered that the disturbance of any organ in the body would disorder the function of respiration. Morgagni devotes more than one-sixth of his celebrated work, *The Seats and Causes of Disease*, to "Diseases which Affect the Respiration."

I have noticed in many cases that if a consumptive patient's vital capacity remained fairly high, the disease could not so easily make headway. As a rule, the vital capacity of these patients had originally been above the average. This shows that a high vital capacity is to a great extent a guard against tuberculosis. Some consumptive patients whose vital capacity had remained at a fairly high amount, had been suffering for many years without any extensive damage to the lungs; whereas other patients, whose vital capacity had decreased to a very small amount, had in less than a year's time a large cavity in the lung. There is in every case of consumption an intimate connection between the deficiency of respiration and the development of the disease.

The causes of deficient respiration are various. A sedentary life never interrupted by any kind of physical exercise sufficient to accelerate

respiration, might in time result in weakness of the breathing powers. Hutchinson gives very interesting statistics of the breathing powers of people of various professions and trades. His statistics show that people whose daily work necessitates a certain amount of physical exercise have a stronger breathing power than other people whose daily work prevents them from taking any considerable physical exercise. So, for example, he says that compositors as a class have the lowest breathing power, and we find amongst this class of workers a large number of consumptives.

Again, pleurisy frequently leaves behind it a weakened respiration. During this disease respiration is painful and therefore the patient instinctively breathes as little and as superficially as possible, and should this continue for some considerable time his breathing power will naturally grow permanently weak. In many cases adhesions arise, thereby actually preventing deep respiration.

Pneumonia also has frequently the same result. Pleurisy and pneumonia are therefore specially important as means of preparing the soil for tuberculosis in strong and healthy persons who have no hereditary predisposition to the disease.

Influenza and frequent colds often develop into consumption. A patient contracts one cold after another, and in time his cold becomes chronic—then he is usually in the first stage of consumption. When the mucous membrane of the lungs gets into a chronic state of congestion it contains considerably more lymph-fluid than normally, and this makes a fertile soil for the tubercle bacillus.

The majority of my consumptive patients had developed this complaint after pneumonia, pleurisy, or influenza.

If a person has occasion to hold his breath frequently for any length of time it may result in permanent weakness of his breathing powers. For example, one patient had for some time previous to his illness frequently been swimming under the water and was rather proud of the fact that he could stay so long below water. Another patient had, just before he broke down with consumption, been working several months with a microscope. To prevent the preparation becoming moist he held his breath during the time he was looking in the microscope.

Surely these patients by holding their breath as long as possible impaired their respiratory powers. Probably this holding of the breath made the inspiratory centre in the medulla less

sensitive to an excess of carbonic acid in the blood, so that an abnormal amount of carbonic acid would be required to effect an inspiration. This would result in the permanent presence of too little oxygen and too much carbonic acid in the blood, which in its turn would disturb nutrition.

It has been supposed that the predisposition to consumption could be hereditary, but I do not think this theory has many supporters nowadays. Delicate children naturally develop consumption more readily than strong children, but that a child has been born delicate does not necessarily mean that the parents should be delicate. Sometimes children of perfectly strong and healthy parents develop consumption. I have noticed in many cases that if a strong and robust mother happened to have been temporarily ill, or to have had much worry during the expectant period, the result was a child predisposed to consumption.

The second feature of the predisposition to tuberculosis is deficient circulation and deficiency of the regulation of the body temperature. It is in many cases present long before any signs of the disease can be detected in the lungs. We almost invariably find signs of bad circulation in consumptive patients, such as cold feet,

cold hands, the necessity for extra warm clothing, etc. It is not necessary that the whole circulation should be bad; very often it is bad only in certain parts, or even in only one part of the body. It is only reasonable to assume that in consumptive cases the circulation in the lungs is defective.

Bad circulation means that the blood flows more slowly and consequently nutrition must be diminished and the resistance power against infection equally decreased. A stagnant or slow lymph circulation constitutes a good soil for the invading bacteria. That disturbances of the circulation are present in tuberculous patients is shown by the experiments of E. Gellhorn and H. Lewin.[1] They found that in a patient with tubercular pleurisy the blood pressure during mental work and during disagreeable taste-impressions sank, whereas it rises in healthy persons. After this patient had recovered, his blood pressure showed the normal reaction during mental work and disagreeable taste-impressions.

The deficiency of the regulation of the body temperature is intimately connected with bad circulation. Our knowledge of the regulation of the body temperature is not yet complete.

[1] *Arch. Anat. and Physiol.*, 1913.

Some writers attribute to the cortex a thermo-regulatory as well as a thermo-productive effect (Bechterew).[1] These thermo-productive effects can arise through influences affecting the muscular system as well as through those affecting the functions of the large glands of the body (Bechterew).

Isenschmid and Krehl[2] attach great importance to the central grey matter of the mid-brain for regulation of the body temperature.

The series of observations by Haldane and Pembrey[3] upon a company of regular soldiers at Aldershot shows that the internal temperature of healthy men is higher than the normal generally stated 36°·89 C. (98°·4 F.). The average temperature observed in the urine of eighty-three soldiers was 37°·58 C. (99°·64), the maximum 38°·2 (100°·8), and the minimum 36°·78 (98°·2). These determinations were made between 3 and 4.30 p.m., after the midday meal, and *not* after exercise. The men were at rest.

A widely accepted rule is to confine consumptive patients to bed as long as their tem-

[1] *Funktionen der Nervencentra*, 1911.

[2] "Ueber den Einfluss des Gehirns auf die Wärmeregulation," *Arch. f. exper. Path. u. Pharmakol.*, Leipzig, lxx. p. 109.

[3] Pembrey, Arkle, Bodus, and Lecke, *Guy's Hosp. Rep.*, London, lvii.

perature rises above 99° F. at any time of the day, as it is considered that this temperature is abnormal, and caused by the disease. This idea is absurd, when we know that the temperature of numerous quite healthy persons is much higher.

Only a few experiments have been made regarding the normal temperature of the human body under various conditions, and consequently it is difficult to say what should be regarded as abnormal. Several writers noticed a rise of temperature after exercise, and that it was the rectal temperature which always rose, whereas the mouth temperature was in some cases even lowered (Pembrey, Arkle, Bodus, and Lecke).[1]

It seems that the greatest difference in mouth and rectal temperature was found to be in cases where a person had done his work dressed in an overcoat, and consequently the loss of heat from the skin was hampered.

Bardswell and Chapman[2] measured the temperature systematically in healthy persons at complete rest and found it to vary between 96°·6 F. and 98°·8 F.; the minimum being at about three o'clock in the morning and the maximum between four and six o'clock in the afternoon. From the experiments with persons taking

[1] *Guy's Hosp. Rep.*, London, lvii.

[2] *Brit. Med. Journ.*, London, 1911.

exercise it can be seen that the more strenuous the exercise the higher the temperature rises, but that with about fifty minutes' rest it falls to the normal again.

Walking for one hour at the rate of two miles an hour raises the temperature about	1° F.
At the rate of three miles an hour . .	1°·5 F.
„ four „ . .	2°·1 F.
„ five „ . .	3°·7 F.

In one of the experimentalists the temperature rose easier and higher than in the others.

Leonard Hill and Martin Flach [1] had the same experience with students during races. In some of these cases the temperature rose up to 102° F. or 103° F., in one case even to 105° F., but in some cases there was no rise of temperature. They mention that the cutaneous loss of heat (perspiration) seemed to be particularly active in the cases where there was no rise of temperature.

The same writers also at the same time measured the blood pressure and found it had risen (some 30 to 40 mm. Hg) immediately after the race, and mostly (60 to 70 mm. Hg) in those whose body temperature was the higher. Both temperature and blood pressure fell rapidly in all cases to either normal or even lower as the

[1] *Journ. Physiol.*, London, 36.

patient rested. These facts point to close connection between the activity of the skin and the rise of body temperature.

When the temperature has risen, after walking exercise, in consumptive patients it usually remains high for some considerable time, but I have noticed that when the patient improves, his temperature after the same amount of exercise lowers much quicker, and I have found this to be a valuable sign of improvement. About the same time the patients become less sensitive to cold and need less clothing, all symptoms of improved circulation. I take these facts as evidence that the abnormal temperature in consumptive patients is largely due to sluggish circulation. As I said before, it is usually only the rectal temperature which rises after exercise, and the mouth temperature remains practically the same or even lower in many cases. Their explanation of this fact is that the parts surrounding the mouth give out a great deal of heat. I do not agree with this explanation.

I have many times noted that if a patient, who has a tendency to a rise of temperature, takes a certain amount of walking exercise his rectal temperature rises and his mouth temperature lowers. If he rests half an hour his rectal temperature lowers and his mouth temperature

rises, both approaching the normal temperature. During this half-hour the mouth surroundings certainly give out as much heat as during the walking, therefore we must attribute the varying temperature to some other cause.

One may be justified in assuming that the temperature of the blood in the brain is almost equal to that of the mouth. As mentioned above, the centre for the regulation of the body temperature is situated in the brain, and if the temperature here has not risen, no command can be given to the skin to give out more than normal heat, consequently as more heat is produced in the body by exercise the internal temperature must rise. The distribution of heat over the whole body is carried on by the circulation of the blood. When the over-heated blood reaches the regulatory centre in the cortex it causes an increased loss of heat. If the circulation is slow, the blood during its passage to the head becomes somewhat cooled, therefore the regulatory centres are stimulated in a smaller degree, and the result is a greater rise of the internal temperature. Perhaps also the regulatory centres are weak and act more slowly than normally under these conditions.

That physical exercise and especially regular training has a good effect upon the regulation of

the body temperature has already been shown by Mosso,[1] who measured the temperature of several mountain guides during their mountain climbing in Switzerland, and found the rise of temperature was considerably less after good training. He took a sturdy porter who ascended to the height of 400 m., carrying 40 kg. on his back. At the end of September when he was in good training his temperature rose from 37°·1 to 37°·5 C. In May the following year Mosso made the same experiment with the same man, and found that his temperature now rose from 37°·2 to 39° C. He also mentioned an exceptionally well-trained mountain climber who made a very long and severe ascent with 40 kg. on his shoulders, and whose temperature was on arrival 37°·4, and after fifteen minutes' rest 36°·5, which was normal for him.

We know that physical exercise influences the circulation, and therefore I consider the result of these experiments to be in favour of the above-mentioned theory.

The principal cause of bad circulation is lack of exercise. This is a result of civilisation. Throughout the evolution the muscular system has been far more efficiently used than it is at the present time by the majority of people.

[1] *Life of Man in High Alps.*

Railways, motor-buses, taxi-cabs, lifts, and other modern inventions encourage us to use our limbs as little as possible; but physical exercise is necessary to maintain a normal circulation. If civilisation has brought the means of making us use our limbs less, and consequently of impairing circulation, it has also brought us the means to counteract this tendency. The Swede, P. H. Ling, has given us a scientific system of gymnastic exercises by which we can in a very short time perform the necessary amount of physical exercise to keep our circulation in a good state. In a little book,[1] *Home Exercises*, I have given instructions for keeping in good health, and I have also described gymnastic exercises suitable to be done at home without any apparatus.

When the circulation has already become bad, more stringent measures may be necessary.

Sluggish circulation is caused by a deficient activity of the capillary vessels and of the veins. One hears the opinion expressed very often, even among medical men, that bad circulation is caused by some weakness of the heart. This may be so in a few cases, but the hearts of the vast majority of people with bad circulation are quite sound. In many cases even there is a hyper-

[1] F. Sylvan, *Home Exercises for Health and Strength* (published by Eveleigh Nash).

trophy of the heart which surely shows no weakness; on the contrary, as the heart muscle has grown bigger, it must be stronger. The cause of this is that the work of the heart has increased because the capillary vessels and the veins do not move the blood forward as quickly as they should, and consequently the heart must, if possible, take over a greater part of the circulatory action.

Hasebrock,[1] who gives a detailed description of the circulation, especially in connection with the relation between the action of the heart and the action of the blood vessels, says: "Disturbances of the circulation have in many cases their cause in disturbances of the independent diastolic and systolic action of the blood vessels." This action is controlled by the nervous system and is influenced by every movement as well as by any mental activity.

Muscular activity always necessitates an increased circulation, and the result is that both heart and blood vessels become more active. In persons with good circulation the activity is increased about equally, and the blood pressure is only slightly higher. In a person with bad circulation it is quite different; here the blood vessels do not increase their activity much, and

[1] *Deutsches Arch. f. klin. Med.*, Leipzig, 1903, No. 77.

consequently the heart has to perform the greater part of the increased work, the result being a considerably increased blood pressure and perhaps a slight palpitation of the heart. Gymnastics or even training in sport will, if used carefully, improve the peripheral circulation, and a smaller increase of the blood pressure with the same muscular exertion will be noticeable. Oertel[1] gives a table of the increase of the blood pressure in a patient after the same amount of walking uphill during a period of training :—

1. August 7.—From 135 mm. to 178 mm.
2. „ 18.—From 132 mm. to 144 mm.
3. September 4.—From 125 mm. to 136 mm.
4. „ 11.—From 125 mm. to 129 mm.

Oertel ascribes the smaller increase of the blood pressure to the result of the strengthening of the heart muscle, but it is hardly possible that a stronger heart would respond with a smaller increase of blood pressure. It is different if we assume, with Hazebrock, that improved peripheral circulation makes the work of the heart easier. Kolb[2] made similar experiments with some people who underwent training for rowing. The blood pressure invariably decreased during

[1] *Therapie d. Kreislaufstorungen*, Leipzig, 1885.

[2] *Beiträge zur Physiologie Maximaler Muskelarbeit*, Berlin.

the time of training. E. Masing[1] found that the blood pressure during muscular work increased, and at the same work the blood pressure in elderly people usually rises higher than in young people, and also that at the repetition of the experiments later on the rising of the blood pressure became less.

The gymnastic treatment of heart diseases and other disturbances of the circulation is based upon the principle of improving the *peripheral* circulation. Sluggishness of circulation in the capillary vessels reacts upon the blood stream in the arteries and makes it slower, and this in its turn can only be counteracted by increased work of the heart, the result of which is an increased blood pressure. If the heart muscle is in a healthy condition it grows bigger to be able to perform the increased work, and the patient will suffer little inconvenience. If the heart muscle is not able to increase its size to cope with the increased work, the patient will suffer and show the usual symptoms of heart weakness. If we can improve the circulation in the capillary vessels and veins we shall leave less work for the heart, by decreased blood pressure, and thus any hypertrophy of the heart would be reduced. This is actually achieved by gymnastic treatment. For

[1] *Deutsches Arch. f. klin. Med.*, Leipzig, 1902, No. 74.

example, I have seen cases of aortic insufficiency with capillary pulse and hypertrophy of the left ventricle, where after a few weeks' gymnastic treatment the capillary pulse disappeared and the hypertrophy of the left ventricle was reduced, so that the heart returned to its normal size. In my opinion this result can only be explained by an improved circulation in the capillary vessels and veins.

Every overstrain impairs the circulation for a longer and shorter time according to how good or how bad a circulation a person may have. A healthy person with good circulation usually recovers from an overstrain after some hours or days, whereas a person with a bad circulation may suffer from the same overstrain for weeks or months, perhaps even years. The result of an overstrain is always an increased stagnation of the lymph-fluid. A slight overstrain may cause a stagnation of the lymph-fluid only in one part of the body, and then always in that part of the body which is the weakest; consequently if a person suffers from consumption, or even has a predisposition to consumption, any little overstrain will result in an increased amount of stagnant lymph-fluid in the lung, which makes a good soil for the tubercle bacillus. We know from experience that properly administered

gymnastic exercises improve the lymph circulation and remove stagnant lymph-fluid. In this way the soil is made unsuitable for the tubercle bacillus, and it can no longer live in the body.

The tubercle has no blood vessels. We know that the smaller arteries and capillary vessels continually send out new branches which pierce the surrounding tissue. Where the tubercle is present, this piercing by new branches must, in some way or other, have been stopped, otherwise the new blood-vessel branches would pierce through the tubercle and absorb it. Gymnastic exercises stimulate the activity of the blood vessels and cause them to send out new branches which do pierce through the tubercles and absorb them. I have noticed in advanced cases of consumption that if one pinched the skin of the patient it remained white, whereas in normal persons it first becomes pale and soon afterwards red. That consumptives have lost their reaction proves that their circulation is defective. After a few weeks gymnastic treatment this reaction invariably returned, so that when the skin was pinched it first became white and afterwards red. This proves that the circulation had improved.

The third feature in the predisposition to

tuberculosis is deficient nutrition. It is generally supposed that there is somewhere in our body a so-called trophic centre which influences the general nutrition. How far the action of this centre, which probably is situated somewhere in the brain, influences the nutrition, particularly in the lungs or any other special part of the body, is not at present known. Most likely the action of the trophic centre is closely connected with the circulation. The general metabolism is usually impaired in consumptive patients, and this is probably due to some deficiency connected with the trophic centre.

Some writers noticed certain disturbances of the general metabolism in consumptive patients. Churchill[1] mentions a deficiency of phosphorus in the system of consumptive patients, caused either by a too rapid exudation or a failure to absorb, and suggests the use of hypophosphites (preferably hypophosphites of calcium or soda) to restore the loss of phosphorus in the body.

Generally it has been assumed that the respiratory exchange in consumptive people is lowered, but the researches by Albert Robin[2] show quite a different result. His statistics

[1] *Consumption and the Churchill Treatment thereof by Hypophosphites of Spirone.*

[2] *Treatment of Tuberculosis*, London, 1913.

show an increase of the respiratory exchange in consumptive patients. They consume more oxygen and produce more carbonic acid per kilogramme a minute than healthy individuals. A noticeable fact is that he found marked elevation of the exchanges in a young man, aged 18½ years, in good health, but the son and brother of phthisical patients. Two years later this young man, whose health had never given rise to the slightest anxiety and whose lungs, examined by several doctors, had always seemed healthy, was carried off in four months by an attack of phthisis, its progress being most rapid. This seems to show that the increase of respiratory exchanges is a sign of predisposition.

Robin's statistics show also a constant demineralisation in consumptive patients, which surely is a symptom of disturbed metabolism. It is a well-known fact that gymnastic treatment has a good effect upon the general metabolism. Therefore it is easily perceived that gymnastic treatment must be the best remedy to restore a disturbed metabolism. Gymnastic treatment always tends to bring the functions of the various organs of the body into a normal state.

Worry and anxiety in some cases are causes of consumption, especially in young subjects.

To explain this fact it is necessary to realise that they cause a predisposition to the disease. Worry and anxiety cause a decrease of the blood supply to the brain, and consequently if the worry is chronic the nutrition of the cortical centres will be impaired. It is noticeable that worrying persons do not breathe deeply, and as a rule such people have no inclination for physical exercise. The result is that a predisposition to consumption easily develops.

The well-known fact that consumption develops most rapidly between the ages of 18 and 25, and that the death-rate from consumption during these ages is considerably higher than among consumptive people of other ages, is another evidence of the correctness of my theory, that the weakness of the respiratory and circulatory cortical centres is the main point of the predisposition to consumption. The cortex, especially the frontal lobe, reaches its full development between the ages of 18 and 25. During this period the head grows in length owing to the development of the brain. This has been proved by a large number of measurements. The growing nerve tissue is always very sensitive to influences, either good or bad, and therefore, if during this period of final development the respiratory and circulatory centres are impaired,

it will be more disastrous than at any other period of life.

As I have already said, at this period the cortical centres are more sensitive to either good or bad influences, consequently if we can by some suitable method strengthen these centres it should be easier and more successful at this period of life than at any other time. The practical experience shows that this, in fact, is the case. I have always had the best and quickest cures with patients between the ages of 20 and 25. The older a patient is, the less easily can his nerve centres be impaired, and accordingly so much the more slowly will he develop consumption. On the other hand, the strengthening of the nerve centres and the healing of tuberculosis will take a longer time than at a younger age.

