The hygienic prevention of consumption.

THE

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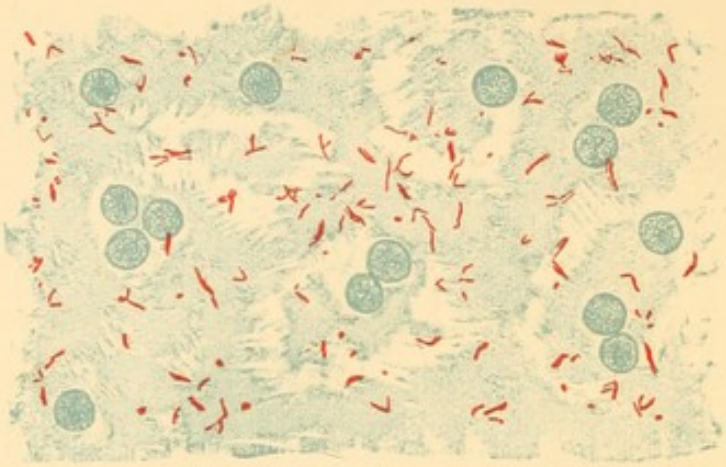

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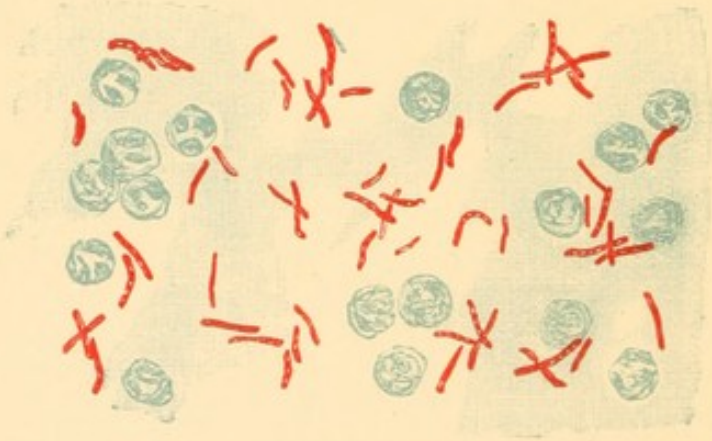

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Bacilli stained red with Fuchsin (see page 12). Sputum stained with Methylene Blue.

TUBERCLE BACILLI IN SPUTA.

THE

HYGIENIC PREVENTION

OF

CONSUMPTION.

BY

J. EDWARD SQUIRE, M.D. (LOND.),

M.R.C.P. (LOND.), D.P.H. (CAMB.),

PHYSICIAN TO THE NORTH LONDON HOSPITAL FOR CONSUMPTION AND DISEASES OF THE CHEST, FELLOW OF THE ROYAL MED. AND CHIRURG. SOCIETY AND OF THE BRITISH INSTITUTE OF PUBLIC HEALTH, MEMBER OF THE PATHOLOGICAL AND HARVEIAN SOCIETIES OF LONDON.

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1893.

TO

My Father,

WILLIAM SQUIRE,

M.D., F.R.C.P.

PREFACE.

In this country little attention has, until quite recently, been given to the question of the prevention of Consumption, and it is in the hope of increasing the interest in this branch of Sanitary Science that this short work is offered to the Profession, and to all who are interested in Preventive Hygiene.

That Consumption depends largely upon conditions which are preventible, is becoming universally recognised by the medical profession; and it is believed that a collection of the hygienic rules on which preventive measures must be based will be found useful.

That the importance of these hygienic rules may be appreciated, however, and their application in special cases judiciously insisted upon, it is necessary to understand the nature of the disease against which they are directed. Part I. has accordingly been devoted to a sketch of the nature of Consumption, giving in brief compass, so far as the nature and limits of the work will allow, a summary of our knowledge of Pulmonary Tuberculosis.

The section on Local Predisposition in the Lungs (Chap. VI.) is chiefly based upon a paper read by me before the Harveian Society of London on "Pulmonary Affections which may lead to Phthisis."

In Chapters III., XV., and XVI., use has been made of my papers on the "Prevention of Consumption" read be-

fore the Epidemiological Society of London in 1889, and at the International Congress of Hygiene in 1891.

The statistics with regard to Heredity on page 34, and the temperature chart on page 185, have been specially prepared for this work from cases under my care. The latter is valuable as being the average obtained from a large number of consecutive observations (made every hour for nearly three weeks) in a single case of active tubercular phthisis. When the patient left the hospital, convalescent, the temperature had been almost normal for about a fortnight.