CHAPTER IV

Different types of pulmonary tuberculosis—Hæmorrhage

AMONG a great number of consumptive patients I have noticed that there are two distinct types of pulmonary tuberculosis, the one being distinguished principally by weakness of the respiration, the other by deficient circulation. These types correspond exactly with the features of the predisposition to consumption, which I have already described. Cases of the former type have the vital capacity and inspiratory power very much reduced. The patients get out of breath with the slightest exertion, even ascending a flight of stairs causes them to pant. Their temperature, however, is normal or almost so. These patients very rarely have a hæmorrhage, and if they have one it is only slight with little blood.

In cases of the latter type, a fairly good vital capacity is maintained, the patients are not short-winded to any appreciable extent, but their

temperature is abnormally high, and in many cases the rise of temperature and perhaps a certain lack of energy are the only signs of mischief for a long time. Patients of this type have frequently a hæmorrhage, and in many cases the hæmorrhage is the first symptom to draw the attention to the existing mischief. Of course but a few cases show only one of these types distinctly. Most cases are mixed, though in many one of these types is quite pronounced. In a number of cases all the symptoms are about equally represented, and therefore they cannot be classified under either of the foregoing types.

For practical reasons I suggest dividing up consumptive patients into three groups, namely:

1. Cases where deficient respiration is more pronounced than other symptoms.
2. Cases where deficient circulation and deficient regulation of the body temperature are more pronounced than other symptoms.
3. Cases where the various symptoms are about equally pronounced.

For various reasons it is of importance to distinguish between these three groups.

The treatment must be different according to

which of these groups the patient may belong. In cases belonging to the first group, the treatment must be directed principally upon the strengthening of the inspiratory centre and the loosening of adhesions, if such be present. In cases belonging to the second group, the treatment must be directed principally upon improving the circulation, and in many of these cases little notice need be taken about strengthening the inhalatory centre. In cases belonging to the third group, the treatment must be arranged to suit the various symptoms of the patient.

The prognosis is also different according to which of these groups the patient belongs. In cases of the first group, the patient usually improves rapidly ; a week's treatment brings about a noticeable improvement. Many cases where no considerable destruction of lung tissue has taken place are cured within two months. Cases belonging to the second group always require a longer treatment, and some of these cases do not show any improvement until after one or two months' treatment. The progress in the treatment of these cases must be very slow, as they are more subject to a relapse than cases belonging to the other groups. In cases belonging to the third group, the improvement is never very rapid, and the patient generally

requires several months' treatment before a permanent cure is effected.

In all cases the prognosis for a perfect cure depends very much on the patient's general constitution, and consequently a patient with a strong constitution, belonging to the second group, may, in fact, be cured in shorter time than a patient with a weak constitution belonging to the first group.

Most consumptive patients have hæmorrhage once or more during the course of the disease, or they have a streak of blood in their sputum, but there are some cases which do not have hæmorrhage at all. Hæmorrhage occurs in early as well as in advanced stages, and it is no sign whatever of how far the disease has advanced. Of course, in advanced cases hæmorrhage is more likely to be profuse and serious, or even to cause death. Sometimes hæmorrhage is the first symptom which brings to the patient's notice that there is something wrong with him. The real cause of the hæmorrhage is not yet quite clear to us. We know that a great overexertion may be followed by hæmorrhage. It seems that some change in the walls of the blood vessels must have taken place, and most likely it is that they have lost their elasticity. This may be so in one patient much more than

another, quite independently of his being in an early or advanced stage. When the blood pressure rises by physical exertion or mental excitement, hæmorrhage would easily occur when the blood vessels have lost their elasticity. The importance of slight hæmorrhage—for example, a streak of blood in the sputum, or even a teaspoonful of blood—is frequently much exaggerated. Following such a hæmorrhage patients are often kept in bed for a long time, even if they have hardly any physical signs of mischief in the lungs; this treatment is ridiculous. Hæmorrhage is always a sign of some disturbance of the circulation, and if after a hæmorrhage a patient is kept in bed for a long time his circulation is bound to be still more impaired, whereas the object should be to improve the circulation.

Various drugs are given to counteract hæmorrhage, although it may be doubted whether these drugs really do any good. In this connection it is of importance to notice the result of the experiments of E. Weber.[1] He found that a number of drugs which usually are given in cases of hæmorrhage, such as infus. digit., digalen and digiparatum, alcohol, ergotin and nitroglycerine, caffeine and nicotine, adrenalin and

[1] *Arch Anat. and Physiol.*, 1912.

imido, all effect dilation of the blood vessels in the lungs, which hardly can be beneficial in the case of hæmorrhage. To cause *contraction* of the blood vessels in the lungs would seem to be the right thing to counteract hæmorrhage. E. Weber found that cold water on the skin effected a contraction of the blood vessels of the lungs. Warm water application in the rectum also had the same effect. He suggests, therefore, the use of a double pipe in which warm water could circulate, to be placed in the rectum; and also at the same time the use of cold water application on the skin.

It seems to me that the weather conditions have a great influence upon hæmorrhage, especially the sudden changes which so often take place between the seasons. At these times, about November and at the end of February and March, more hæmorrhages occur than at other times of the year.

Sometimes a hæmorrhage may not be of any importance at all. Several of my patients had a hæmorrhage some considerable time after they had recovered without any other ill effect whatever. Some were examined and nothing wrong could be found with their lungs, and they remained well without taking any special measures; others took no notice at all of the hæmorrhage.

They usually lost a mouthful of blood or about half a teacupful, and the occurrence in most cases came when they had had some great strain or had been working harder than usual. One of my patients who was cured in the beginning of the year 1913 had a hæmorrhage (half a teacup of blood) in November the same year. He felt quite well after it and did not stop work. In November 1914 he had again a hæmorrhage similar to that of the year before. On both occasions he was examined, but no trace of disease could be found in his lungs. Even immediately after the hæmorrhage he was working rather hard, but felt very well and his appetite was very good.

This seems rather to show that hæmorrhage depends upon some condition which is not directly associated with consumption itself.

CHAPTER V

Physiology of respiration—The relation of respiration to speech and singing

THE physiology of respiration is a very complicated affair, and it is only in recent years that physiological researches have brought us a clear knowledge of the various nerve centres which are directly connected with respiration.

The physiology of automatic or unconscious respiration is as follows: An excess of carbonic acid in the blood stimulates the breathing centre in the medulla, and this sends out a command to the inspiratory muscles to contract, and so causes an inspiration. The unconscious expiration is caused by relaxation of the inspiratory muscles and the elasticity of the lungs themselves, which causes them to contract.

The respiration, when we so wish, is under the influence of our will power, and in this case is directed from centres in the cortex; we may call this conscious breathing. Many writers

(Danilewsky, Unverricht, Krause, Horsley, Preobranzensky, Bechterew, etc.) studied cortical centres of breathing in animals. The latest view seems to be that of Bechterew,[1] who found in apes two cortical centres for breathing: one situated a little in front of the upper end of the sulcus præcentralis, the excitation of which causes an instant cessation of breathing upon inspiration; another situated in the frontal lobe, a little frontal and lateral of the above mentioned. By excitation of the latter, the breathing becomes more superficial and rapid. We may assume that the cortical centres for breathing are the same in man. For practical convenience, I will call the former of these centres the inspiratory centre, and the latter the centre for superficial respiration. We may be justified in assuming that in ordinary healthy persons the inspiratory centre is called into action by any exertion which requires increased respiration, and that the centre for superficial respiration comes into action when deep inspiration is prohibited by some cause, for example, by illness.

The respiratory centre in the medulla is an automatic one; the cortical centres are centres of will power. As a general rule, a higher nerve

[1] *Funktionen der Nervencentra*, 1911.

centre always exercises an influence over the lower centre, consequently the influence from the cortical breathing centre exceeds that of the respiratory centre in the medulla. According to this rule we should be able to stop breathing voluntarily, but we know that this is possible only to a limited extent. The explanation of this fact is that the higher centre is more easily impaired in its function by deficient nutrition than the lower centre, therefore after a very short time the voluntary influence from the cortical centre to stop breathing gives way to the involuntary influence to inhale, which comes from the centre in the medulla.

Several writers (Bechterew) during their experiments noticed the intimate connection between the general motor and the breathing centres. This we see also in daily life. In healthy persons any little exercise quickly increases respiration. I have repeatedly noticed that this influence of exercise upon respiration is decreased in consumptive patients. For example, when a healthy person mounts a staircase he very soon increases his respiration, so that he does not get out of breath. Some consumptive patients, when they go up a staircase, are soon obliged to stop because they cannot breathe deeply enough to take up a sufficient amount

of oxygen; other consumptive patients are able to breathe almost as deeply as a healthy person, but they do not increase their respiration nearly as soon as an ordinary person, and then they remain out of breath and panting for a considerable time. I have also observed that when these patients improve they commence to increase their respiration much sooner on going up a staircase, and they pant less and feel more comfortable.

I have therefore put forward the theory that deficient respiration is caused principally by a weakness of the inspiratory cortical centre.[1]

A great many writers have expressed their views with the object of teaching people how to speak and sing. Much paper and print has been wasted on this subject, because without proper knowledge of the physiology of respiration it is a hopeless task to try and explain the use of certain muscles employed in speech or song. Generally it is the action of the diaphragm which has obsessed the minds of these writers. Long and tedious, and mostly incorrect, descriptions have been given of the action of the diaphragm in speaking or singing, and many pupils have tired themselves out in

[1] Sylvan, "Pulmonary Tuberculosis and Medical Gymnastics," *Med. Press and Circ.*, London, 1912.

vain to acquire some special method of breathing which should be the one and only possible road towards correct vocalisation. Most pupils become so enthusiastic over their teacher's special method that they quite disregard any commonsense reflection which would open their eyes to its possible mistakes. It would be hopeless to criticise any of the hundreds of methods in vogue, and I will therefore go on to describe a theory which is the result of a long and careful study of the subject.

Respiration is only of one kind, whether in rest or exercise or during speech or singing. The breathing itself is the same, but the command (see foregoing chapter) to inspire is given during rest from the medulla, during exercise or during speech or singing from the inspiratory centre in the cortex.

In order to make the voice carry well, it is necessary that there should be a "sounding-board," as there is in most musical instruments. This human "sounding-board" is composed of all the muscles which compose the walls of the abdominal cavity, and all these muscles must be put into a certain fixed contraction which must be retained as long as sound is emitted. The more expanded the lungs are, the better and clearer the tone will be. To attain this result

it is most important that the inspiratory muscles should be as strong as possible and able to hold out in contraction as long as required.

The inspiratory muscles[1] are the diaphragm and those which lift the ribs; these when contracting serve to extend the cavity of the thorax. The expiratory muscles, used only when expiration is voluntary, are the abdominal muscles. Involuntary expiration is caused by the elasticity of the lungs and involves no muscular action. When the muscles are contracted to form the "sounding-board," their effect must be counteracted by the inspiratory muscles, otherwise the lungs would be emptied quickly, therefore it is important that the inspiratory muscles should be very strong. When this is the case, contraction of the muscles which form the "sounding-board" is an easy matter for the pupil; the production of his voice being now quite correct, he can comfortably devote his attention to the interpretation of the song.

The best means to put the inspiratory muscles and the muscles composing the "sounding-board" in good condition and in full and easy control of the student's will is to use gymnastic

[1] Which these inspiratory muscles are can be looked up in any book of anatomy, but they need not be known to the student of this subject.

exercises specially suitable for this purpose, and this has, in my opinion, nothing whatever to do with the teaching of singing. The principal necessity for good voice production is a perfect control over the respiratory muscles, and the best means of acquiring this control is by gymnastic exercises. Teachers of singing would be wise to note this fact and advise their pupils accordingly.

I have noticed that the inspiratory and expiratory powers of most singers are above the average. The inspiratory power is usually between 60 and 90 mm. mercury, but I have seen several singers and speakers with good voice production whose inspiratory powers exceed 90 mm. mercury. If a singer's inspiratory power was below 50 mm., he had usually some trouble with his voice. Many students of singing who had difficulties with their study on account of weakness of the respiratory powers, found their difficulties disappear as soon as their respiration became so much stronger that their inspiratory power exceeded 50 mm. mercury.

CHAPTER VI

The various methods of treating consumption—Inhalations — Hydro-therapeutics — Diet — Sanatorium treatment — Tuberculin (auto-inoculation theory) — Effect of physical exercise upon circulation—Effect of vibrations on the lymph circulation and in cases of inflammation—Immunisation

In the good old times people used to shut up consumptive patients in hot rooms with closed windows, fearing a draught whereby a patient might catch cold. Later on, people began to realise the value of fresh air, and now they go to the other extreme. They put consumptive patients, who are weak and ill, to sleep outside in a shelter though the temperature may be freezing, and even snow and mist falling upon their beds and on them, in the vain and ridiculous hope that such a state of things would cure them.

For no disease have so many various remedies been tried and recommended as for consumption. Hundreds of different remedies have been

claimed as a cure for this dreaded disease, but ultimately they have proved to be beneficial in only a few cases, and it is highly probable these few cases might have improved without these remedies. It has been stated that about 10 per cent. of consumptive patients get well anyhow, with or without treatment or in spite of any treatment. In view of this fact it is quite natural that if a remedy is advertised and tried by a number of patients, some of these are bound to get well. This fact, however, does not prove at all that this special remedy has cured them; although it is usually taken for granted and put forward by the producer of the remedy. Any remedy may have a beneficial effect in certain cases, and may to a certain extent be a little help to the patient. Anything that has a good influence upon the general health must be beneficial to a consumptive patient although it does not cure him.

We may divide the remedies which have been recommended for consumption into the following groups :—

1. Remedies which have a stimulating influence upon the mucous membrane of the lungs and throat and stimulate respiration.

2. Remedies which have a stimulating influence upon the circulation.
3. Remedies which stimulate the appetite and so influence nutrition.

To the first group belong those remedies used for inhalations, such as creosote, carbolic acid, turpentine, guaijacol, spirone, and many others. In some cases of consumption such inhalations undoubtedly have a good effect upon the cough, and as the patient very often breathes deeper during the inhalations, this may at the same time have a beneficial effect upon his respiration.

Of remedies in the second group, hydro therapeutic measures are of great importance. Before prescribing hydro-therapeutics it is necessary to ascertain a patient's power of reaction to cold or warm water applications. As in many consumptive patients this power is deficient, it is advisable to start water applications very cautiously; as a general rule I have prescribed them only after the patients have shown some improvement by gymnastic treatment. Of course I followed this rule when the patients themselves made the water applications in their homes; if the patient can have skilled attendants naturally we can proceed more rapidly. I usually start with moist wrapping, first warm

and then, directly the patient's reaction allows it, cold. This is specially beneficial in cases of pleurisy. Robin[1] advises the use of moist wrapping in cases of pleurisy to soothe fits of coughing coming on through bronchial irritation, to facilitate expectoration, and to reduce attacks of congestion and pulmonary stasis.

The application of cold water is always invigorating, and as soon as the patient can endure it we should commence this beneficial remedy. Cold applications, especially upon the chest and abdomen, produce a great irritation of the respiratory centre, and the respiration becomes deeper.[2] As a result, Winternitz and Pospischl[3] have shown an unmistakable increase of carbonic-acid elimination.

Exposure of the naked body to cold produces, according to Friedrich, a decided increase of oxygen consumption in proportion to the intensity of the cold. The projection of cold water upon the body also produces an increase of oxygen consumption and carbonic-acid excretion in warm-blooded animals.

As many patients cannot endure cold water

[1] *Treatment of Tuberculosis.*

[2] Baruch, *Hydrotherapy*, New York, 1905.

[3] *Neue Untersuchungen uber den respiratorischen Gaswechsel unter thermischen und mechanischen Einflüssen*, 1893.

applications over the whole body, it is advisable to commence by applying the water first to only one part of the body, for example, as follows: First day, sponge over the chest and abdomen; next day, sponge over the arms; third day, sponge over the legs; and fourth day, sponge over the neck and back. The temperature of the water should be at the start 75° F., and gradually go down to 60° F. Later on, the patient may sponge the whole body every day with water of this temperature. When the patient has still further improved he may take a cold bath, starting with a temperature of 75° and gradually taking it a little colder, but not below 60° F. During the bath, friction with the hands should be made over the whole surface of the body.

A rather important question is how to dry the body after the bath. Frequently the advice is given to rub the skin with a rough towel to produce a good reaction. This may have a good effect if it is done once now and again, but if done daily for longer than a fortnight it frequently impairs the nerve system and makes a person more liable to catch cold. The best way, and the way which will always be beneficial, to dry the body after a cold bath, is the following: Dry the body superficially with a towel without rubbing, and then massage the

whole skin with the bare hands. This produces a good reaction as well as an agreeable sensation of warmth.

Rubner[1] investigated with Zuntz's apparatus the effect upon the respiratory function of short baths and douches as they are applied in practice. That the latter is greatly enhanced is obvious by the following increased average percentage after a short bath :

Bath.	Volume of Air.	CO_2.	O.	Respiratory Quotient.
16° (61° F.)	+22·9	+64·8	+46 8	0·86 : 1·00
30° (86° F)	+ 7·3	+31	+16·2	0·95 : 0·93
33° (91° F.)	+ 1·8	− 1·8	+ 6·2	0 87 : 0·90
40° (104° F.)	+16·1	− 3·9	+ 3·2	0·86 : 0·90
44° (111° F.)	+18 8	+32·1	+17·3	0·86 : 1·00

This summary shows clearly that a bath of 61° F. produces a decided increase of the respiratory function, that a bath of 91° F. produces little effect, and that a rising bath temperature again increases its effect.

An interesting finding was that the effect of a douche at the same temperature was double

[1] *Arch. f. Hyg. Munchen u. Leipzig*, 1903, 46.

that of a short bath. A douche of 61° F. increased the

Volume of air	54·5	per cent.; a bath		22·9	per cent.
CO^2 exhalation	149·4	„	„	64 8	„
Oxygen consumption	110·1	„	„	46·8	„

Two Italian physicians, Vinaj and Maggiora,[1] undertook a series of investigations with the ergograph invented by Mosso in order positively to establish the effect of the most important hydro-therapeutic procedures upon the resistance of the muscles to fatigue. The normal "fatigue curve" was ascertained by several applications of the ergograph upon the flexor muscles of the middle fingers of both hands, the instrument carrying a weight of 3 kg. and registering the contractions every two seconds. Two and a half hours after this "fatigue curve" had been registered, the individual was placed in a tub containing water of 50° F. (10° C.) for fifteen seconds. He was now dried, wrapped in woollen clothes, and the "fatigue curve" of the right and left middle fingers taken. The middle finger of the right hand, contracting with the greatest exertion until completely fatigued in order to raise a weight of 3 kg. every two seconds, was capable under normal conditions of completing

[1] *Blatter für klinische Hydrotherapie*, 1892, Bd. ii. No 15, and Bd. iii. No. 7.

fifty contractions, corresponding to mechanical work of 5139 kg. A while after the cold bath, the same muscle could complete seventy-four contractions before it was fatigued, which corresponds to mechanical work of 9126 kg. This simple and exact experiment demonstrated that the cold bath produced a considerable increase of the working capacity of the muscles.