Generalised directions must always require adapting to the special needs of individual cases; but I venture to believe that the bringing together of hygienic rules applicable to those with a tubercular tendency, or with early Consumption, may be acceptable to my professional brethren, as well as to the large number of others interested.

J. E. S.

Harley Street, W.

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THE

HYGIENIC PREVENTION OF CONSUMPTION.

PART I.

THE NATURE OF CONSUMPTION.

Introduction.

That preventive medicine has done a vast deal towards the diminution of prevalent diseases, will be recognised by all; and comparing the past with the present, we can see how certain diseases—such as plague, small-pox, and typhus—have almost disappeared, whilst others have been rendered less prevalent and less deadly.

Small-pox alone, for example, caused 9 per cent. of the annual deaths in London during the last century; whereas it has lately for some years past been accredited with no more than 0·002 per cent. Now anyone who a hundred years back had looked forward to the time when the fatality from small-pox would be reduced from 1 in 10 to 1 in 50,000, would probably have been ridiculed as a visionary dreamer.

When adequate grounds are put forward in support of certain preventive measures, these are usually adopted without serious opposition; and if we were asked against what diseases preventive medicine would be most profitably employed, we should assuredly name those which claim the largest death-roll in the country, or which incapacitate large numbers of the population during the ages of greatest

usefulness. The acute infectious fevers, scarlet fever, measles, whooping-cough, &c., still cause a high mortality, but in these the duration of illness is limited, and a large proportion of those affected are attacked during childhood: recovery with immunity from a second attack is the rule, and permanent incapacity for work in after-life is comparatively rare. Study of these diseases has however shown that their spread depends upon conditions which may be controlled by proper precautions, and the State has wisely framed regulations by means of which the prevalence of infectious diseases has already been lessened, and their mortality greatly diminished.

Consumption, however, remains a national plague: it is credited with causing about one-tenth of all the deaths which occur in this country every year, or about the same proportion that small-pox showed a hundred years ago. The greatest mortality from consumption occurs during the ages when bodily vigour should be at its best; and the disease, when not fatal, runs a prolonged course, and frequently causes permanent incapacity for labour.

According to the latest report of the Registrar-General, the deaths from consumption during the year 1890 in England amounted to 48,366, and of these a large majority occurred between the ages of fifteen and forty-five—that is, during the working period of life.

Till comparatively recent times consumption was considered incurable; and though we now recognise its curability under favourable conditions, we are still unable to check its advance in a majority of cases. Here, then, is a disease which pre-eminently appeals to preventive medicine—its prevalence is appalling, its ravages great, and its cure uncertain. If consumption can be shown to be dependent in any degree upon causes which are within human control, and thus in some measure preventible, there is no more worthy object for preventive medicine; and with the encouragement afforded by past successes against other plagues, we may hopefully anticipate a marked diminution in the death-rate from consumption.

But *is* consumption dependent upon conditions which may be controlled?

There are still many who consider the dampness and

variableness of our climate to be a sufficient cause for the prevalence of this disease, and who would, therefore, look upon it as an unavoidable result of natural conditions to which we must submit. But consumption is by no means confined to cold and damp climates: it is found in almost every country in the world, and under widely different climatic conditions. It attacks those who live in the heat of India, and those dwelling in the dry cold of Canada. Clearly, then, its causation cannot be entirely explained by climate. When we come to examine further and more minutely into the distribution of phthisis, we find its prevalence greatest where the population is most dense. The most thickly populated countries and towns show the greatest proportion of consumptives amongst their inhabitants, and in the larger cities the proportion is far greater than in villages and country places. Even amongst the towns we note differences, according to the density of population and the prevailing industry. In the same town, again, there is a marked difference in the amount of consumption in the various districts. Where the houses are closely packed together, and the inmates crowded in ill-ventilated dwellings, consumption is more rife than in the more open districts; and even amongst the inhabitants of the consumption area it is those who follow indoor and sedentary occupations, or who work in close rooms or amidst much dust, that are affected, rather than those whose employment keeps them out of doors and exposed to all kinds of weather.

Thus we come to realise that consumption—once considered the type of a climatic disease—is largely dependent on the circumstances and mode of life of a population or of the individual, and may, therefore, be brought under the regulating influence of hygiene and sanitation.