A gradually cooled bath furnished an interesting "fatigue curve." The water was 96°·5 F. when the individual, a student of medicine, 27 years of age, entered it after his "fatigue curve" had been noted. Five minutes elapsed when the outflow was opened, and cold water was admitted until the temperature of the water was 68° F., and the man felt slight chilliness. Upon emerging from the bath the "fatigue curve" was again taken. The average result of several trials shows that the flexor muscle of the left middle finger, which before the bath was capable of making thirty-nine contractions, corresponding to 3603 kg. of work, made under the same conditions after the gradually cooled bath (96° F. to 68° F.) eighty-seven contractions, equal to 9349 kg. of work. The plain enhancement of the working capacity is shown clearly also by the change in the form of the "fatigue curve." Before the bath the

"curve" showed high contraction, which fell regularly and slowly. After the bath the lines show a nearly even height for a long period, then a slow lowering ensues, gradually ceasing. The studies of Vinaj upon the cooled bath show that it increased the tone of the blood vessels.

The effect of hydropathic procedures upon the muscles which have been fatigued is well brought out by later experiments of Vinaj and Maggiora.[1] Their diagram shows the effect of a general cold bath upon the flexor muscles of the right middle finger with the weight of 4 kg. and a rhythm of two seconds, and demonstrates that the effect of fatigue is entirely removed by the cold bath.

The effect of rubbing with a cold sheet upon the capacity of work of a muscle which has been fatigued is graphically shown in a diagram by Vinaj and Maggiora. This shows not only a removal of the fatigue but the establishment of a muscular capacity superior to that shown by the diagram representing the normal fatigue curve.

The effect of cold water applications to remove fatigue must depend upon a stimulation of the nerve centres and not upon any stimulation of the muscle itself, because the nerve centre tires quicker than the muscle. We are able by

[1] *Blatter fur klinische Hydrotherapie*, July 1893.

electric excitation to cause contraction of the muscle though the nerve centre is fatigued, and in spite of the greatest effort no voluntary action can be performed. Probably the stimulation of the blood vessels results in an increased nourishment of the nerve cells so that they are able to work longer. We know that the work of the nerve cells is impaired immediately the blood supply is decreased, whereas we can excite contractions in a muscle which is bloodless.

The Swedish physician, Dr. Ernst Aberg, having himself been rescued from phthisis by ice-water ablutions, effusions, and plunges, and having treated many cases of phthisis during twenty-two years' experience, placed his results before the Scandinavian Congress of Naturalists at Stockholm in 1880. His treatment is a progressive one. He uses three different measures which can be described as grades.

The first one consists in rapid ablution with a sponge over neck, back, shoulders, face, and chest. A piece of ice is placed in a small quantity of water which brings the temperature of the water to freezing-point. Aberg says that ablutions of a higher temperature are less effective and more disagreeable to a patient. At first the water is squeezed out of the sponge a little, but gradually it is left full to increase

the effect. It is extremely important to see that the neck is well cooled off.

These ablutions should be made in the morning, while the patient is still in bed, and he must be well dried and rubbed afterwards and remain in bed for an hour or two, without any added covering unless insufficient reaction should make such necessary. After this has been continued for a few days the operation may be repeated in the evening. The ablutions should be completed as quickly as possible, especially at first, until the patient has become accustomed to them. They have a quietening effect, and usually the patient falls asleep after. Even in quite bad cases they may be used, as they always give the patient some relief. If the patient is doing well and has continued these ablutions for some weeks, he may pass over to the second grade—Effusions.

The patient is placed in an empty tub, and with an ordinary water-can, holding from one to one and a half gallons, water of a temperature nearing freezing-point is poured over him. The spout should be directed on the back of the head and neck of the slightly stooping patient, who, erecting himself, receives the last of the water over the trunk. Very careful drying and rubbing follows. As this procedure requires a

certain amount of strength from the patient, he should take a little exercise afterwards to get quite warm. These effusions, after some time, are prescribed twice daily, morning and evening.

After a longer or shorter time, according to the effect of the effusions and the improved condition of the patient, he may pass over to the third degree, or the bath. As the water in a bath touches the whole surface of the body and deprives it of a considerable amount of heat, Dr. Aberg never used it of lower temperature than 45° F. (7° C.), but never of a higher temperature than 55° F. (13° C.). He did not find it necessary to use any lower temperature, as the effect of the bath can be increased by longer duration. They must, of course, be used in suitable cases and at first taken instantly—in and out. The best time is in the morning, when the patient is still warm in bed, so that he goes straight from the bed into the bath; the patient should also dip the head. After the bath strong frictions and exercise is necessary. The effect of the bath can be increased by gradually prolonging the time the patient remains in it. At first they should be prescribed to be taken instantly, later half a minute, one minute, one and a half minutes, and two minutes.

Of special importance, particularly with weaker patients, is the drying. The skin must be quite dry, dampness must be removed by brisk rubbing, especially when the patient remains up. During the cold time of the year, this procedure should be performed in a warm room or even before a fire. Carelessness in this respect may have a serious result.

Dr. Aberg mentions that, so far from requiring any "heroism" on the part of the patients, as soon as they have once tried it they find so much relief that they look forward to it. It requires some little energy to take the third grade, the cold bath, but the patient is prepared by the two preceding grades, and the desire to get well is in most cases stronger than the prejudice against the cold.

Professor Winternitz refers to Aberg's ice-water treatment with favourable comments, stating that while he does not use such low temperatures as Aberg, he obtains the stimulating effect by applying water of a somewhat higher temperature with very considerable pressure, by the rain bath and douche. All writers on hydrotherapy agree that cold water applications increase the vascular tone, and in this way improve the circulation. They have also a stimulating effect upon the respiration,

and consequently it is the predisposition to consumption which is favourably influenced by hydrotherapeutic measures. The good results which are invariably reported from all quarters where hydrotherapeutic treatment of phthisis is properly administered must be attributed to the effect upon the predisposition and not to any effect upon the tubercle bacillus.

Moderate exercise is always good for consumptive patients, but the word "moderate" must in this case imply not what is generally considered "moderate," but what amount may be considered "moderate" for this or that particular patient.

Remedies which stimulate the appetite are of various kinds, but they are not very efficient. Diet is of great importance and may have to be varied for different patients. In some cases a vegetarian diet seems to have a very good effect, especially in cases with a tendency to rise of temperature. I have seen patients whose temperature was normal when they kept vegetarian diet, but as soon as they ate meat their temperature rose.

Most consumptive patients do well with ordinary food, and do not need any special diet. If a consumptive patient has a weak digestion a diet must be chosen to suit his digestive trouble.

Alcohol is a great danger to consumptives; habitual or heavy drinkers have considerably less chance than others of recovery. Alcoholic excess is a common predisposing factor to the disease. Alcohol present in the blood requires a considerable amount of oxygen for the process of combustion, and therefore puts a greater strain on the already impaired action of the lungs.

The principal ill effect of alcohol is, however, on the circulatory apparatus. Small quantities of alcohol taken occasionally stimulate the circulation, but habitual use of it, especially in large quantities, always impairs the circulation. As bad circulation is one of the features of the predisposition to consumption, it is easily understood that the chronic use of alcohol will undermine a person's resisting power.

For a convalescent patient, however, small quantities of light wine or beer at meals are frequently given with advantage. I have specially noticed that patients whose appetite was rather poor could eat better if they took a glass of claret or burgundy with their meals. Of course, such a thing must be prescribed individually, for as a general rule I believe that consumptive patients are better without any alcoholic drink.

Diet has lately become the most important

point in the treatment of consumption, and great efforts are usually made to get the patient to eat as much as possible. It is generally at present assumed that consumption can be cured by the putting on of fat, and an increase of weight is considered the principal symptom of improvement. Unfortunately, this is a totally misleading symptom, which every one may notice if he will open his eyes and see facts as they are. Certainly cases of consumption where the patients have fallen off much and are very thin (whose nutrition is in a very bad state) will benefit by increased weight. In many cases, where the weight is already high, an increase is a very bad symptom, because too much fat always impairs the respiration and, as I will show later, improved respiration is of greater importance to a consumptive patient than increased weight.

Sanatorium Treatment

About a generation ago it was discovered that consumptive patients live longer or die more slowly in a sanatorium where the conditions of life are specially favourable. Some cases are reported to have been cured by the so-called "sanatorium treatment," but if we investigate these cases we find that either the patients never

had the disease, or they were temporarily run down or overworked, and naturally such patients would easily and quickly recover when they have good rest, good diet, fresh air, and other favourable conditions. Whether one single patient with developed consumption was ever cured by sanatorium treatment is more than doubtful. That in some cases in the sanatoria the disease is brought to a standstill is quite true, but what good is this if the patient breaks down as soon as he comes out and starts work? Everything is done in the sanatoria to conserve the patients' strength that it may last as long as possible, but nothing is being done to increase the patients' strength.

A very common development of the disease under sanatorium treatment is the following. Say, for example, a patient has one lung affected. During his stay in the sanatorium the diseased part dries up and fibroid tissue grows and partly fills the places where the lung tissue is wasted. The tubercles at the same time spread farther into the lung tissue and prepare further wasting. Then frequently the disease invades the other lung, and the result of a year's stay in a sanatorium is that the first lung affected is partly dried up and the disease is fully active in the other lung, which was quite sound when he

started this treatment. I do not say that all patients in sanatoria take this course, but I have seen a considerable number where this has been the result.

One part of the sanatorium treatment is continuous rest when the patient's temperature is higher than normal, and a certain amount of walking exercise when the patient is deemed fit for it. Both these means are detrimental to consumptive patients. Continuous rest impairs both respiration and circulation, and as these actions are already deficient in consumptive patients, it is obvious that rest continued for a long time must make the patient still worse. I quite admit that in some cases a short stay in bed, say for a few days or in some cases even longer, may be beneficial to the patient, but longer complete rest is always detrimental to a consumptive patient. Walking is a bad form of exercise, if taken as a therapeutic means. I will speak about this later.

The apparent good result which has been sometimes observed after a longer confinement to bed can be explained in the following way. When the whole system has been brought down to the same low level of efficiency as the lungs, then there is harmony between the various organs of the body, and the patient feels well

and is apparently better. He has gradually learnt to avoid any strain which might cause the temperature to rise. This state of the patient is always looked upon in the sanatoria as a great improvement, and both doctor and patient are overjoyed. At this time the patient's lungs are fairly well dried up, he feels well, is looking extremely well, with rosy cheeks and a good proportion of fat, and he is dismissed as cured. Of course, he is absolutely unfit to do anything but live the life of an invalid. When the patient leaves the sanatorium he may remain in this condition if he takes great care of himself, but if he starts any kind of work he soon breaks down again.

The principal agent in sanatorium treatment is open air. The good effect of being in the open air has nothing to do with the properties of the air,[1] but merely in the influence of the moving air upon our skin. The cutaneous nerves are stimulated, and this has a very great influence upon our comfort. How much oxygen or carbonic acid the air contains is of no importance for our well-being. The whole effect of open-air treatment is due to the movement, temperature, and moisture of the air, and has

[1] Leonard Hill, *Journal of the Royal Army Medical Corps*, August 1913.

nothing to do with its chemical properties. The stimulating effect upon the cutaneous nerves by wind and weather increases the metabolism and consequently the appetite. In this way the patient is enabled to eat so much that he puts on fat, but this does not in any way make him stronger, and therefore it is no cure.

The best evidence that no one is cured by the sanatorium treatment is that medical authorities have substituted the word "recovery" for the word "cure," and speak of so many consumptive patients having "recovered" in the sanatoria. All writers agree that it is always difficult to find any work easy enough for the patient after his discharge from the sanatorium as "recovered."

If the present so-called sanatorium treatment really had any effect in reducing the mortality among tuberculous people, the keeping up of sanatoria would still be justified, but this does not seem to be the case. W. P. Elderton and S. J. Perry[1] have collected statistics of patients who have undergone sanatorium treatment, and have finished their report in the following words: "We confess that these conclusions are not those we hoped to reach. It would have

[1] *A Third Study of Pulmonary Tuberculosis: the Mortality of the Tuberculous and Sanatorium Treatment*, London, 1910.

been far more pleasant to record that the whole-hearted energy of those members of the medical profession who have devoted themselves to sanatorium treatment had succeeded in reducing the mortality among the tuberculous, but we cannot go beyond our statistics or introduce opinions they do not justify."

The general introduction of sanatorium treatment has a decidedly detrimental effect upon the community. The constitutions of thousands of consumptive patients are weakened in a sanatorium and they are kept alive artificially to produce degenerate children. Children of consumptive parents do not always develop tuberculosis; frequently the children of such parents are born with a neuropathic taint, and are likely to develop any mental abnormalities. In this way sanatorium treatment is one of the causes of the increase of insanity and other mental diseases. From this point of view alone the abolition of the so-called sanatorium treatment would be justifiable.

As already pointed out, physical exercise is considered by some writers to be imperative for the recovery of consumptive patients. The idea of physical exercises as a means for the treatment of consumptives is of very old date. More than two centuries ago two English

medical men, Sydenham and James Fuller, recommended physical exercises for consumptive patients. In 1680 Dr. James Fuller published a book, *Medicina Gymnastica*, in which he pointed out the great value of physical exercises for the health. This book came out in nine editions, the last one in 1777. I feel sure that this book has had a wide influence upon the development of sport in England during the last two centuries.

Nowadays breathing exercises are mentioned by some writers as good for consumptive patients, and generally walking is prescribed in the sanatoria, but no scientific treatment with physical exercises has yet been officially adopted.

Various serums have been used in the treatment of tuberculosis, and I think Robert Koch was the first to introduce the so-called tuberculin as a special agent against tuberculosis; since then many different tuberculins have been produced, but the great hopes which have been placed in these remedies have turned to grave disappointments. Of course, opinions vary enormously. Sir Richard Douglas Powell[1] says on this point: "It is very difficult to adopt a completely judicial view on the usefulness of tuberculins in tuberculosis amid the chaos of

[1] *Practitioner*, London, July 1913.

opinions that prevails, varying from enthusiastic acceptance of their almost infallible curative influence to utter scepticism of their possessing any value at all." I believe I come very near the truth if I say that tuberculins judiciously administered, at least in some cases, reduce the tubercle bacillus, but at the same time usually have an injurious effect upon the patient's general health and strength. Tuberculin is not in any sense at all a cure for consumption (even if it should eradicate the tubercle bacillus in the patient), because it has no effect upon the predisposition (or if it has any effect it is an injurious one) and the patient would soon become again infected.

The administration of tuberculin is usually guided by the temperature of the patient, but this guide is quite fallacious, and therefore it is merely by good luck if the patient happens to receive the right dose of tuberculin. As I have said before, the temperature of a patient depends to a great extent on the circulation, and not only upon the presence of tubercle bacillus or inflammatory processes of other kinds. Besides this, the temperature varies in different parts of the body, and various opinions prevail as to the temperature of which part of the body should be used as a guide for tuberculin treatment;

some take the mouth temperature and some take the rectal temperature, but frequently the difference between the mouth and rectal temperature is as much as 4° F., therefore it is easy to imagine what a misleading guide the temperature must be. If I should suggest anything on this line I would rather take the arithmetical medium between the mouth and rectal temperature, but happily we can dispense altogether both with tuberculin treatment and with the temperature as a guide for any treatment.

The use of tuberculin ought to be prohibited altogether, because even in cases where tuberculin seems to reduce the tubercle bacilli it is of very little value, if any at all, and frequently does the patient actual harm.

In close connection with the theories as to the effect of serums has emerged a theory which, nowadays, is very much in vogue among medical men, namely, the auto-inoculation theory. This expression is a very unfortunate one, as the explanations of the facts concerning it are in reality not in accordance with the title. It has been said, and I think it is believed, by a great number of medical men that exercise increases the blood stream, which carries with it a greater amount of poison from the tubercular focus in

the lung over the body, and this in its turn causes an auto-inoculation with a rise of temperature. On the other hand, when a patient has a complete rest in bed the blood stream slows down and carries less poison out into the body, and the result is a cutting off of the auto-inoculation with a decrease of temperature. This theory is not correct. Exercise may cause auto-inoculation or may not, it depends entirely upon what kind of exercise has been employed. Over-exertion always causes auto-inoculation. As A. E. Wright[1] says: "The complete rest in bed which gradually reduces the temperature in the large majority of cases of tubercular phthisis, as well as in other localised forms of tubercular infection, is, I take it, to be regarded as a therapeutic measure for making an end to those auto-inoculations which follow upon every over-exertion."

Of course after over-exertion it is best to let the patient stay in bed, but I do not regard this as a therapeutic measure; the object is simply to give the patient the best chance to recover from his over-strain. This auto-inoculation is not an inoculation in the usual meaning of the word; the explanation of the facts is as follows. Every over-exertion results in an increased

[1] *Studies on Immunisation*, London, 1909.

stagnation of the lymph-fluid, which makes it a suitable soil for the tubercle bacilli. Naturally, when the soil is prepared the tubercle bacillus will rapidly increase, but this increased stagnation of the lymph-fluid takes place, first and principally, in and around the tubercular focus in the lungs. This fact is easily ascertained, as the area of the crepitation is usually larger after an overstrain.

The assumption that the blood current during or after exercise carries poison from the tubercular focus out all over the body is perfectly absurd, on the following ground. After an overstrain the action of the capillary vessels is rather decreased although the action of the heart is increased. Therefore if it is the capillary vessels which carry the poison from the tubercular focus out into the body, they should carry less of it after an overstrain. On the other hand, exercise which is no overstrain tends to accelerate the blood current in the capillary vessels, and consequently in this case more poison would be carried from the tubercular focus out into the body; but this cannot be the case, as there is no rise of temperature. If it were true that increased blood current spreads poison from the tubercular focus, then after gymnastic exercises there would be a rise of

temperature, and this is never the case, unless the patient has been overstrained, which of course ought never to happen.

Of course, if a patient has had an overstrain there is no objection to his having a thorough rest for a short time, but even during this time he will greatly benefit by gymnastic treatment, which naturally must be suited to his condition. A rest after an over-exertion gives the stagnated lymph-fluid a better chance to be absorbed, but in cases where there is a chronic lymph stagnation the patient will not benefit by a complete rest, because he needs physical exercise to prevent his circulation becoming worse. It is in these cases where the temperature remains high when the patients have complete rest in bed.

Speaking about auto-inoculations, A. E. Wright[1] says: "We have been able to show that auto-inoculations follow upon all active and passive movements which affect a focus of infection, and upon all vascular changes which activate the lymph stream in such a focus." This is not correct; it is true that sometimes active as well as passive movements may have such an effect, but it depends entirely upon what kind of movements are used. Certain active as well as passive movements have quite

[1] *Studies on Immunisation*, London, 1909, p. 343.

the opposite effect to other movements. All movements, active or passive, which activate the lymph stream prevent an auto-inoculation, because the soil is made less suitable for the tubercle bacillus; whereas all movements, active or passive, which cause a dilation of the lymph vessels make the lymph stream slower, and so facilitate an auto-inoculation, as the stagnation of the lymph-fluid constitutes a good soil for the tubercle bacilli.

Active movements which activate the lymph stream are all those which, in each particular case, effect the normal blood distribution, and give an increased blood supply to the muscular parts. Active movements which tend to make the lymph stream slower and cause over-exertion are all those which, in each particular case, effect a reversed blood distribution, a decreased blood supply to the muscular parts.

Among passive movements which activate the lymph stream, fine vibrations are of the greatest importance. To illustrate the activating influence of fine vibrations on the lymph stream, I will mention some special cases. A middle-aged man had a transverse fracture of the patella with exudation of blood in the knee-joint. A week after the fracture had happened I saw the patient; the knee was still very much

swollen, and now vibrations were made once daily for about twenty minutes without removing the bandage. After six days the bandage was changed; the exudation had completely disappeared. The parts of the patella could easily be brought into complete touch with each other, and were kept in place with strips of plaster and healed up quite well. Why the exudation disappeared so quickly can only be explained by the considerably increased activity of the lymph vessels caused by the vibrations.[1] This was a non-infectious case.

Equally good results are obtained by using vibrations in cases of infectious complaints. I have before described the treatment with vibrations in five cases of rheumatic fever.[2] In all these cases the effect was to be seen immediately; the pain in the inflamed and swollen joints lessened during the time the vibrations were performed, and the temperature sunk considerably every day, and after four or five days' treatment the temperature was normal, and in

[1] It may be better treatment in a case of this kind to open the knee-joint and sew the parts of the patella together, but on account of various circumstances which made an operation in this case almost impossible, the above-mentioned treatment was resorted to.

[2] *Svenska Gymnastiken i In- and Utlandet*, 1907.

no case did the temperature rise again above normal. The swelling of the joints was visibly reduced during the few minutes the vibrations were performed. I take it, that it is the increased activity of the lymph vessels which causes absorption of the stagnant lymph-fluid in and around the inflamed joints, and so deprives the bacilli of the soil they need. This is also a method of immunisation, and I am sure much more efficient, more rapid, and more certain than any immunisation by serums or vaccines designed to call forth an anti-bacterial reaction in the organs.

The patients were treated once a day, and after eight to twelve days they were all quite well, but were kept in the hospital more than a month to make sure they had no relapse. I add the temperature charts of two of these patients. Miss E., aged 21, was admitted to the hospital on 19th December 1906. Two days previously both her knee-joints became suddenly swollen and very painful. The day after her admittance in the hospital I started treatment with vibrations on all the affected joints. Both her ankles and knee-joints as well as both elbow-joints and shoulder-joints were swollen and extremely painful. I may say that the vibrations must be given with the fingers

so delicately and gently as to cause the patient no pain at all. From the temperature chart (Fig. 1) can be seen that after four treatments (once a day) the temperature, which was 104°·8 F. when I started, had gone down to normal; I continued the treatment to 31st December, when all the joints were painless and the patient felt quite well. She had no relapse.

Miss H. P., aged 24, was admitted to hospital on 1st January 1906. She had been suddenly taken ill a week before with a chill, pains in the throat, and fever. Soon the joints began to swell and became very painful. She had had rheumatic fever twice previously, nine years and four years ago. On 8th January I began to give the patient treatment with vibrations on all the inflamed and painful joints. From the temperature chart (Fig. 2) can be seen that the temperature had risen to 105° F. (40°·5 C.), but during my treatment it rapidly fell, and after a week's treatment became normal. Patient had no relapse.

Naturally, in the case of acute inflammation, the effect of the vibrations is much more marked than in the case of chronic inflammation. The important point, however, is that activating of the lymph stream decreases the inflammation, causing immunisation and not

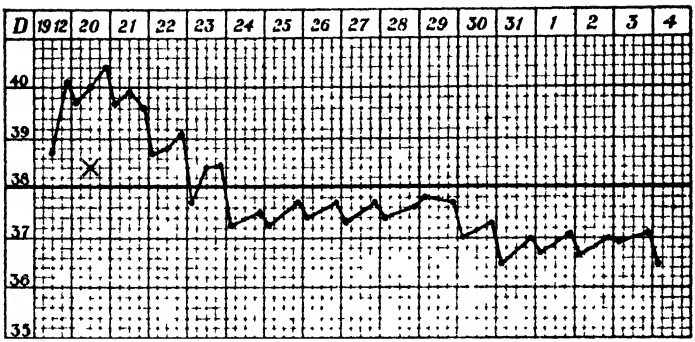

FIG. 1.

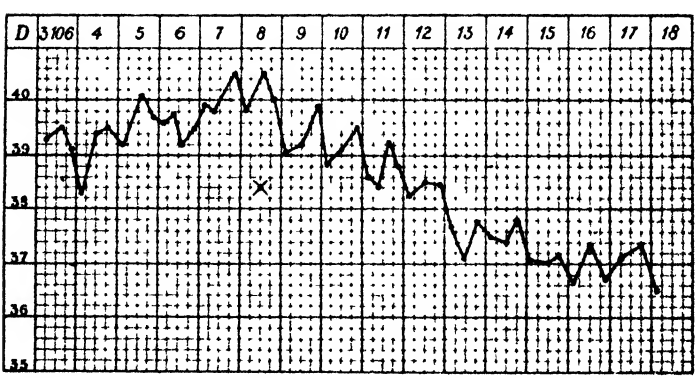

FIG. 2.

Temperature Charts of two patients with acute rheumatic fever, showing the rapid fall of temperature during treatment with vibrations. The crosses mark commencement of the treatment.

auto-inoculation, because the soil is made less suitable for the bacilli. In the case of acute inflammation, any active exercise touching the inflamed part would aggravate the lymph stagnation and consequently be harmful.[1] Any passive movement except very fine vibration would have the same harmful effect. In the case of chronic inflammation the matter is quite different. Here various, both active and passive, movements may be beneficially employed, but it is extremely difficult to make any general rule regarding this; it must be left almost entirely to personal judgment and experience to decide in each case how the treatment should be performed.

Tubercular infection always causes a chronic inflammation, and what active or passive movements may be usefully employed I mention in another place.

Prolonged stay in bed is, in my opinion, always harmful to patients with pulmonary tuberculosis, but it is at present largely used as a therapeutic measure on the theory that the patients are, during long rest, making progress in the direction of a cure. Writers on this point forget that prolonged rest in bed always impairs

[1] Sylvan, "Massage vid ledakommor," *Svenska Gymnastiken i In- and Utlandet*, September 1906.

the patient's circulation. This increases the predisposition to consumption, and consequently the patient's condition becomes worse. A. E. Wright[1] says on this point: "We may usefully ask ourselves exactly how much will have been achieved in the case of a tubercular infection, if when the influx of tubercular poison into the blood has been arrested and the pyrexia has been abolished we stop at this point. The question is an all-important one, in view of the years and years of inaction to which many patients are condemned on the theory that they are, while they continue to rest and wait, every day, making progress in the direction of a cure. To any one who has surveyed the tuberculous patients laid out on spinal chairs in our sea-side health-resorts — waiting: or the patients who are lying in bed or on deck-chairs in our open-air sanatoria — waiting: it is plain as demonstration can make it that there is gained for the patient by the arrest of the influx of tuberculous poison into his blood, the power of assimilating his food and an appearance of vigorous health. If only to the appreciation of this fact there could be added the belief that the cure of bacterial infections depends neither on the storage of fat nor upon the bronzing of

[1] *Studies on Immunisation*, p. 278.

the skin, nor yet upon the breathing of fresh air (seacoast air, country air, pine-wood air, mountain air, or warm southern air), but only upon the destruction of the invading bacteria by the anti-bacterial substances of the blood (with or without the co-operation with the leucocytes), we should, I think, have come close to the truth."

To the first sentence of this, my answer is that the patient has recovered from his over-exertion and very little more has been achieved. The stagnation of the lymph-fluid caused by the over-exertion has lessened, and consequently the soil is less suitable for the tubercle bacilli; at the same time, however, if the complete rest in bed has been long the patient's circulation is weaker, and he will be able to stand less strain than heretofore. This means in practice that the patient has grown worse, and that such a patient must live the life of an invalid and never put any strain on himself, as this would result in increased lymph stagnation with following auto-inoculation, therefore complete rest in bed can never be considered as a therapeutic measure in the direction of a cure. The longer complete rest a patient has had, the less chance he has of being cured. I have always found that patients who have undergone *no* rest-cure were comparatively easy to cure, whereas those who had taken

a rest-cure needed much longer treatment, and the longer rest-cure they had had the more difficult it became to accomplish a complete cure. The only means to a cure is to improve the circulation to such an extent that the patient can stand the strain of ordinary life without causing him an over-exertion.

The connection between generalised and localised infections and auto-inoculations depends, in my opinion, upon the state of the circulation. A. E. Wright[1] says: "Generalised infections must be characterised by frequent, perhaps continuous auto-inoculations; that strictly localised infections must be characterised by an absence of auto-inoculations; and that there must be an intermediate class of localised infections which are associated with occasional disturbances—where there must be occasional auto-inoculations."

In cases of generalised infection the general circulation is bad, and consequently any little over-exertion will result in lymph stagnation with the following auto-inoculation. In cases of strictly localised infection the general circulation is good, and if such person has a slight over-exertion he recovers from it so quickly that auto-inoculation has not time to take place. In cases belonging to the intermediate class of localised

[1] *Studies on Immunisation*, p. 343.

infections the general circulation is fairly good, so that the patient seldom has a strain sufficient to cause disturbance of the circulation with following auto-inoculation.

If a vaccine is successful, it causes immunisation only against an infection of its own kind, whereas immunisation brought about by gymnastic treatment increases the patient's resisting power against any infection. I may mention the following examples: Mr. Y. had suffered for many years with his lungs. Tubercle bacilli, pneumococci, and Micrococci catarrhalis were present in his sputum. When he had tuberculin treatment, the tubercle bacilli decreased and the pneumcocci and Micrococci catarrhalis increased. Then he had treatment with vaccine of pneumococcus, with the result that the pneumococci decreased and the other bacilli increased. Vaccine of Micrococcus catarrhalis decreased these bacilli, but the tubercle bacilli and pneumococci increased. At last all three vaccines were given alternately, but this proved to be too much for the patient, he became ill, so the treatment had to be discontinued.

The following case illustrates the effect of gymnastic treatment upon the resistance power against infection. Elene W. (p. 196), 6 years old, had for a year suffered from pulmonary tuberculosis

when she came under my treatment in June 1913. In October of the same year she was quite cured. In the following December her sister and brother contracted mumps rather severely, and she herself also developed this disease but in a much milder form. One would rather have expected that so soon after the recovery from a long and severe illness the infection with mumps would have proved severe, but the disease took in her a milder form than in her sister and brother, and she recovered much more quickly than they.

The gymnastic treatment had not only cured her pulmonary tuberculosis and made her immune against the tubercle bacillus, but also at the same time increased her resistance power against the infection of mumps.

Of late years physical exercise has been used in the treatment of consumption in the form of various kinds of manual labour, such as carrying baskets of various weights, sweeping paths, chopping firewood, painting with a large paint-brush, cutting grass, hoeing, general light work about the house or garden, further digging with a small shovel, mowing grass, mixing concrete, and even hard navvy work, described by Marcus Paterson.[1] This writer seems to attribute every

[1] *Auto-Inoculations in Pulmonary Tuberculosis*, London, 1911.

rise of temperature in a tuberculous patient to auto-inoculation, and mentions that patients at the Brompton Hospital already suffering from fever frequently had a rise of temperature immediately after the visit of the physician, and he attributed this to auto-inoculation caused by the physical examination: he says that the nurses used to attribute such rise to excitement (p. 35). I think the nurses in this case showed better judgment and more common sense than the doctor. Excitement always has an effect upon the circulation as well as upon the temperature of the body.

Manual labour of the above-mentioned kind may be quite beneficial for patients who can stand it, to give them occupation and let them get used to some work, but it cannot be considered as scientific treatment. To give the patient physical exercises which cause a rise of temperature is to over-exert him, and to use over-exertion as a treatment is simply absurd. Besides, such work can never be properly graduated: one patient does the same amount of work with twice as much effort as another. Of course such work may improve the muscular system of the patient and prevent his growing weaker, but it is merely good luck if any patients get well under this kind of treatment. If the author of

this treatment had brought it out some two hundred years ago, at the time of James Fuller and Sydenham, it would then have been an advance on previous methods, as at that time no science of physical exercises existed; but in our time, when we have a highly developed scientific system of physical exercises, to go back to using walking and manual labour as a therapeutic measure is crude and clumsy — one might as well revert to the antique custom of consulting a barber in surgical cases.

CHAPTER VII

The cure of consumption by gymnastic treatment—Normal and reversed blood distribution—The nature of fatigue —Effect of scientific exercises upon the higher nerve centres — Effect of gymnastic treatment upon the features of the predisposition, upon respiration, circulation, and nutrition — Running and swimming for consumptive patients

If we treat a patient with drugs it is necessary to write down a prescription of certain drugs having a special desired effect, and of these drugs we prescribe a certain dose. Exactly in the same way we use gymnastic treatment for a patient. We must make up a prescription with certain exercises, with a special desired effect, and how much of these exercises the patient should do and how often he should do them.

Medical men have to study in their curriculum the effect of different drugs and what doses should be given in different cases. But the medical curriculum does not yet provide any

instruction about the effect of gymnastic treatment, nor any tuition of its technique, which is of decisive importance for the proper use of such treatment. It is comparatively easy to prescribe drugs, because certain distinct doses of each are always used, whereas during gymnastic treatment the prescription must be varied according to the improvement and other conditions of the patient. Therefore, far more knowledge, skill, experience, wisdom, and judgment of the medical attendant are required when gymnastic treatment is used than when drugs are prescribed. Not even this is sufficient to be able to administer effective gymnastic treatment, a certain talent for the technique is required, which in some people is inborn, but which many other people never can acquire; consequently this treatment must be a speciality, just like surgery. Of course it is far more comfortable for a medical man to sit in his arm-chair at his writing-table and write down a prescription for a bottle of medicine, and tell the patient to take so much so many times a day, rather than to give resistance-exercise, petrissage, and vibrations, which is rather strenuous work if one has more than twenty-five patients a day.

Beside this difficulty for the general intro-

duction of gymnastic treatment, we have the strong and well-known prejudice against any new method, which always has been fashionable among the medical authorities.

Before we can expect to have any really good result in the treatment of consumption by physical exercises we must first of all know two things:

1. The exact nature of consumption.
2. The effect of each physical exercise upon the various organs of the body.

I have before described what constitutes the predisposition to consumption, and by eradicating this the disease is cured. *The various features of the predisposition are physical conditions and can only be remedied by physical means*, among which exercises have the foremost place.

I have already stated that the weakness of the inspiratory centre in the cortex is one of the features of the predisposition. Several writers (Bechterew, etc.) during their experiments noticed the intimate connection between the general motor and the breathing centres. The system of association tracts constitutes the connecting-link between one sensitive-motor centre and another, as, for example, from the vision centre to the hearing centre, from

smell to vision, or from motor to breathing centre. If in two sense-centres of the cortex simultaneous or closely following excitations take place, then by virtue of the existence of association tracts only one of these excitations needs to be repeated afterwards in order to animate the perception in the other sense-centre.

Bechterew mentions the following experiment, which will explain this rule. A solution of acid was dropped into the mouth of a dog, which caused an increased secretion of saliva, and at the same time a certain tune was played on the piano. When this performance had been repeated a number of times, the tune on the piano *only* needed to be played once to cause increased secretion of saliva. This same rule we can apply for the strengthening of the inspiratory centre in the following way. Let the patient make a movement and let him inhale deeply at the same time. For example, let him raise the arms during inhalation, and lower the arms during exhalation. When he has repeated this a number of times, as soon as he starts the movement the inhalation will, by virtue of the existence of association tracts, unconsciously become deeper. Of course, in practice there are many special points of great importance to consider. It is not sufficient

for the patient to go through one exercise only. He must in the same way combine the act of inhalation with the motor function of every muscle group in the body, and thus acquire the habit of breathing deeper as soon as he starts any kind of movement.

In making the movement a *resistance* exercise the effect on the cortical centre will be considerably increased, and I conclude that it is principally in this way that the inspiratory centre is strengthened. It is necessary to make the effect on the cortical centre as strong as possible, otherwise it might be disturbed by other impressions. When the inhalatory centre is once strengthened the patient will *always* breathe more deeply, and not only during the time he is doing muscular exercises.

The resistance exercises must be, to begin with, very easy, and only gradually increased in strength, otherwise they would have the contrary effect to that desired. I start always with very easy exercises, and very slowly and gradually proceed to stronger ones. This has proved, by experience, to be necessary, and the same experience has been made during the laboratory experiments. Bechterew found that new or strong excitations had a lessening effect on the associative reflex.

This means in practice that if we start exercises too suddenly, or if we make a too great increase in the strength of the exercises, the effect upon the inspiratory centre will be lessened instead of increased, and consequently the patient would get worse.

What I have already stated shows how extremely important it is to start with easy exercises, and how very careful we must be when we allow the patient to pass on to stronger exercises.

The treatment of the second feature of the predisposition (deficient circulation) is principally also by gymnastic exercises. We must make the circulatory centres stronger, as this is the only way in which we can permanently improve the circulation.

We know that both blood circulation and lymph circulation are under nervous influence. With regard to the arteries this has been proved by Stilling and C. I. Bernard. The nervous regulation of the veins was proved by Goltz, and the nervous influence on the capillary vessels by Steinack and Kahn.[1] There are vaso-constrictors and vaso-dilators. The blood pressure and the distribution of the blood to the various parts of the body is directed from

[1] Lewandowsky, *Handbuch der Neurologie*, 1910.

the vaso-motor centre in the medulla, but it is also influenced by circulatory centres in the cortex, and probably also by circulatory centres in the spine and in the ganglions of the sympathetic nerves.

The lymph circulation is also doubtless directed by the nervous system.[1] In the lymphatic vessels Camus and Gley[2] found vaso-motoric nerves causing constriction as well as those causing dilation.

The action of the various circulatory centres is very complicated, and further researches will surely reveal more facts about this important matter.

By experience we know a great deal about the influence of physical exercises upon the circulation, but naturally the views on this matter are bound to vary as much as personal views and observations vary. Frequently the opinions hereon are guided much more by prejudice and assumptions than by accurate observations and facts. It is therefore of the utmost importance that more researches into the influence of various physical exercises upon the nervous system and circulation should be made both under physiological and pathological conditions.

[1] Bechterew, *Funktionen der Nervencentra*, 1911.

[2] *Arch. de physiol. norm. et path.*, Paris, 1895.

Ernst Weber[1] has found that the increase or decrease of the blood supply in various parts of the body follows certain rules, which he confines in the following table:

	Brain.	External Parts of Head.	Abdominal Organs.	Limbs and External Parts of Trunk.
At conception of muscular movement (with or without performance of the movement) . . .	+	−	−	+
At mental work .	+	−	+	−
Fright . . .	+	−	+	−
Agreeable impressions . . .	+	+	−	+
Disagreeable impressions . . .	−	−	+	−
Sleep . . .	+	...	−	+

+ means increase; − decrease of the blood supply.

This table shows the increase or decrease of the blood supply in healthy and normal persons who had been rested. If a person is tired either by mental or physical work, the normal fluctua-

[1] *Der Einfluss Psychischer Vorgange auf den Korper*, Berlin, 1910.

tion of the blood supply is reversed, so that where there should normally be an increase there is a decrease. This is also very often the case in persons who are ill. So, for example, he has proved that a normal increase of the blood supply to the brain during mental work is in neurasthenic patients reversed into a decrease.

It is obvious that a decreased blood supply to an organ in activity must impair the function of this organ, and further, if the organ has to work strenuously during some considerable period of time with an insufficient blood supply, it is bound to be detrimental to the organ itself. E. Weber[1] has further shown that certain relations exist between respiration and the distribution of the blood in various parts of the body. For example, a long deep inspiration causes in a healthy person lowering of the blood pressure and decrease of the volume of the arm. In persons who are ill there is an increase of the blood pressure and also an increase of the volume of the arm.

Relating to all the known facts regarding the circulation and distribution of the blood, although the following has not been actually proved, I may be justified in assuming that in consumptive people and probably also in people with a predisposition to consumption, the normal increase

[1] *Arch. Anat. and Physiol.*, 1913, iii. and iv.

of the blood supply simultaneously following a deep inspiration is reversed into a decrease. The natural result of this would be that the nutrition of the lungs is disturbed, and this in time renders the soil suitable for an invasion of tubercle bacilli.

As I said before, the ordinary increase of the blood supply to the brain during mental work is in neurasthenic patients reversed into a decrease; however, this is not the case when such a person is rested and starts to work. At the commencement of the mental work the blood supply is increased, but after a very short time the increase lessens. It seems as if the circulatory centres were tired out quickly. The same thing happens after a person has tired himself out with muscular work.