Consumption, most prevalent and most fatal in the more civilised communities, and spreading under conditions which are, many of them, the outcome of civilisation, claims its victims chiefly amongst young adults taken from the ranks of workers when they should be in their prime, and thus demands that earnest attention of medical science it continues to receive. Sufferers from consumption too often despair of its arrest, and clutch at any means which promise

relief. There is perhaps no other disease in which so many "special cures" have at different times been advertised to a credulous public: there is hardly one of these which has gained a reputation beyond the range of the proprietor's reiterated assurances. But though consumption has so long been known, and so widely studied and described, it is only of late years that its nature has been definitely recognised. Whilst at one time the influence of climate was held to be a sufficient cause of the disease, undue stress has at other times been laid on hereditary transmission. Now and again authorities have advocated the theory, since established, that consumption is contagious, and may be directly communicated from the sick to the healthy. But the old observers were limited in their study of the disease and its causation to the distribution and course of the ailment in their own districts; and a more complete study of the disease only became possible when registration of deaths became general. The influences of overcrowding and of occupation were then seen to be greater than those of climate, and a fresh light was thrown on the causation of consumption. In 1843, experimental research added a new and most important fact to the knowledge of the disease, by demonstrating that tuberculosis could be produced in animals by inoculation with tuberculous material. These experiments were repeated and confirmed by numerous investigators, some of whom believed that the same result could be obtained by inoculation with other matters besides material derived from a tuberculous source, such as putrid substances and mechanical irritants. More careful experiment, however, proved that tuberculosis could only be produced when tuberculous material was employed for inoculation; thus the specific nature of tuberculosis, and therefore of Consumption, was established. Then followed in 1881, after prolonged and careful inquiry, the discovery by Koch that a special minute micro-organism is to be found in tuberculous material, and that when these living particles are separated from their surroundings and cultivated outside the body,* even through as many as seventy successive reproductions, tuberculosis can with certainty be produced in animals by introducing these isolated micro-

* See Appendix.

organisms within the body. Since that time the study of the bacillus tuberculosis has occupied numerous investigators; and the conditions of its life and growth, the materials which favour its development and those which are inimical to its existence, are being anxiously and laboriously investigated in the hope of benefiting the numerous sufferers from tubercular disease. Though the discovery of the tubercle bacillus has not as yet resulted in the discovery of a cure for consumption, it has undoubtedly furnished the key to *preventive measures*. Knowing the nature of the disease, and the many circumstances which influence its spread, we may avoid those conditions which are found to favour the development of the exciting cause.

Means for prevention to be successful must be based on an acquaintance with causation. A summary of the precise nature of consumption, becomes then an absolutely necessary introduction to the full consideration of preventive regulations.

CHAPTER I.

DEFINITION OF CONSUMPTION—A SPECIFIC INFLAMMATORY DISEASE—ITS PROMINENT SYMPTOMS—THE CHANGES PRODUCED IN THE LUNG.

Consumption may be described as an inflammatory disease of the lung, tending towards destruction of the lung-tissue. The inflammatory changes are excited by a special microscopic living organism—the **bacillus tuberculosis**—which gains entrance into the lungs from without. It is, therefore, a specific infective inflammatory disease of the lung.

As the causative micro-organism is known to infect almost any part of the body, producing inflammatory changes which from their appearance in certain stages are called **tubercles**, the disease may be described as tuberculosis of the lung (pulmonary tuberculosis), or more fully *pulmonary tubercular phthisis*.

The symptoms of consumption are many of them familiar, for the disease is unfortunately too prevalent.

Wasting, or emaciation, has determined the popular, as well as the medical name of the disease: the term "*Consumption*" implies progressive wasting away, and "*Phthisis*" is derived from the Greek verb "to waste." But this loss of flesh, though a common and almost a constant symptom, is not distinctive of pulmonary consumption. All fevers cause wasting, as do also some chronic diseases; whilst others, especially those affecting the stomach, interfere with nutrition.

Cough is one of the first and most constant pulmonary signs of tubercular deposit, and is in some form present at nearly all stages of the disease.

Fever, usually increasing in the afternoon, marks all the active stages of the tubercular process; the hectic flush, and the night perspirations, which increase as the disease advances, accompany the rise in temperature.

The diagnosis of consumption would by many be considered sufficiently indicated if the three symptoms—wasting, cough, and night-sweats or hectic fever—were associated. But to the physician symptoms are indications of changes in the tissues of the body, or of alterations in the performance of function; and it is these changes, and not only the presence of certain symptoms, which must be ascertained in forming a conclusion as to the nature of an illness, and the way to its relief. Therefore, although we shall mention the more common symptoms associated with consumption, it is the morbid condition of the lungs and other tissues, and the alterations of function dependent on this, which constitute the special disease. The changes in the lungs are to be ascertained by a careful physical examination of the chest before we can pronounce a person to be consumptive, or judge of the extent of the disease and the prospect of life and recovery.