It is quite evident that a certain amount of work can be done by a person who is ill with a normal blood distribution, and when this amount, which is different in each person, has been exceeded, the blood distribution reverses. If we, therefore, use physical exercise as a means of improving the circulation we must not exceed the point where the blood supply reverses. Gradually the amount of physical or mental work which a patient can do before he reaches the point of reverse will increase, and by and by he will come nearer the amount which a normal

person can perform without reverse of the blood distribution.

When using gymnastic treatment it is imperative that the patient should not be in the least tired, and consequently it is of the utmost importance to know exactly the nature and cause of fatigue.

Experiments on animals have proved that, through continuous activity of the muscles, substances are produced in them the presence of which reduces their working ability and causes fatigue. These substances of fatigue may be washed away by normal salt solution passed through the muscle, and then the working ability of the muscle returns.

In another way, if the blood of a highly fatigued animal which contains a great quantity of these substances of fatigue is passed over into the blood vessels of a fresh animal it causes immediate fatigue in this animal.

A highly important factor for removing fatigue is the supply of oxygen; the more oxygen supplied to the tired muscle the quicker it will recover up to a certain degree. Consequently the muscle will recover much quicker by the supply of arterial blood than by the supply of venous blood. All these facts show what an extraordinarily beneficial influence on the work-

ing ability of the muscles an increased blood supply must have, which Weber has shown in man normally follows muscular work and which constitutes a redistribution of the blood from the abdominal organs to the external muscular parts of the body during simultaneous increase of the activity of the heart.

The small blood vessels and capillary vessels in the muscles dilate during this process, so that a much larger portion of arterial blood passes through the working muscles than before, by means of which the fatigue of the muscles will be delayed and the working ability increased to the maximum.

On the other hand, all these facts make it equally conceivable how injurious to the working ability of the muscles it must be when under certain conditions the normal increase of the blood supply during muscular work reverses, because in this case the muscles receive during their work not only no increase of arterial blood, but even less than during rest. Consequently the muscles must suffer as the supply of oxygen and other nourishing substances is decreased, as well as the washing away of the used-up substances is delayed.

At the experiments on animals the greater muscular fatigue was caused by the movements

of the muscles during electric excitation of the nerve or muscle itself.

At the voluntary performance of muscular work in man we have also to consider that the brain which causes the impulse to muscular movement could tire separately and perhaps earlier than the muscle itself.

Frequently the muscle cannot use its full strength, if for some reason or other the brain for the moment is prevented from applying its full energy. It is even possible to cause muscular movement by direct electric excitation of the nerve when a person cannot voluntarily, in spite of the greatest effort, effect any movement. There is no doubt that a redistribution of blood in the body during muscular work is caused by a central enervation of the blood vessels from the brain. In normal circumstances the dilation of the blood vessels in the muscles is not limited to the area of the working muscles alone, but the redistribution of blood is the result of a rather complicated change of the width of the blood vessels in all the different parts of the body under increased activity of the heart. The blood vessels of the abdominal organs contract, whereas the blood vessels of all the external muscular parts of the trunk and of the limbs dilate; at the same time the blood vessels of

the face contract and the blood vessels of the brain dilate (Weber).

These occurrences can naturally only take place through simultaneous enervation of the various blood vessel areas from the brain, and the same complicated redistribution of blood can also be effected in the animal by electric excitation of the motoric area of the cortex.[1] To effect this blood distribution the participation of the cortex is of excessive importance, and by cutting off the connection with the cortex this effect fails. The same blood distribution which is effected by muscular work can also be effected without this muscular work being actually performed, if to hypnotised persons was suggested the conception of muscular action. In this case, the effect is even stronger, through absence of any disturbing influences, than if the work was carried out with full consciousness. On the other hand, if the same localised muscular movement which voluntarily performed caused the above-mentioned blood distribution was passively performed with the same effort by some other person upon an unconscious person in hypnotic sleep, this blood redistribution does not take place.[2]

[1] Lewandowsky and Weber, *Arch. Anat. and Physiol.*, 1906.

[2] Weber, *Der Einfluss Psych. Vorg.*, etc., Berlin, 1910.

If this blood redistribution during muscular work is dependent upon the co-operation of the brain, then it is quite clear that when the blood distribution is reversed the condition of the brain must be the decisive factor. Naturally the excitation from the cortex is not conducted direct to the blood vessels, but through the mediation of the various nerve centres for the blood vessels.

Experiments have shown that when the muscular action of one part of the body, for example, the arm, begins to show objective signs of fatigue (causes a reverse of the normal blood distribution), the muscular action of another part, for example, the foot, still effects the normal blood distribution (Weber).

In this way we may be able to let the one muscle group after another work until all the various groups of muscles in the body have been exercised, without causing the normal blood distribution to reverse. It means, in other words, without causing any fatigue of the circulatory centres.

Practical experience with gymnastic treatment shows exactly the same result. In using resistance exercises, which bring into play only a small group of muscles, we are able to let a patient perform a number of exercises without

causing the slightest fatigue. The effect of these exercises is principally upon the circulatory centres. The muscular effect in these exercises is so slight that it hardly counts. The amount of used-up substances is hardly worth mentioning, and gradually increasing the number and the strength of the gymnastic exercises, the effect upon the circulatory centres is gradually increased, so that the nerve cells in these centres have time to develop and grow stronger, and that exercises which before the start of the treatment caused a reverse of the blood distribution now effect the normal blood distribution. How far we can advance to increase the exercises and still effect the normal blood-vessel reaction depends entirely upon the patient's constitution.

The time which is necessary to recover from fatigue, or in other words, the time which is necessary for the signs of fatigue to disappear, is naturally dependent upon the amount of effort as well as the duration of the muscular work which causes fatigue, but probably still more upon the bodily condition and training of the person himself. Weber mentions two cases which show a great difference in this respect. The one showed the normal blood-vessel reaction an hour and a half after a ten minutes' run;

whereas the other one, who was delicate and not used to any muscular work, after four hours still showed the objective signs of fatigue (reversed blood distribution).

The principal thing we have to do to strengthen the circulation, or in other words to make a person able to stand a greater strain without reverse of his blood-vessel reaction, is to start with a number of gymnastic exercises which are not sufficiently strong to cause a reverse of his blood-vessel reaction, and slowly and gradually proceed to stronger ones.

Without knowing these physiological facts, P. H. Ling found by experience that various exercises employing only a small group of muscles had a beneficial effect in improving the circulation and strengthening a person's constitution and general health. He divided the exercises into different groups according to their effects; by an exceptional gift of observation he found out through experiments in what order exercises from the different groups should follow upon each other so as to have the most beneficial effect. He had no intention of developing large muscles, his principal object was the general well-being of his pupils. His system has been described under the title of "Swedish Educational Gymnastics," and various

books on the subject have been published, so I refrain from a detailed description of it. The physiological effect of Ling's gymnastic system is very little known. It is frequently believed that the principal effect of physical exercises, even when performed in accordance with his scientific system, is to strengthen and develop the muscles. Such an opinion is entirely erroneous. Over-development of one part of the body can only be accomplished at the expense of other parts, consequently a too great muscular development is certain to be injurious to vital parts. Good health and long life can only be achieved by a harmonious development and efficient performance of their function by all the different parts of the human body. Practical experience tells us that champion athletes seldom live to exceed fifty years of age. The effect of Ling's gymnastic system is to exercise every nerve centre. In daily life we have no use for any muscular over-development; but it is of the greatest importance for every one that his brain should be in a high state of efficiency, and this is effected only by proper gymnastic exercises.

I will mention a few instances which prove this fact. In a London school Swedish drill was introduced in 1897. Before that there

were physical exercises of some kind, and under the old régime accidents were very frequent—almost every day there was a broken bone or dislocated joint. That serious accidents were very frequent was shown by the fact that a medical man who lived close to the school often came to watch the physical drill in order to be ready at hand when an accident occurred; he seldom came in vain. After the Swedish drill, under a rather clever instructor, had been introduced in this school, the number of accidents decreased rapidly, and after some time it was quite an exception if an accident took place. Subsequently during two years not a single serious accident happened. The medical man ceased his visits to the school because his services were never required.

These facts clearly show that Ling's gymnastic system has a strengthening effect upon the higher centres of the brain, especially upon the association tracts, and therefore it improves the ability of observation and presence of mind, and at the same time gives a full control over all movements. I give another instance of this. A mining engineer used, during two years, to do physical exercises according to instructions from one of the advertising "experts" on physical culture. In his profession he had daily to solve

mathematical problems. During these two years he required on an average two hours to solve each such problem. After that he gave up these exercises and took part in a gymnastic class under a Swedish instructor. During the following two years he required on an average only half an hour for the same class of mathematical problem for which he formerly needed two hours. During both these periods he was living exactly the same life, there was no difference except in the exercises. The difference in the working capacity of his brain, so that he could get through a certain amount of work in much shorter time, I attribute to a better circulation in the brain. I have seen numerous other cases with exactly the same result.

Several tennis players have told me that after leaving the game for over a year, on taking it up again they played better than ever before, having received gymnastic treatment in the interval. They were surprised, because they had expected to play less well after being out of practice for so long. They attributed the fortunate result to the gymnastic exercises. It is only possible to explain this by a strengthening of the higher centres in the brain, especially the centres for attention and the centres for controlling of movements.

I may perhaps mention that several of these patients mentioned this fact spontaneously, so that any kind of suggestive influence from my side was quite out of the question.

From the above-mentioned examples it is evident that gymnastics after Ling's system have a far better effect upon the general circulation than either sports or athletics. We know by experience that automatic exercises, which can be performed without the attention being fixed on them, have very little influence on the circulation. We may explain this fact in the following way: The centres for the blood distribution are situated in the frontal lobe in close connection with the centres for co-ordination of movements and the centres for attention. The muscular centres are situated in the centre of the brain. An automatic movement is directed from the muscular centre, and the centres in the frontal lobe hardly participate in this action, and therefore no influence upon circulation is effected; whereas gymnastic exercises, requiring attention and co-ordination of movements, necessitate the participation of their centres in the frontal lobe, which simultaneously bring about the stimulation of the centres for the blood distribution and so influence circulation. This is the reason why habitual exercise, like walking or riding, is of

little avail for the improvement of the circulation. Experience has proved that the effect of gymnastic exercises is decidedly better when the patient has his attention concentrated on them, than if he has his attention fixed on something else. During resistance exercises the patient is obliged to fix his attention upon them, and therefore these exercises are most efficient for the improvement of the circulation.

The first improvement in consumptive patients during gymnastic treatment is the increase of the vital capacity, and the lower the vital capacity was the more rapidly it increased at the beginning of the treatment. In many cases every day there is a considerable increase of the vital capacity, and after a week's treatment the patient can breathe much more freely, is less short-winded, and feels more comfortable. In one patient, Mr. G., 24 years old, the vital capacity at the commencement of the treatment was 260 c.c., and after a week's treatment it had risen to 1500 c.c. In another patient, Miss W., 25 years old, the vital capacity at the commencement of the treatment was 300 c.c., and after a week's treatment 990 c.c.

To increase the vital capacity as much as possible it is necessary to use various exercises for the expansion of every part of the chest.

Some patients are rather stiff and cannot move their ribs much; we have, therefore, to apply exercises to make the ribs and the shoulders more supple and movable. To this effect we may apply both active and passive movements. However, very great care must be taken to proceed very slowly and cautiously. We must start only with what the patient can easily perform himself, never using the slightest force, as this might result in suddenly tearing adhesions or perhaps even lung tissue, and so cause a hæmorrhage. After some time we may proceed with more effective exercises, but never forget to advance very gradually and slowly. When adhesions are present we must try to loosen them by and by. Sometimes the patient will feel pain in a certain spot when he expands the chest, and as a rule this spot is the seat of an adhesion. If we effect this spot gently and carefully the adhesion will gradually loosen, and frequently the patient will, during some exercise, loosen the last part of the adhesion. He may at this moment feel a slight pain (which soon passes away) on the spot where the adhesion was, and after that he can suddenly breathe much more deeply. During the next twelve hours or so the patient may have a little blood in the sputum. I have seen this happen with

several patients and they were all very frightened about what they thought was a haemorrhage, but I explained to them that the blood came from the loosening of the adhesion and that it was not an ordinary hæmorrhage. I will mention one example. Mr. Y., 32 years old, had been under treatment six weeks and during this time his vital capacity had increased from 1440 c.c. to 2700 c.c. The day after I had measured his vital capacity he ran a distance of 100 yards after my advice, as he had done twice previously. As it had just started raining and he was near home he ran a little faster than before, and suddenly he felt a pain in the chest about an inch below the right clavicle; after this he noticed that he could breathe more easily and deeply. Half an hour afterwards his expectoration was mixed with blood. The next morning he also had some blood in the sputum, but afterwards no more blood came. His vital capacity was now 3240 c.c., a sudden increase of 540 c.c. It is impossible to explain this fact in any other way than that an adhesion in the spot where he felt the pain had prevented him from expanding his chest, and now when there was no hindrance he could expand his chest more freely.

As a general rule I let the patient exercise

the active expansion of the chest (lifting of the ribs and sideways expansion of the floating ribs) first, and later on I let him exercise expansion of the cavity of the thorax with both ribs and diaphragm. This exercise is somewhat strenuous, and one must take care that the patient makes no effort. The passive expansion of the chest must be started very carefully, and the patient must *relax* his muscles, otherwise he would prevent a proper expansion, which is frequently the case, especially if the stretching of an adhesion causes a pain. The patient often unconsciously contracts his muscles, which prevents an expansion, and it requires sometimes great skill to make him relax his muscles. Any effort, even the slightest, must never be used.

The inspiratory and expiratory powers improve more slowly than the vital capacity. Usually it requires some weeks' treatment before any decided increase of the inspiratory power can be observed. This increase of inspiratory power depends to a great extent upon what exercises are employed and how strong a resistance is applied.

The increase of the expiratory power usually follows the improvement of the patient's general health.

The improvement of a patient's respiration

must be judged by the increase of the vital capacity together with the increase of the inspiratory power. In some cases the vital capacity increases largely and the inspiratory power only slightly; in others the vital capacity increases only slightly and the inspiratory power shows a large increase. Only when these figures show a satisfactory result, together with the disappearance of the physical signs of the disease in the lungs, can it be ascertained that a patient has been cured. The figures in the table on the opposite page will show the result of gymnastic treatment in a few consumptive patients.

There may be a great temptation to sum up these figures and see what the average would be; however, such an average figure would be of no avail, and might lead many a one to believe that a patient's vital capacity or respiratory power ought to be near this average figure, and nothing could be more fallacious. It is the increase of the vital capacity and the inspiratory power which must be judged, taking into account the stature and constitution of the patient, which are of importance.

To measure the expiratory and inspiratory powers I use a mercury manometer, a double bent glass tube with a fixed scale, which must

	Vital Capacity.		Inspiratory Power.		Expiratory Power.	
	At the Start of the Treatment.	At the End of the Treatment.	At the Start of the Treatment.	At the End of the Treatment.	At the Start of the Treatment.	At the End of the Treatment.
	c.c.	c.c.	mm Hg	mm. Hg	mm. Hg	mm. Hg
Mr. A., 23 years of age	...	3660	...	40	...	52
Miss B., 24 „ „	1860	2985	14	...	22	...
Mr. C., 28 „ „	1820	...	48	60	50	70
Mr. C., 53 „ „	1980	3960	20	40	. .	60
Mr. C., 33 „ „	942	1200	24	50	28	...
Mr. F., 28 „ „	3660	3960	32	54	...	102
Miss F., 21 „ „	1980	2580	22*	30	26*	40
Mr. G., 24 „ „	260	1590	...	62	...	80
Mr. G., 27 „ „	2700	3450	28	70	...	...
Mrs. H., 40 „ „	2160	...	20	44	44	56
Mr. J., 17 „ „	1980	3072	...	90	...	100
Mr. M., 21 „ „	1800	2700	30	60	54	74
Mr. P., 31 „ „	1860	3390	...	...	..	...
Mr. S., 34 „ „	3650*	3900	20	90	60	80
Mr. T., 32 „ „	1440	3270	36*	90	80*	105
Mr. W., 35 „ „	2580	2600	40	60	60	95
Mr. W., 30 „ „	2970	5520	...	70	...	170
Mr. W., 40 „ „	1980	2730	36*	62	62*	78
Miss W., 25 „ „	300	1500	20	46	...	60

* After patient had been under treatment for some time.

be placed in a vertical position. A rubber tube is fixed on one end of the glass tube, at the other end of which is fixed a mouthpiece of glass, which must be changed and disinfected after each patient has used it. The patient takes the mouthpiece between his lips and tries to inhale with all his strength. The rising of the mercury

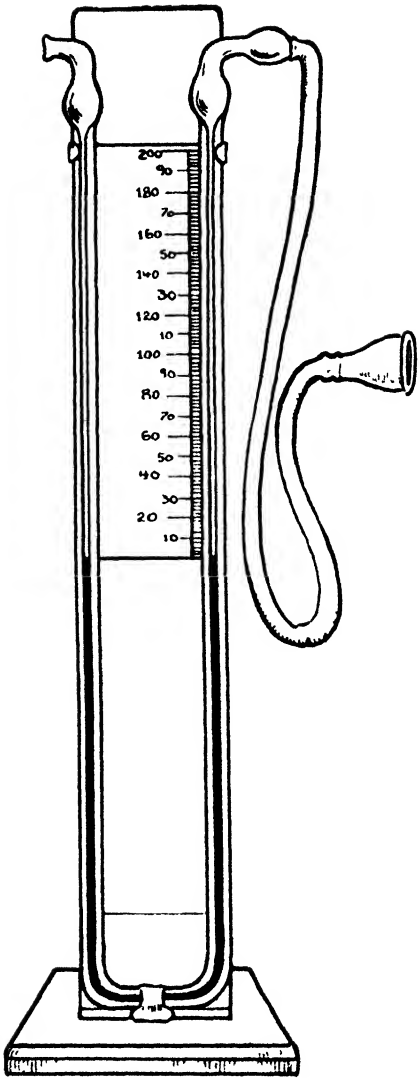

FIG. 3.—Spiromanometer to measure the inspiratory and expiratory power.

at the scale will show the strength of the inspiratory power. The patient of course must close his nose. It must be carefully watched that the patient does not suck with the mouth, as this would cause the mercury to rise much higher. For some patients it is impossible to distinguish between inhaling and sucking, and therefore I have had constructed a glass tube to fit one nostril. The patient then closes the other nostril with his finger and inhales strongly.

The expiratory power is measured by blowing as strongly as possible in the tube, when the rising of the mercury on the other side of the scale will show the strength of the expiratory power. The vital capacity is measured by the spirometer, of which there are several kinds.

As we have no means of measuring the accurate state of a person's circulation, it is very difficult to ascertain the improvement of the circulation brought about by gymnastic treatment. We have to judge the improvement from subjective signs, such as cold hands and feet becoming warmer, the patient keeping warm with less clothing, and certain objective signs, like bluish nails becoming more rose-coloured, blue hands and lips becoming more red. Usually after a few weeks' treatment these signs become more and more pronounced. Perhaps the most

valuable sign to medical men is the reduction of the temperature. As I have stated before, the abnormally high temperature in consumptive patients depends to a great extent upon a slow circulation. The more the circulation improves the more the temperature will approach normal.

As a rule there is a distinct connection between the pulse rate and the rise of temperature, so that the higher the temperature rises, the faster is the pulse rate. In consumptive patients, especially in advanced cases, this connection between pulse rate and temperature is disturbed, and we find high temperature with comparatively slow pulse, and fairly normal temperature with abnormally fast pulse. This fact rather indicates that the integrative action between the centres for the movements of the heart and the centre for the regulation of the body temperature is disturbed.

After a few weeks of gymnastic treatment this disturbance is disposed of, and the connection between temperature and pulse rate is brought to its normal condition.

As previously explained, it is detrimental to consumptive patients to confine them to bed for more than a few days. I have rarely seen the temperature of a consumptive patient rise higher than 102°, unless he had some acute illness or

had overstrained himself. In a number of patients whom I have treated the temperature rose every day up to 101° and 102° for some considerable time (in some cases a very long time) before they came under my treatment. This temperature, however, is not at all a ground for postponing gymnastic treatment. I advised such patients to rest the greater part of the day during the first week. Usually during the second week the temperature lowered somewhat, and the patient could then remain up a little longer, and as a rule, after three weeks' treatment he only needed two hours' rest in the middle of the day. Naturally, he had to retire early. I have seen many patients whose temperature rose every day to over 101° improve so much during six weeks' treatment that their temperature rarely rose above 99°·6, and after some weeks' further treatment the highest limit of their temperature was 99°·4, and again after some time it was only 99° or below this figure. At the same time, however, the height of his temperature depends very much on what the patient has been doing during the day. We must at this time take the temperature in a different way. We may let the patient do a certain amount of walking and take his temperature immediately after the walk—then half

an hour later, and an hour later, and note how quickly and how much it drops. As a rule if the temperature after an hour's rest is down to about 99° it must be considered that the patient's temperature is normal. This is achieved in most cases after three or four months' treatment.

However, the temperature is influenced by so many circumstances that it remains normal only when a patient has been completely cured. In patients who have been suffering from consumption for many years, and consequently a considerable part of the lung tissue has been wasted and replaced by fibroid tissue or left behind a cavity, the temperature may, as a result of gymnastic treatment, become quite normal and remain normal during the whole summer, but when the winter comes with cold and damp weather these patients usually get a rise of temperature. This rise of temperature, frequently to about 100° F., does not prevent them continuing their work. On the other hand, some patients who had not been suffering more than a year but had a large cavity in the lung, did not suffer any inconvenience at all after they had been cured by gymnastic treatment, and the temperature remained normal even in the winter.

The influence of gymnastic treatment upon

the third feature of the predisposition to consumption, namely, deficient nutrition, is invariably good. As a rule, this does not mean that a patient should put on fat, because obesity is a disease, and to substitute one disease for another is not in any way a cure. The effect of gymnastic treatment is to increase the metabolism and to strengthen the organic tissue and eliminate superfluous fat. The patient will assimilate his food better and consequently derive more benefit from it. As a rule, after a trial of gymnastic treatment, the patient's appetite increases and at the same time he digests his food better. Some patients have a slight increase in weight, 3 to 4 lb. or even 6 to 7 lb., whereas other patients lose weight as their health improves. One of my patients, who had been suffering for many years from pulmonary tuberculosis and bronchitis, lost nearly 2 stones (from 16 stones 2 lb. to 14 stones 6 lb.) in weight during the time he was under my treatment. At the same time his health improved immensely, he felt very much better both physically and mentally, and his working ability increased considerably. When the patient was in a sanatorium some years before, his weight increased to over 18 stone, and the doctors were overjoyed at this "wonderful improvement," but the patient did

not feel at all well having to carry this fat, and on his own account began to take less milk and more exercise to reduce this enormous weight.

The cough is in most cases the last symptom to disappear, and some patients still cough a little for a long time after they are quite well. As a rule, there is no change in the cough until the circulation has improved, and therefore during gymnastic treatment the cough begins to diminish only after several weeks' treatment. If the cough is very hard and the patient has a difficulty in getting up the sputum, I have seen great benefit from some mild expectorant. Shaking and vibration of the larynx and light friction over the vago-sympathicus seem to have a very good effect upon the cough. In a few patients a little cough in the morning remained; another patient was quite free from cough during the day, but when dusk came on he coughed for a little while. The change from warm to cold easily brings about a coughing attack—for example, if a patient goes from a warm room into the cold air in the winter he frequently gets a little attack of coughing. In this connection we must remember that many people who never have any trace of consumption have a little cough in the morning or when the temperature changes.

Sometimes a consumptive patient suffers from indigestion, and this, of course, must be considered during the treatment. In some cases petrissage of the abdomen must be added to the treatment. For all kinds of indigestion and deficient assimilation there is no better cure than gymnastic treatment, the effect of which is to improve the circulation in the abdominal organs. To understand how this can be effected by gymnastic exercises we must remember the result of the researches by E. Weber,[1] which show that muscular exercises cause a contraction of the blood vessels in the abdomen; this is, however, only the case when the exercises are not too strong, otherwise the blood distribution will be reversed and cause a dilation of the abdominal blood vessels, which would make the patient worse. Some massage manipulations may be usefully employed during the gymnastic treatment of consumptive patients. I usually give petrissage on the back, on both sides of the spine, where the nerves emerge; this causes an increased blood supply to the lungs. E. Weber[2] has proved by experiments that mechanical excitation of the sensitive nerves results in an increased blood supply to the lungs.

[1] *Der Einfluss psych. Thät.*, etc., Berlin, 1910.

[2] *Arch. Anat. u. Physiol.*, 1911.

To influence catarrh in the lungs tapotement (Fig. 4) and vibrations on the chest, during which the patient must breathe deeply, should be added. The effect of this is to loosen the phlegm and to remove the stagnant lymph-fluid. During these tapotement and vibrations the patient is usually able to expand his chest more fully.

The researches of Kisskalt[1] show that a development of bacilli is very often checked by venous hyperæmia. When the inhalatory power increases, the inhalation will be much stronger and deeper and the air pressure in the lungs decreases, resulting in dilation of the veins and a hyperæmia, which arrests the development of the tubercle bacillus. As mentioned above, petrissage of the back has the same effect, and consequently in two ways we bring about the venous hyperæmia which stops the development of bacilli in the lungs.

To give an idea how resistance exercises are performed I will mention one example—raising of the trunk while sitting (Fig. 5). The patient sits on a chair with the hands on the hips and bends forward. The operator places his hand on the patient's back between the shoulders, and now the patient raises his trunk and at the

[1] *Arch. f. Hyg.*, München u. Leipzig, Bd. xxix.

FIG. 4. EMBOLEMENT ON THE CHEST

Fig. [illegible] SITTING RAISING OF THE TRUNK
WITH RESISTANCE

same time inhales deeply, and the operator makes a slight resistance with his hand; then the patient bends forward exhaling. The exercise is repeated three or four times. In the same way different exercises with hands, feet, trunk, arms, legs, head, etc., are performed. A prescription must be made up for each patient containing ten to fifteen various such exercises, coupled with petrissage on the back, tapotement (Fig. 4) and vibrations on the chest, and other exercises or manipulations which might be suitable to each individual case. In making up these prescriptions, which must often be altered according to the state and condition of the patient, lies the greatest difficulty in the treatment of consumption. A prescription which might cure one patient might kill another, and it requires great experience to know the effect of each exercise on different patients, as well as to be able to judge the constitutional strength of each patient. Without such experience and knowledge it is impossible to treat consumptive patients successfully. It is much easier to kill consumptive patients with physical exercises than to cure them, and I therefore seriously warn any one not to start gymnastic treatment for consumptives without sufficient training and experience in this special branch. No degree or

qualification gives any one justification to use gymnastic treatment for consumptives; knowledge and experience alone are here decisive factors. How necessary this warning is, is proved by the following incident. An army drill instructor was called to a certain sanatorium in the autumn of 1913 to instruct the patients in gymnastic exercises. Some of the patients immediately found the exercises too strenuous and declined to perform them. After a fortnight's trial the leading men of the sanatorium probably found out that this army drill was not a suitable treatment for consumptive patients, and the drill instructor disappeared. Possibly the medical men of this sanatorium took their idea of the advantage of gymnastic exercises from the excellent results shown by my patients to the Royal Society of Medicine both before and after treatment, but a grain of common sense would surely have been enough to show that exercises which are suitable for healthy and strong soldiers can never be suitable for weak and delicate consumptives.

All I have said principally concerns pulmonary tuberculosis, but on the whole the same rules apply also to other forms of tuberculosis. The improvement of the circulation in the diseased part is always the important factor, and where

pulmonary tuberculosis, together with tuberculosis of another organ, is present, the pulmonary tuberculosis must be considered first. In regard to laryngeal tuberculosis, Sir St. Clair Thomson[1] says: "The first and most important principle is to treat the patient and his pulmonary tuberculosis, and the second is, if possible, to cure his larynx, and the third in all instances is to remove symptoms."

That tuberculosis of the larynx with pulmonary tuberculosis can be cured by gymnastic treatment even where other treatments have failed, can be seen from the history of cases which I will add later.

When the patient has improved so much by gymnastic treatment that the physical signs of the disease are beginning to disappear in the lungs, he might start some running and swimming and also some kind of physical work, of which I think gardening is the most suitable. However, this must be started very carefully, otherwise it could easily make the patient worse.

When the patient's respiration is sufficiently improved so that he is no longer short of breath, and when his circulation is improved so much that his temperature is normal or almost normal, I usually prescribe a little running once a week.

[1] *Practitioner*, London, January 1913.

I let him start to run very slowly a distance of 50 yards, and he must breathe deeply during the whole run. He must not run faster than he can walk, and he must never run so much that he gets tired or out of breath, as this would do him a good deal of harm. At the end of the run the patient must feel as if he wanted to run farther, but he must not follow this desire but stop at the 50 yards. He may walk quietly afterwards for some minutes, breathing deeply. If he feels quite well after the run and also the following day, he may after a week's time repeat the run and now increase the distance to 60 or 70 yards, but never forget to run slowly and breathe deeply during the whole time he is running. If he feels quite well after this he might continue the running once a week, and each time increase the distance by 10 or 20 yards. No patient who has been in a far advanced stage of the disease, or who has had a great portion of the lung tissue wasted, should start any running unless he is under the observation of a medical man who should watch the condition of his lungs. Running has a strong influence upon the circulation, and if the patient does not strain himself it will improve the circulation, but if the patient over-exerts himself it will have a bad effect, and the over-exertion takes place

long before the patient can notice it himself, therefore *he should never judge the distance of running by what he feels he can do.* If he does, there is sure to be an overstrain, which will do him harm. Anyhow, no patient, either in an early or in an advanced stage, should ever attempt to do any running before he has performed the exercises described at the end of this book for *at least* two or three months.

Walking is a bad form of exercise which does not much improve the circulation, and therefore never can be considered as a therapeutic measure. Of course every patient should go out for a stroll daily just to be out in the fresh air and move about a little.

The difference of the effect between running and walking upon the circulation can be seen by the rise of temperature. Bardswell and Chapman[1] made experiments on the rise of temperature after walking and running the same distance in the same time, and it is clear from these experiments that the effect of running upon the circulation is far greater than walking.

One hour's walk at a pace of 5 miles an hour rose the temperature from . .	98°·7 to 102°·5

[1] *Brit. Med. Journ.*, London, 1911.

In another person, 5 miles an hour rose the temperature from	99°·3 to 103°
One hour's walk at a pace of 6 miles an hour rose the temperature from . .	98°·5 to 103°·1
In another person, 6 miles an hour rose the temperature from	99°·3 to 103°·4
One hour's running at a pace of 5 miles an hour rose the temperature from . .	98°·6 to 101°·5
One hour's running at a pace of 6 miles an hour rose the temperature from . .	98°·8 to 102°·4
In another person, 6 miles an hour rose the temperature from	98°·8 to 102°·2

We see from these figures that walking produces a much higher rise of temperature than running when the same distance is covered during the same time, in spite of the fact that running usually entails more muscular effort than walking, and therefore produces more heat in the body.

The explanation of the lower temperature after running lies in the fact that running has a greater effect upon the circulation, and consequently the centres for the regulation of the body temperature are stimulated to a higher degree and cause a greater loss of heat. Al-

though running has a good effect upon the circulation, it is a very dangerous remedy for consumptive patients, because it constitutes a comparatively great strain upon the lungs, and therefore no patient should try running before his lungs are fairly well healed up, and even then he must never do it more than once a week. Disregard of my advice is certain to be disastrous.

Swimming is an excellent exercise to complete the cure of a consumptive patient. It must be used very cautiously and gradually, otherwise it will do more harm than good. It must never be started by any patient until his lungs are healed up. Of course no patient should start swimming in the winter, and never in the open air unless the weather is very warm; it is always better to use a covered swimming bath, where the temperature is properly regulated. The temperature of the water should be about 72° in the summer and 75° in the winter, and the temperature of the air should be kept at an agreeable point. If these conditions are not fulfilled, the swimming can do no good for a consumptive patient.

The best method is to start the swimming with a short distance, say 50 yards, and swim slowly, breathing deeply all the time. The

first time the patient must not stay in the water more than two minutes. After the swim the patient must dress quickly and he might take a short walk, but afterwards he must lie down, with plenty of covering to keep him quite warm, and rest for at least two hours; he must not go out the remainder of the day or do any work. He usually feels well and fit and rather energetic after the swim, but the risk of an overstrain is extremely great. *The slightest overstrain after a swim is much more dangerous than in other circumstances, and a patient might suffer for several months from an overstrain after a swim so slight that he himself did not notice it as a strain.* If the patient has been quite well after this first swim he might after a week try another, and now increase the distance to 75 yards, but after the swim he must take all the precautions mentioned above. If he feels quite well after this he might take a swim once a week and each time increase the distance by 25 yards. Of course some patients who are rather delicate or have some other complaint which would make swimming inadvisable, should refrain from this exercise.

Swimming, when carried out carefully and with all the precautions I have mentioned, has

a very beneficial effect upon the circulation and at the same time upon the body temperature, and is a most excellent remedy to complete the cure of consumptive patients. Patients who cannot swim might learn, but must then start more carefully, as the learning to swim entails more effort than when proficient. They must never stay in the water more than one or two minutes for the first few times, and not swim more frequently than once a week.

When a patient is well enough to do running and swimming he might about the same time start some kind of manual work, for example, gardening. He should start with half an hour or an hour a day according to his strength, and gradually increase the amount of work. In this way he will prepare to start his ordinary work. Patients who do not leave their work during the treatment will derive much benefit from some kind of manual work to which they are not accustomed. It will increase the general strength as well as the resisting power against any kind of illness; this, of course, not only applies to consumptive patients but to every one. It is easy for every one to find some hours a week to do physical drill, running, or swimming, or some kind of manual work to keep in good health.

The old proverb says "Prevention is better than cure," and, as already said, the best means of preventing consumption is physical exercise after Ling's system, which can be performed in classes where it is usually called Swedish drill. It is of great importance that this drill should be more widely spread among all parts of the population, and that a sufficient number of instructors should be properly and sufficiently trained.

CHAPTER VIII

Home Exercises for Consumptive Patients

As it will be some considerable time before a sufficient number of medical men have made a study of gymnastic treatment thorough enough to enable them to give such treatment to the enormous number of consumptive people in this country alone (it is estimated that in the United Kingdom 60,000 persons develop consumption every year), I will describe a few simple exercises which the patients can perform at home without any aid, and which, if used carefully according to my directions, will be very useful in combating the disease. I cannot give instructions for exercises suitable to each individual case, but the great majority of consumptives are sure to derive much benefit from these exercises if they perform them carefully and with regard to all advice I give for each special exercise. I have found patients even in far advanced stages of consumption, and where

other treatments had failed, to be completely cured by using these home exercises.

It is, however, of extreme importance that patients should not judge for themselves which exercises to perform. Most patients will probably think the first group of exercises too easy for them, but if they attempted the second or third group it would be disastrous for most of them. These exercises must never cause any, even the slightest feeling of fatigue; on the contrary, the patient should feel less tired when he has finished than when he started. The exercises must be repeated the number of times I have marked in each case. It would do no one any good to perform any or all of the exercises a greater number of times than I have specified, and in most cases it would do a great deal of harm. Very weak patients should rest some minutes between each exercise. In any case they should only be performed when the patient is well rested. The *best* time to perform the exercises is in the morning. Any acute illness may prevent a patient from doing these exercises, or if a patient's temperature is above 103° F. he should wait until his temperature has gone down to 102° F. A temperature not above 102° F. need not prevent any patient from performing the *first*

group of exercises. As I have explained before, these exercises when properly used never cause any rise of temperature at all; on the contrary, very soon the temperature will become more normal. Of course no patient should pass on to the second group of exercises before his temperature is fairly normal.

Group I

No. 1.—Heel Raising	3 to 6	times.
„ 2.—Shoulder Lifting	3 „ 5	„
„ 3.—Sitting, Hands on Hips, Trunk Turning	2 „ 5	„
„ 4.—Arms Raising (Inhaling) and Lowering (Exhaling) . .	2 „ 5	„
„ 5.—Legs Sideways Raising . .	2 „ 4	„
„ 6.—Sitting, Hands on Hips, Trunk Bending Forwards (Exhaling) and Raising (Inhaling) . .	3 „ 6	„
„ 7.—Knee Raising with Support of the Hands	2 „ 5	„

FIG. 6.—HEEL RAISING.

Group I.—No. 1

HEEL RAISING (Fig. 6)

First take up the proper position, heels together, and feet at a right angle. Head high, shoulders well back, chest well expanded. Then slowly raise the heels as high as possible, and thus the whole body (Fig. 6). Then slowly lower the heels again. While raising inhale and while dropping exhale. Repeat this exercise at first three times, and gradually increase to six times.

Group I.—No. 2

Shoulder Lifting (Fig. 7)

Place both hands on hips, keep head high, trunk quite straight, chest well expanded. Then raise the left shoulder as high as possible during inhaling and at the same time bend the head slightly to the right (Fig. 7), then lower the shoulder again during exhaling. Then lift the right shoulder as high as possible during inhaling and at the same time bend the head slowly to the left, and lower again during exhaling. Repeat this exercise at first three times, later on up to five times.

Fig. SHOULDER CUTTING

Group I.—No. 3

SITTING, HANDS ON HIPS, TRUNK TURNING
(Fig. 8)

Sit on a chair with both hands on the hips, head high, chest well expanded. Now turn the trunk slowly to the left as far as possible (Fig. 8), then slowly to the right. Take care to breathe well and deeply during the exercise. Repeat this exercise twice, and gradually increase to five times.

Group I.—No. 4

Arms Raising (Inhaling) and Lowering (Exhaling) (Fig. 9)

Sit comfortably on a chair, but as far as possible in an upright position. Now raise both hands slowly sideways upwards (Fig. 9, *a*) and inhale deeply simultaneously, then lower the arms, exhaling while doing so. Any one who is very weak need not at first raise the arms quite upwards, only horizontally (Fig. 9, *b*), and gradually each day higher and higher. Repeat this exercise twice, and gradually increase to five times.

ARMS RAISING

FIG. SIDEWAYS RAISING.

Group I.—No. 5[1]

Leg Sideways Raising (Fig. 10)

Place the hands on the hips, heels together, and the feet at a right angle. Raise first the left leg slowly sideways, directly to the side, not in the least to the front or back. At first the patient need only raise the leg slightly, but as soon as he begins to get used to it the leg must be raised fairly high (Fig. 10); then bring the leg slowly back again. Then do the same with the right leg. Repeat this exercise twice, and later on four times. This is principally a balancing exercise, which also teaches the body to respond to the will. Take care to keep the whole body straight and not let it totter too much. The most important aim of this exercise is to preserve the equilibrium. It may be somewhat difficult at first, and weak patients should not trouble themselves much with it in beginning. Later on, when one is accustomed to it, the exercise presents no difficulty.

[1] Patients who have been confined to bed for some time should not use this exercise for the first three or four weeks.

Group I.—No. 6

Sitting, Hands on Hips, Trunk Bending Forwards (Exhaling) and Raising (Inhaling) (Fig. 11)

Sit on a chair with the hands on the hips and the feet on the floor somewhat to the front. Now inhale deeply, then bend the trunk forward, exhaling (Fig. 11). Raise the trunk again while inhaling deeply, and take care that the head and shoulders are well held back. Repeat exercise three times, and gradually increase to six times.