So, too, any of the symptoms usually looked for may be absent in certain cases and in certain stages of the malady, without affecting the diagnosis; and any or all of these symptoms may be present in conditions of the lungs other than phthisis. Symptoms are important as indications of pathological changes, and guide the physician to the organs to be most carefully examined; but he who relies on symptoms alone as the basis of a diagnosis will formulate

an opinion based on incomplete knowledge, and may attempt to treat he knows not what.

Let us then first discuss briefly the results of this disease as found in the lungs, and reserve for a later chapter the further consideration of the prominent symptoms and their signification.

Pathological Changes. — Consumption is seldom rapidly fatal; so that the lungs of a person who has died of phthisis generally give evidence of advanced disease; whilst in different parts of these organs we may recognise various stages of the tubercular process and its effects.

Instead of being free to move within the smooth pleural cavity of the chest, the lung may be bound to the chest-wall, especially at the apex. The pleural surfaces may be roughened; and other adhesions may be found, the strength and tenacity of which depend upon the length of time they have existed.

The affected portion of the lung has lost its sponginess, and has become consolidated to a greater or less degree. Scattered throughout the organ are small firm grey nodules, and larger masses of yellow colour with a soft or caseous core. From these larger yellow masses this core may be squeezed out, a cavity being then formed. In the portion of the lung where the disease is more advanced, cavities of various sizes—from that of a bean to that of an orange—may exist: sometimes one only, but usually more. The tissue round these cavities has lost the characteristics of lung-tissue, and is firm and hard. All parts of the affected organ may be more dense than natural, from the increase of fibrous tissue between the air-cells and around the blood-vessels. The disease is usually most advanced in the apex of the lung, although occasionally the base is affected from the earliest period of the disease.

It was till recently considered that the changes found in the lungs in phthisis were pathologically distinctive and characteristic of tuberculosis; the grey granules found scattered through the affected organs, and called "tubercles," were considered to be special new growths, the formation of which was peculiar to this disease. The important part which these tubercles take in the disease is undoubted, their multiplication and enlargement leading to consolidation of

the lung, while their subsequent degeneration or softening produces the cavities; but they can no longer be looked upon as new deposits. We now recognise that the process throughout is dependent upon inflammatory changes, excited and maintained by the presence of the special bacillus. The tubercles themselves are results of inflammation, and the various conditions found in the lungs in phthisis indicate different phases of inflammatory action. The special characteristic of phthisis thus depends upon the originating cause of the inflammation, and not upon the changes thereby induced.

Similar changes are to be found where inflammation is set up by other causes, such as the irritation of inhaled particles of metal, grit, or coal dust; or by various constitutional diseases, such as cancer; or by various forms of bronchitis and pneumonia.

The special cause of the inflammatory changes in phthisis is found in a minute organism—the **tubercle bacillus**—colonies of which form in the lung and induce inflammatory action in their neighbourhood; and as the bacilli invade different parts of the lung, they set up inflammation of varying extent and degree round their seat. This inflammation may be sufficiently intense to cause destruction of tissue; or being slower, may lead to development of fibrous tissue, which then forms an enveloping wall to the tubercular focus, and by preventing the extension of the mischief tends to limitation and cure of the disease.

The irritant bacilli cause at first a catarrhal pneumonia, apparently extending from the minute bronchial tubes. With extension of the inflammatory process, the air-sacs and the minute air-tubes become blocked with cells. The walls of the air-sacs also become thickened by excessive development of cellular elements, until at length they become indistinguishable from the cell-blocked air-chamber, and a mass of closely packed cells replaces the true lung structure. This limits the extent of surface to which the air has access and the amount of blood reaching it for aeration, whilst restraining the free expansion of the lung. With the cell development in the walls and within the alveoli there is usually increase in the connective tissue of the lungs, causing the affected portion of the organ to

become indurated and fibroid. The newly formed cells soon choke the capillary blood-vessels, and the tubercle is thus deprived of nourishment from the blood. The mass of closely packed cells then commences to undergo degeneration. As the cells degenerate, we find the tubercle disintegrating or breaking down, and the cell structure replaced by a structureless or granular substance. This is the "yellow tubercle," or in large masses the "caseous mass."