TRUNK BENDING FORWARDS AND RAISING.

KNEE RAISED WITH SUPPORT
OF THE HAND

Group I.—No. 7

Knee Raising with Support of the Hands (Fig. 12)

Stand upright, supporting yourself by placing the hand on the arm of a chair or mantelpiece or in some similar way. Now raise the left knee slowly as high as possible (Fig. 12), and let it slowly drop again, then raise and drop the right knee in exactly the same manner. Take care to breathe well and deeply. Repeat exercise twice, and gradually increase to five times.

Group II

No. 1.—Heel Raising and Alternate Toe Raising	3 to 6	times.
„ 2.—Shoulder Lifting	5	„
„ 3.—Standing, Feet Apart, Arm Flinging	3 „ 6	„
„ 4.—Feet Apart, Arms Stretching, Arch Standing, Heel Raising	2 „ 4	„
„ 5.—Arms Stretching, Feet Apart, Trunk Bending Forwards and Downwards	3 „ 6	„
„ 6.—Leg Circling	2 „ 5	„
„ 7.—Sitting, Hands on Neck, Trunk Turning	3 „ 5	„
„ 8.—Lying (Face Down), Hands on Floor		
„ 9.—Foot Lifting Backwards . .	3 „ 6	„
„ 10.—Arms Raising Forwards Upwards (Inhaling), Lowering Sideways Downwards (Exhaling).	3 „ 6	„

I [illegible] TOE KAISING

Group II.—No. 1

Heel Raising and Alternate Toe Raising (Figs. 6 and 13)

The heel raising is the same exercise as No. 1 in the first group (Fig. 6) and should be repeated five times. Immediately afterwards follows the toe raising; in this both heels remain on the floor. Raise first the right toes (Fig. 13) as high as possible, and drop again. Then the left toes as high as possible, and down again. Repeat three to six times.

Group II.—No. 2

Shoulder Lifting

This exercise is almost the same as No. 2 (Fig. 7) in the first group, but now the patient must try to lift the shoulder still higher, and simultaneously bend the head over a little farther and inhale still a little deeper than before.

FIG. 14 ARM FLINGING

Group II.—No. 3

Standing, Feet Apart, Arm Flinging (Fig. 14)

The patient takes up the right position, feet apart, head high, chest well expanded, and arms stretched out sideways (Fig. 14). Now patient bends both elbows so that the thumbs touch the front parts of the shoulders. Then he stretches out the arms again. Repeat exercise three to six times. The elbows remain still the whole time.

Group II.—No. 4

Feet Apart, Arms Stretching, Arch Standing, Heel Raising (Fig. 15)

Stand 7 to 9 inches away from the wall with the back against wall. Stretch the arms upwards, feet apart; now bend the arms, neck, and head so that the tips of the fingers touch the wall, then raise the heels as high as possible during inhaling (Fig. 15), then drop the heels again to the floor during exhaling. Repeat exercise twice, and gradually increase to three or even four times. The patient must take care during this exercise not to put the abdomen forwards. The chest must be raised high and the abdomen slightly drawn in.

FIG. 5.—AR. H STANDING HEEL RAISING

1 TRUNK BENDING FOR ARMS AND LEGS AND ARMS

Group II.—No. 5

ARMS STRETCHING, FEET APART, TRUNK BENDING FORWARDS AND DOWNWARDS (Fig. 16)

Stretch the arms upwards and place the feet two foot-lengths apart (Fig. 16, *a*). First inhale, then bend the body forwards and downwards till the tips of the fingers come as near as possible to the ground while exhaling (Fig. 16, *b*), then raise again during inhaling. The knees must remain straight the whole time. Repeat exercise three to six times.

Group II.—No. 6

Leg Circling (Fig. 17)

Place both hands on the hips and stand quite straight. Lift the left leg forwards, then move it sideways (Fig. 17), then backward, and then down to the ground. The foot thus describes a wide circle; the knee is kept straight the whole time, and the patient should not totter too much but try to keep his equilibrium. The same should be done with the right leg. Repeat this exercise two to five times.

Group II.—No. 6

LEG CIRCLING (Fig. 17)

Place both hands on the hips and stand quite straight. Lift the left leg forwards, then move it sideways (Fig. 17), then backward, and then down to the ground. The foot thus describes a wide circle; the knee is kept straight the whole time, and the patient should not totter too much but try to keep his equilibrium. The same should be done with the right leg. Repeat this exercise two to five times.

[illegible] SITTING, TRUNK TURNING

Group II.—No. 7

SITTING, HANDS ON NECK, TRUNK TURNING
(Fig. 18)

Sit on a chair, both hands on the nape of the neck, so that the tips of the fingers touch, head and elbows well back. Now turn the trunk first to the left as far as possible (Fig. 18), then slowly to the right, also as far as possible. Take care to breathe well and deeply the whole time. Repeat three to five times.

Group II.—No. 8

Lying (Face Down), Hands on Floor (Fig. 19)

The patient places himself on a bench or across a bed face downwards, the greater part of the trunk free, the hands on the floor. Then he bends down so that the forehead touches the floor. He breathes deeply and turns the head to the right and left once or twice. The effect of this exercise is to send the blood to the head. The patient must not remain long in this position, especially at the beginning, as this might cause headache. When he is a little used to the exercise he could remain a few seconds in that position. This exercise, if carefully employed, is a good means of curing headache.

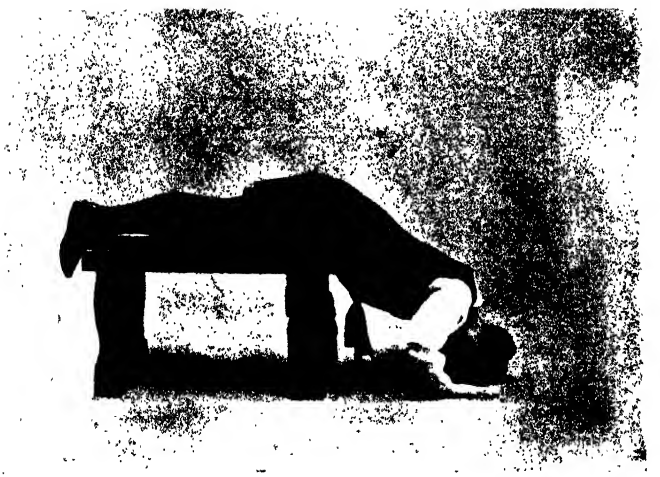

FIG. 1. LYING FACE DOWN: HANDS ON FLOOR

I FOOT LIFTING BACKWARDS

Group II.—No. 9

Foot Lifting Backwards (Fig. 20)

The patient stands straight, places hands on hips, and then lifts the right foot slowly backwards, upwards as high as possible (Fig. 20), and lowers it again. He must take care to keep the knees together and not let either of them move forwards. Then he lifts the left foot backwards as high as possible, and down again slowly. Repeat exercise three to six times.

Group II.—No. 10

ARMS RAISING FORWARDS UPWARDS (INHALING), LOWERING SIDEWAYS DOWNWARDS (EXHALING)

The patient stands straight and lifts both arms forwards and upwards during inhaling, and then he lowers the arms sideways downwards during exhaling. Repeat exercise three to six times. During the exercise the patient must breathe as deeply as possible and lift the arms as high as possible.

Group III

No. 1.—Heel Raising and Knee Bending with Support	2 to 4	times.
„ 2.—Arm and Shoulder Lifting	3 „ 5	„
„ 3.—Knee Lifting and Stretching Forward	3 „ 5	„
„ 4.—Arms Stretching, Arch Standing, Heel Raising	3 „ 4	„
„ 5.—Arms Stretched, Heels Together, Trunk Bending Forwards and Downwards	3 „ 5	„
„ 6.—Standing, Hands on Neck, Trunk Turning	4 „ 5	„
„ 7.—Hands on Hips, Trunk Bending Forwards, Leg Backwards	2 „ 5	„
„ 8.—Lying (Face Down), Hands on Floor		
„ 9.—Hands on Hips, Lunging	3 „ 5	„
„ 10.—Arms Raising with Heel Raising	3 „ 5	„

Group III.—No. 1

Heel Raising and Knee Bending with Support (Fig. 21)

Place the heels together and the feet at a right angle. Place the hands on the arm of a chair or a mantelpiece, then raise the heels (and at the same time the whole body); bend the knees *slightly* (Fig. 21), then stretch the knees again and drop the heels. Repeat this exercise two to four times. Take care to breathe deeply all the time. The patient must not bend the knees too much, as this would be a too great strain upon the lungs.

Fig. 16 HEEL RAISING AND KNEE BENDING WITH SUPPORT

ARM AND SHOULDER HEELING

to face page 167

Group III.—No. 2

ARM AND SHOULDER LIFTING (Fig. 22)

The patient sits on a chair, head high, chest well expanded. Now he places the left hand on hip, lifts the right arm and shoulder as high as possible during inhaling (Fig. 22), and at the same time bends the head slightly to the left. He then lowers the arm and shoulder during exhaling. Then he places the right hand on the hip and lifts the left arm and shoulder as high as possible during inhaling, and at the same time bends the head slightly to the right. Then lowers arm and shoulder, again exhaling. Repeat exercise three to five times.

Group III.—No. 3

Knee Lifting and Stretching Forward (Fig. 23)

Place the hands on the hips, heels together, and the feet at a right angle. Raise the left knee to the height of the hips, stretch out the knee (Fig. 23); bend again and put the foot down again. Then raise the right knee and stretch it out in the same manner. Take care to breathe properly during the exercise. At first the patient may place one hand on a chair or mantelpiece. Repeat exercise three times, later four and five times.

KNEE BENDING AND STRETCHING

Group III.—No. 4

Arms Stretching, Arch Standing, Heels Raising

Stand 12 inches away from the wall with the back against the wall. Stretch the arms upwards, heels together and the feet at a right angle. Now bend the arms, head, and neck so far back that the tips of the fingers touch the wall. Then raise the heels as high as possible during inhaling. Drop the heels again to the floor, exhaling. Repeat the exercise three to four times. Observe that the chest is well thrown out and the abdomen slightly drawn in.

Group III.—No. 5

Arms Stretched, Heels Together, Trunk Bending Forwards and Downwards

Stretch the arms high upwards and place the heels together and the feet at a right angle. Bend trunk forwards and downwards exhaling, then rise up again inhaling. Repeat exercise three to five times.

FIG. 4—STANDING, HANDS ON NECK
TRUNK TURNING

Group III.—No. 6

Standing, Hands on Neck, Trunk Turning (Fig. 24)

Place both hands on the nape of the neck, so that the tips of the fingers touch each other. Take care that head and elbows are well drawn back. One is disposed in this exercise to hold the elbows too much to the front, but this causes an undesirable carriage and must be carefully avoided. Now turn the body first to the left as far as possible (Fig. 24). Then turn in the same way to the right. Take care to breathe deeply the whole time. Repeat exercise four to five times.

Group III.—No. 7

Hands on Hips, Trunk Bending Forwards, Leg Backwards (Fig. 25)

Place both hands on the hips, and then bend trunk slightly forward and at the same time raise the left leg backwards (Fig. 25); then raise the trunk and lower the leg again. Take care to breathe well and deeply the whole time. Then bend trunk forward and raise right leg backward just in the same way. Repeat exercise two to five times. The patient must not totter too much, but keep the equilibrium.

I TRUNK BENDING FORWARDS
BY TWO KWAKES

Group III.—No. 8

LYING (FACE DOWN), HANDS ON FLOOR

This is the same exercise as No. 8 in Group II., but now the patient remains with the head down a little longer.

Group III.—No. 9

Hands on Hips, Lunging (Fig. 26)

Place both hands on hips, heels together and feet at a right angle. Then take a long step with the right foot in the direction the foot is pointing. Keep the body and the left leg in one straight line. Now lift the right heel slowly upwards (Fig. 26) and drop it down again. Then place the right foot in the original position and then take a long step with the left foot in the direction the foot is pointing, the trunk and right leg to be in one straight line. Now lift the left heel. Take care to breathe deeply the whole time. Repeat exercise three to five times.

FIG. 2. HANDS ON HIPS LUNGING

FIG. 7 ARMS RAISING WITH HEEL RAISING

Group III.—No. 10

ARMS RAISING WITH HEEL RAISING (Fig. 27)

Place the heels together and the feet at a right angle. Then raise both arms sideways upwards during inhaling, and simultaneously raise the heels and thus the whole body (Fig. 27). Then drop the heels and lower the arms sideways downwards during exhaling. Repeat exercise three to five times. The patient may also for a change raise the arms forwards upwards, and lower them sideways downwards.

CHAPTER IX

Histories of a few cases to illustrate the result of gymnastic treatment for consumptives

Mr. C. A., aged 23.—In January 1910 patient had bronchitis, from which he never recovered. For several years he had been suffering from headache about twice or three times a week, sometimes so badly that he had to stay away from business. For the last year he had a hæmorrhage every three months and on the following few days he felt very tired. He has been treated with creosote, but felt no benefit from it. He formerly felt very energetic, but lately he lost all energy and felt always as if he wanted to lie down. Had a chronic catarrh of the nose so that he had some difficulty to breathe, and slept with his mouth open. Had a great deal of cough and expectoration, and was very short-winded. Weight, 8 stone 11 lb.

On the 17th June 1912 patient came under my treatment. Over upper half of both lungs, dullness on percussion; over back part, fine

râles; over front part, crepitation with scattered râles.

July 1.—Patient feels better and stronger, can breathe more freely and is less tired.

July 25.—Now no râles, but still crepitation and prolonged expiration. Patient feels quite well and can breathe perfectly easily. Goes away for a fortnight's holiday.

August 13.—Starts treatment again, is feeling very well. Weight, 9 stone.

September 2.—Weight, 9 stone 3½ lb. Patient feels very well. Crepitation over apex of right lung, very little over left.

September 12.—Patient has had a bad cold in the head for several days, but it has not affected the lungs at all.

September 23, 1912.—Patient feels perfectly well, has no symptoms of disease in the lungs, and has not had headache for a long time. Finishes treatment.

November 11, 1912.—Patient still quite well, although he has been working very hard lately. The catarrh of the nose is so much better that he now no longer sleeps with the mouth open.

June 21, 1913.—Patient still keeping perfectly well. Weight, 9 stone 10 lb. Inspiratory power, 40 mm. Hg; expiratory power, 52 mm. Hg; vital capacity, 3660 c.c.

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April 1915.—Patient is still enjoying splendid health.

Miss B., aged 24, teacher by profession, had influenza, February 1912, and stayed in bed three days. She was very hoarse and had a difficulty in speaking. After six weeks she went to a specialist, who said her lungs were slightly affected. In June 1912 she went to King Edward VII. Sanatorium. There she was told that both her throat and lungs were affected. Tubercle bacilli were found in her sputum. From August she had tuberculin injections. In November her throat was cauterised, but it proved rather irritable and became slightly worse, so the galvano-cautery was discontinued. The tuberculin treatment was continued till March 1914, when she left the sanatorium. She did not feel very much benefit from the treatment, but she felt better after the injections were discontinued. She went from the sanatorium to Bournemouth, where she stayed till June. On 8th June 1914 patient came under my treatment. She always felt her throat aching in the evening if she had been talking during the day. She was short-winded and got easily tired. Had a great deal of cough and expectoration. Dullness on per-

cussion over right apex. Prolonged expiration over both lungs, and crepitation behind right shoulder-blade. Vital capacity, 1860 c.c.; inspiratory power, 14 mm. Hg; expiratory power, 22 mm. Hg. Tubercular infiltration and ulceration in interarytenoid region and over both vocal processes. She had been told by several medical men that she would never be able to teach again.

July 7. — Patient much improved. Over lower lobe of right lung, normal sounds; over left lung and upper part of right, prolonged expiration; behind right shoulder-blade still crepitation. Patient had had a speaking exercise at school on the previous day for more than an hour, and afterwards she only felt the throat a little dry, otherwise all right. A month earlier she had had the same exercise, and afterwards she could hardly speak and her throat was badly aching the whole day.

October 15.—Patient felt very well, her lungs were quite well. She had still a cough in the morning. Her larynx was examined by a throat specialist, who only found a trace of tuberculosis left.

In November patient got a bad cold, from which she gradually recovered.

In March 1914 her larynx was again examined by the same specialist, who told her that her

throat was perfectly cured, and that none who saw it would dream that there had ever been anything wrong with it.

In April 1914 she started teaching in a school and has continued ever since, and is still now (April 1915) following her profession and feeling perfectly well. If after one year's teaching she is still keeping well she must be considered as definitely and lastingly cured.

Mr. G. G., aged 27 years, for several months had not felt well, and in July 1913 his lungs were declared to be affected. On 1st September he went to Downs Sanatorium, where he stayed till 13th November. Tubercular bacilli were found in his sputum; his temperature was frequently above 100°, but after six weeks in the sanatorium it was normal. Leaving the sanatorium he started work the next day, but had a hæmorrhage and stopped work; a few days later, he had still slight hæmorrhage on two occasions.

On 24th February 1914 patient came to me. He coughed mostly in the morning and expectorated a fair amount; had slight dullness on percussion, and crepitation over upper part of both lungs. Vital capacity, 2700 c.c.; inspiratory power, 28 mm. Hg. This patient

was shown at the clinical section of the Royal Society of Medicine[1] on 13th March 1914.

On 1st May 1914 patient felt perfectly well and fit for work. His vital capacity was then 3450 c.c.; inspiratory power, 70 mm. Hg. Normal sounds over both lungs. Started running and swimming on my advice.

June 24.—Patient swam a distance of 700 yards, and felt quite well after it. Being an army reservist, he was called up to join the army as soon as the war broke out. He joined the British Expeditionary Force, and arrived in France on 22nd August, where they started at once marching. After four days' marching he took part in a ten hours' battle on 26th August, after which they retired and kept on retiring for about thirteen or fifteen days, in which time they covered about 200 to 300 miles, with plenty to carry and little rest. After retiring, they started advancing and had several encounters during the advance; after some time they arrived at Ypres, where, unfortunately, G. G. was wounded in the ankle and was subsequently brought to the hospital at Oxford. His lungs were examined here again, but no trace of the disease could be found.

This case illustrates the excellent result of

[1] *Proc. Roy. Soc. Med.*, April 1914.

gymnastic treatment where sanatorium treatment had failed. There can be no doubt that this patient was absolutely cured, as he was able to stand the enormous strain of being in the first fighting line for about two and a half months. I have had news from him, and he is still keeping well.

Dora G., aged 9 years, had had scarlet fever five years ago, and had never since been quite well. Grandmother and one sister died of consumption.

During the last twelve months she had grown thinner and had been coughing. For at least six weeks she had become worse and had expectorated much in the night.

She started my treatment on 21st August 1912. Over both lungs dullness on percussion, and crepitation with scattered râles.

October 16.—Patient is very well; normal sounds over both lungs. Finishes treatment. She is still now, April 1915, keeping in good health.

Miss X., 21 years of age.—Her grandfather died of consumption, one brother of tuberculosis of the bowels, cousins died from phthisis, mother is said to have had phthisis. Patient has a good constitution, and has always been well

until August 1910, when she caught a bad cold, with pains in her chest. A month later she got water in her lungs while bathing, after which she had very bad pains in her chest for a fortnight. She got better, but at Christmas she caught another chill, from which she never quite recovered. She felt the pains in her chest often, began to lose weight, felt weak and got tired quickly. Used to suffer very much during her monthly periods, especially the first and second days. Patient got worse and worse.

In May 1911 patient went to the Brompton Hospital, where she attended as out-patient for three months; during that time she continued to get worse.

On August 1911 the patient came under my treatment. She was then so weary and weak that she had to lie down several hours every day. She coughed and expectorated slightly; her appetite was bad. Over right lung, dullness on percussion; crepitation and scattered râles over greater part of the lung. Over lower half of left lung, complete dullness on percussion; scattered râles over greater part of the lung. Patient weighed 8 stone 13 lb.

On 26th August patient feels much better; the fine râles over half of left lung can be heard more clearly, very little crepitation over right lung.

On 1st September patient feels considerably less tired. Over lower half of left lung, pectoral fremitus feeble, indicating that effusion has been absorbed; she could breathe much easier.

October 16.—Patient feels quite well. Under right clavicle prolonged expiration, otherwise quite normal sounds over both lungs. At her last monthly period she had not suffered at all. She finishes the treatment.

On January 1912 I saw patient. She was keeping quite well, had had no trouble with her lungs, and no pains at all. She asked me if there would be any danger for her to marry. I told her that there would be none.

On 7th January 1913 patient came to me again, she had had a miscarriage some time ago, after which she had pains in her abdomen, especially on the right side. Three weeks ago she had caught a bad cold with pains in her chest. Her vital capacity was 1620 c.c. I advised her to start the treatment for a fortnight, after which she was perfectly well; her cough was gone, the pain in the abdomen had disappeared. Her vital capacity was now 2060 c.c. She is still keeping well.

Mr. R. K., aged 36 years. For about nine months he had not felt well, and found it an

effort to do his work. He had occasionally night sweats, and was sensitive to cold. Three months ago he had slight hæmorrhage several times, and was advised to give up his work, which he did. A specialist examined patient a few days before I saw him, and gave him a certificate for admission to a sanatorium, telling him that he should stay there for at least six months.

On 26th February 1912 patient came to me. Over the upper part of his left lung dullness on percussion, and fine crepitation.

On 16th March patient felt much better, and had gained 5 lb. of weight.

April 4.—Patient feels very well indeed; his breathing is very satisfactory, no crepitation to speak of.

May 3.—No crepitation at all; patient feels exceedingly well, and practises swimming and running on my advice.

April 1915.—After three years, patient is still keeping perfectly well.

Mr. W. G., aged 24 years, got a bad cold in September 1911, which did not leave him till Christmas. At the following Easter he caught another chill, and began to cough badly and bring up phlegm. Since then he became

gradually worse, until January 1913, when he suddenly got much worse, lost 1 stone of weight in three weeks, and felt so weak that he was obliged to give up work. Since last Easter he had lost 2 stone in weight.

He came under my treatment on 13th February 1913. Over right lung dullness on percussion, and fine crepitation over greater part of the lung. Under left clavicle cracked-pot sound, indicating a large cavity. Over rest of lung fine râles. Vital capacity, 260 c.c. When the patient became very ill, almost all his hair fell off; but when his health improved, his hair began to grow again.

This patient was shown at the clinical section of the Royal Society of Medicine[1] on 14th March 1913.

On 2nd May 1913 this patient was again shown at the clinical section of the Royal Society of Medicine, and my opinion was that the activity of the disease had ceased and that the patient was fit for work. However, one of the members, consulting physician to the Brompton Hospital, declared that although the patient was well for the present, he would soon break down again, having a huge cavity in the left lung. His vital capacity was now

[1] *Proc. Roy. Soc. Med.*, April 1913.

1590 c.c.; inspiratory power, 48 mm. Hg; expiratory power, 80 mm. Hg. I assume that this medical man in his great experience had never seen a patient recover when in so far advanced a stage of the disease, and therefore he categorically declared that this patient would break down again.

In June 1913 patient is feeling very well. Inspiratory power, 62 mm.; expiratory power, 80 mm. Hg. He is looking for a situation.

July 21.—Patient started work two weeks ago. During the first week he lost ½ lb. in weight, felt very tired in the evening, and almost thought he would have to give up work. However, the second week he felt better, and gained 2 lb. in weight, had very good appetite, and felt well. Patient got gradually better and stronger.

The patient was again shown at the clinical section of the Royal Society of Medicine on 9th January 1914, in order that the members should see that he was still keeping well in spite of the predicted breakdown. As this patient is still now, after two years, keeping well and fit for work, this case proves the superiority of gymnastic treatment for consumptives.

Mr. P. C., aged 34 years. In 1908 he had pleurisy and pneumonia, and after this had never quite recovered. In 1910 he had hæmorrhage in his office one morning and brought up about a cupful of blood. He was then laid up for thirteen weeks at home. He coughed and expectorated a great deal. He sometimes felt better, but never well. Later he was extremely weak and short-winded. He could not go up even a few steps without having to stop for rest.

He began my treatment on the 18th July 1912. There was dullness on percussion, and also crepitation over the whole of both lungs.

August 28.—The patient has improved every week, and can now go up to the third floor of his house without feeling tired or out of breath.

September 10.—Patient has just started work, feels very well. Finishes treatment.

Notwithstanding the fact that this patient finished the treatment rather early and also that he had very unsuitable work, as he worked at night, only coming home at one o'clock in the morning, and on the way home was exposed to the cold, patient is now keeping very well.

Mr. P. H., aged 31, began in autumn 1911

to feel weak and got tired quickly, and at this time he had hæmorrhage—about a teacupful of blood. After the hæmorrhage he was examined, and the medical man told him that he was not very ill and that he need not be afraid, but that his right lung was doubtful. After some time he got better again.

In October 1912 he had another hæmorrhage, and attended the Brompton Hospital, where tubercular bacilli were found in his sputum, and he was advised to go to a sanatorium.

Patient came under my treatment on 26th November 1912. Over right lung dullness on percussion, over lower part prolonged expiration, over upper part crepitation; over upper part of left lung dullness on percussion and slight crepitation, over lower part prolonged expiration. Vital capacity, 1860 c.c.

This patient was shown at the clinical section of the Royal Society of Medicine[1] on the 10th January 1913.

March 14.—Patient was shown at the clinical section of the Royal Society of Medicine as cured. He felt very well, and was free from any physical signs of the disease. His weight had increased 8 lb. Vital capacity, 3390 c.c.

The patient had done his usual work during

[1] *Proc. Roy. Soc. Med.*, February 1913.

the whole course of treatment, and at the end of the treatment I gave him a few exercises to do at home, and he kept these up.

In November 1913 he had a slight hæmorrhage (about half a teacupful of blood), but he felt perfectly well and strong. His lungs were examined, but no trace of the disease could be found, so he took no notice of the occurrence and continued his work without any precautions.

At the end of November 1914 he had again a hæmorrhage, with the same amount of blood as a year before. He had his lungs examined again, but no trace of the disease was found. Immediately after his second hæmorrhage he was working rather hard for some time, but felt perfectly well and strong; his appetite was good and he felt quite well.

Patient was again shown in the Royal Society of Medicine[1] on 9th January 1914 to show that the good result of the treatment was lasting.

Patient is now (April 1915), after more than two years, still quite well.

Mr. Rh., aged 31 years, a strongly built man with a very good constitution. In November 1911 he began to cough a great deal.

In March 1912 he got hæmorrhage at one

[1] *Proc. Roy. Soc. Med.*, February 1914.

o'clock in the morning for about one hour; he estimated the amount of blood brought up as several teacupfuls. After this he was so weak that he had to give up work and stay in bed for three weeks. Soon after the hæmorrhage a sample of his sputum was taken for examination, and bacilli were found in small quantities.

The patient came to me on the 7th May 1912, and began treatment. He came irregularly, as he lived far away and had just started some light work. He improved with astonishing rapidity, and even after one month felt so well and fit for work that he did not continue the treatment.

In the following July I had a letter from him, saying that he felt very well, had no shortness of breath, and still continued the home exercises I had prescribed for him.

One year later I had a letter from Australia, saying that he was still keeping very well.

Mr. M., aged 21 years.—In May 1912 he caught a cold, and after that he had pleurisy. Some weeks later his lungs were affected, and he went to Nummela Sanatorium (Finland), where he stayed for nearly two years. In September 1912 he had hæmorrhage, and he had some blood coming up every day for about

three weeks. His temperature was 40° C. (104 F.), gradually it went down to 39° C., and later to 38° C. He was kept very still in bed with ice on his chest for about seven weeks—was in bed altogether for seven months. During the spring of 1913 he improved, and his temperature became nearly normal; but in the autumn of 1913 his temperature began to go upwards, and during the winter 1913–14 he was sometimes better and sometimes worse. The medical man at the sanatorium had no hope for his recovery.

At the beginning of June 1914 he left the sanatorium and came over to London, and started my treatment on the 18th June. Fine râles over nearly all the right lung; chest under the right clavicle considerably drawn in; left lung crepitation behind shoulder-blade. Vital capacity, 1800 c.c.; inspiratory power, 30 mm. Hg; expiratory power, 54 mm. Hg; temperature in the afternoon varying between 100° and 102° F.

During the first week of the treatment patient was resting most of the day. During the second week he went out for a few minutes every day, but still had plenty of rest; gradually he took less and less rest.

September 1.—Patient was feeling very well;

temperature normal; had still some cough and expectoration in the morning. Vital capacity, 2600 c.c.; inspiratory power, 50 mm. Hg; expiratory power, 84 mm. Hg.

October 8.—Patient feels quite well, is leading quite an ordinary life, has begun work. Vital capacity, 2700 c.c.; inspiratory power, 60 mm. Hg; expiratory power, 84 mm. Hg.

April 1915.—Patient is still quite well and fit for work. This case proves that the change from the good climate of Finland to the damp climate of London did not prevent the patient's recovery.

Mrs. H., 40 years old.—In November 1912 had a bad cold, but got quite well again. In June 1913 she had again a bad cold, with bronchitis, and tubercular bacilli were found in her sputum. She lived an outdoor life in Canada, and came back to England in October 1913; went to King Edward VII. Sanatorium at Midhurst, where she stayed till March 1914. She was feeling very well when she left sanatorium, but could not stand any strain; as soon as she tried to do any little work her temperature rose and she had to stay in bed two or three days, when the temperature became normal again. During the time she was in sanatorium,

her throat was aching, and the doctor at the sanatorium who had examined her larynx said it was like "peppered," and prescribed her silence for three months.

On the 26th May patient came under my treatment. Right lung fairly dried up, only slight scattered crepitation; left lung, still crepitation over lower lobe. Vital capacity, 2160 c.c.; inspiratory power, 20 mm. Hg; expiratory power, 44 mm. Hg. She weighed 10 stone. Patient had been told by a specialist that she would always be an invalid.

July 7.—Right lung, no crepitation; left lung, still slight scattered crepitation. Inspiratory power, 44 mm. Hg; expiratory power, 56 mm. Hg.

August 1.—No crepitation at all; patient feels very well, even if she has not taken any rest all day; temperature normal.

On 7th August she has been swimming; was four minutes in the water. When she came home her temperature was 99°·2 F. In the afternoon she had a three-mile walk, and at 6.30 p.m. her temperature was 100°·8, and at 6.40 p.m., 100°·2. In the evening about 9.30 p.m., 98°·6. The next day, after a walk, the temperature rose to 100°·2; after a few minutes' rest it was 99°·8; later, 98°.

August 14.—Patient is feeling perfectly well, and wants to go home. Finishes treatment.

April 1915.—Patient is keeping wonderfully well and strong, never rests in the daytime, and her temperature is normal. She continued a few home exercises which I had prescribed for her.

Mr. C., 33 years old, had a bad cough from September 1912 till December, when tubercular bacilli were found in his sputum. He then stayed in bed for about fourteen weeks, and subsequently went to Hahnemahn's Convalescent Home in Bournemouth, and stayed there till the end of May. In the beginning of June his left side was tapped for effusion from pleurisy; after that he felt better, but did not feel fit for any work yet.

On 29th September patient came under my treatment. Suffered a great deal from shortness of breath. Right lung over front part, prolonged expiration and slight dullness on percussion; on the back part, dullness on percussion, crepitation, and fine râles. Over lower half of left lung, complete dullness on percussion. Over upper lobe, râles. Over lower lobe, râles can be heard but only faint, indicating pleuritical effusion reaching up to third rib. Over lower half of left lung, no pectoral fremitus. Heart was dis-

located to the right side about 1 inch. Vital capacity, 940 c.c.; inspiratory power, 24 mm. Hg; expiratory power, 28 mm. Hg.

October 20.—Patient was less short-winded; his heart was in its normal place. Effusion in the left pleura considerably reduced.

December 13.—Right lung, few crepitations at apex; left lung, still dullness over lower part; still a few râles.

January 6.—Patient was feeling very well. Vital capacity, 1200 c.c.; inspiratory power, 50 mm. Hg.

In the following March, patient felt very fit and had several Turkish baths, which he liked very much.

In the following summer he started swimming on my advice, and felt very well. Started work again, and is still now, April 1915, keeping quite well.

Elene W., 6 years old, had always been delicate; had double pneumonia after measles in 1911; after that she had been very susceptible to colds. Last winter she had whooping-cough.

More than twelve months ago it had been stated that she had pulmonary tuberculosis, and had been prohibited to go to school. She had been coughing and expectorating very much.

In June 1913 she came under my treatment. Dullness on percussion over both apices, and slight crepitation mostly over left.

She gradually improved till October the same year, when she was quite cured. In the following December her sister and a brother contracted mumps rather severely. She got it also, but only slightly, and recovered more quickly than her sister and brother. She is still now, April 1915, keeping quite well.

Mr. J., 38 years old.—Since he was a boy, he was liable to catch cold easily. In 1902 tubercle bacilli were found in his sputum. He has had open-air treatment, both in sanatorium and at home. During the last eleven months he has had treatment with tuberculin and vaccines of Pneumococcus and Micrococcus catarrhalis, with apparently no benefit. He always felt better after exercise if it did not fatigue him. Walking is fatiguing for him, as he is rather heavy. He has frequently temperature up to 99°·6.

In April 1912 he had a hæmorrhage, and again in the following May and July.

Before he broke down with tuberculosis he had been working with a microscope for several months, and used to hold his breath during the

time he was looking in the microscope to avoid moisture on the preparation.

On 25th July 1913 patient came under my treatment. His vital capacity was 3380 c.c.; inspiratory power, 32 mm. Hg; expiratory power, 40 mm. Hg. He weighed 16 stone 2 lb. During the time he was in sanatorium his weight went up to over 18 stone.

Patient gradually improved, became less short-winded, and could work both physically and mentally much easier.

August 20.—After a 3¾ mile walk his temperature was 100°·3, and after an hour's rest it was 99°·8; later in the evening, 99°.

September 9.—After a walk up a steep hill his temperature was 101°·2; after one hour it was 99°·4.

February 2.—Patient felt very much better; could go through his work in his office much easier and in considerably shorter time than before he started gymnastic treatment. His weight was now 14 stone 13 lb.

During the following few months his weight fluctuated between 14 stone 6 lb. and 14 stone 13 lb., according to his way of living.

Miss M., 19 years old, had always been delicate, had whooping-cough when 6 months

old, had pneumonia twice at 2 years and at 9 years of age. Had frequently colds in her head which went down to her chest, and lately she had difficulty in getting rid of them. Had suffered from bronchitis on and off for several years.

In spring 1913 she was rather bad, and had a breakdown. In following July she went to King Edward VII. Sanatorium, where she stayed till October. When she left the sanatorium she felt very well, but soon she began to contract colds again and was as bad as ever.

On the 7th January 1914 patient came under my treatment. Over right apex prolonged expiration and crepitation, over left apex prolonged expiration.

April 1914.—Patient's lungs were quite well, but she had still some bronchitis with slight cough.

November 1914. — Her lungs were keeping quite well; occasionally she had attacks of asthma, due to indigestion, but when she had no indigestion she had no trouble with her chest.

Mr. S., 34 years old, twenty months ago had a hæmorrhage during influenza. He went to a sanatorium for some months, and later had treatment with injections. He coughed very much,

and expectorated about 200 c.c. in twenty-four hours. His weight used to be 10 stone; was now 9 stone.

Right lung, very slight crepitation over lower lobe, a little over apex; left lung, scattered crepitation over upper lobe. Vital capacity, 3650 c.c.; inspiratory power, 20 mm. Hg; expiratory power, 60 mm. Hg.

October 31.—Patient felt very well and fit; coughed hardly anything worth mentioning. Vital capacity, 3900 c.c.; inspiratory power, 90 mm. Hg; expiratory power, 80 mm. Hg. Swam 50 yards and felt very well after it. Finished treatment to re-enter active service in the army.

April 1915.—The patient is still feeling very well and fit. Coughs sometimes slightly in the morning.

Mr. A., 42 years old, had pneumonia in February 1909 in the right lung. After this he went to a convalescent home in Folkestone for three weeks, and was in April apparently quite recovered. Weight, 10 stone 4 lb. During 1910 gradual development of cough.

In June very ill in bed, very thin; weight, 9 stone 2 lb.

August–September.—Convalescent home three

weeks; great improvement, but still slight cough.

October. — Cough and expectoration slowly increase, weight decreasing.

November.—Attended Mount Vernon Hospital. Tubercular bacilli found in his sputum.

In April 1911 he came to Frimley Sanatorium, where he did graduated labour, which was much interrupted by fever.

After six months, in October 1911 he was discharged, having gone through the course. Patient was feeling very well and fit for work, but had still cough and expectoration.

January 1912.—Back to work, but under unfavourable circumstances; cough and expectoration increased, temperature rose to 101°, and after three weeks obliged to give up work.

February–April 1912.—Trying to get stronger with dumb-bell exercises and increased walking, but temperature often rose.

On 1st May I saw patient. Under left clavicle cracked-pot sounds, indicating a large cavity; over rest of lung, râles. Over upper part of right lung, râles; over lower part, crepitation and scattered râles. He gradually improved up till 31st July, when he felt very well, could breathe quite deeply without any inconvenience at all, no rise of temperature, coughed only two or three

times a day, and expectorated hardly anything; did clerical work and felt very well with it.

In beginning of August he over-exerted himself, in spite of my warnings. He assumed that by increasing the exercises I had prescribed for him he would become an athlete in time. He got a relapse with fever, and had to stay in bed for some time. However, he got better soon, and I had a serious talk with him, explaining that as a great part of his right lung was gone, he would never be quite as strong as he had been before. He now promised to confine himself to my prescriptions, and he got very well.

On the 6th November there was no more crepitation, and over the cavity in the right lung only a blowing sound, which indicated that his lung was healed up. He felt splendid, and could work for several hours without wanting to rest. He had taken his temperature three times a day, but for several weeks it had not been over 99°·4 F., although he had been working. No cough or expectoration to speak of.

February 1913. — He started work and felt very well. In November 1913 he was still very well and at work.

In spite of my serious warning he later started wrestling, which naturally resulted in an overstrain, and he broke down with a hæmorrhage.

This may serve as a warning to every one who is desirous of doing stronger exercises than his lungs are able to support.

Mr. C., 53 years old, had very bad influenza, after which he coughed and felt very weak. He went away to the seaside for some time, but got worse instead of better. After that he was advised to go to Algeria. However, he did not go, but came under my treatment on 2nd April 1913. Right lung, slight dullness on percussion behind shoulder blade, and at the base of the lung scattered crepitation. Prolonged expiration over the whole lung. Over left lung, prolonged expiration, slight crepitation behind shoulder blade. Vital capacity, 1980 c.c.

May 10.—Over front of right lung, slight prolonged expiration; behind shoulder blade, slight crepitation. Behind left shoulder blade, very slight crepitation; otherwise, almost normal sounds over left lung. Inspiratory power, 20 mm. Hg.

June 7.—Both lungs quite well. Patient feels very well and fit. Vital capacity, 3960 c.c.; inspiratory power, 40 mm. Hg; expiratory power, 60 mm. Hg. Finished the treatment.

April 1915.—Patient still feels well and fit; has had no trouble with his lungs.