The softened, caseous result of degeneration becomes more liquid, and, when the softening has extended to the opening of a bronchial tube, the matter, with many enclosed bacilli, may be removed and expelled by coughing, and a cavity is left.

The nodules increase by the extension of the inflammatory changes at their margins, and thus may invade a considerable area of lung-tissue. New centres of inflammation are established in other and perhaps distant parts of the lung by the migration from the primary tubercle of bacilli, which, forming new colonies, set up in their neighbourhood changes similar to those just described. Thus tubercular nodules may become distributed throughout the lung. In every tubercular patch the process is found most advanced in the centre, as this no longer receives its normal blood supply. The centre, thus cut off, undergoes degeneration, and the contents of the resulting cavity are expelled into the bronchial tube. A source of infection is thereby carried to other parts of the lungs in the passage towards the bronchi of the sputa to be expelled in coughing. Such particles may get down the bronchus of the opposite side, and thus infect the other lung, or, being expectorated, may become sources of infection to other persons, for in these caseous masses are numerous bacilli. By such means also infection may be conveyed to the larynx, and the vocal cords may become the seat of tubercular infiltration and ultimate ulceration.

Under more favourable conditions, the spread of the tubercular process in the lung may become arrested, and the progress of the disease checked.

This may be brought about by fibrous tissue formation at the advancing margin of the nodule, which then becomes enclosed in an impervious envelope through which the bacilli cannot wander, being thus prevented from producing

further mischief. The enclosed caseous material becomes inspissated or dried, and may become cretaceous, whilst the fibrous envelope contracts; and, if the tubercular patch be small, finally nothing is left to mark the site of the tubercular nodule except a scar of fibrous tissue. This process has been called "natural arrest by obsolescence" (*Douglas Powell*), and such scars in the lung have been detected in situations where tubercle had been previously diagnosed.*

In most cases where the inflammatory process is not very intense, and where from any cause the rapid extension of mischief has been checked, fibrous overgrowth forms in the neighbourhood of the tuberculous deposit, and constitutes a bar to extension of the disease: here recovery may ultimately follow, though with a much damaged lung.

CHAPTER II.

The Tubercle Bacillus.

The Tubercle Bacillus—The Specific Cause of the Inflammatory Changes—Koch's Discovery—Description of the Bacillus, and the Conditions under which it Thrives—The Proofs of the Connection between the Micro-Organism and Tuberculosis.

The structural alterations which are found in the lung in consumption are, in their early stages, like those which attend pneumonia or inflammation of the lungs. But whilst in acute pneumonia (lobar or catarrhal) resolution and absorption of the inflammatory products generally occur, in tubercular inflammations resolution is uncommon and degeneration the almost invariable sequence. So, too, simple inflammations extend only by direct continuity, and not by the formation of fresh disease-centres in distant parts as so frequently occurs in phthisis.

This difference in the mode of extension, and the tendency to degeneration rather than to absorption, constitute so im-

* See page 153.

portant a characteristic of phthisis, that we must examine the cause of these peculiarities more fully.

The mode of extension of tubercular disease in itself suggests an infective cause for the inflammation, and, as we shall see, this infective theory is now fully established.

Though clinical observation seemed to justify the belief that consumption might, under certain circumstances, be communicated from the sick to the healthy, the proof of the infectiveness of tuberculosis was only to be obtained by experimental research. The clue was found in the discovery that infectious diseases followed upon the entrance into the body of certain living micro-organisms, and numerous investigators turned their attention to endeavouring to ascertain if tuberculosis might not also be dependent upon a microbe.

Several observers described various minute organisms which they had found associated with tubercle, but the special agent could not be identified until Koch published his investigations. He also elaborated a series of proofs by which the causative relation of a micro-organism to its attendant disease could be satisfactorily established.

These proofs are now acknowledged to be essential, and may be mentioned here :—

1. The micro-organism must be invariably associated with the disease.
2. It must be cultivated outside the body and through several generations.
3. Any one of these cultures must be capable of producing the disease if inoculated into a susceptible animal.
4. The same micro-organisms must be discoverable in the animal thus inoculated.

Koch discovered, associated with tubercle, a rod-shaped micro-organism which satisfied the above tests, and this he named the *bacillus tuberculosis*. This is a cylindrical rod about a quarter to a half the diameter of a blood-corpuscle in length (about $\frac{1}{8000}$ to $\frac{1}{12000}$ of an inch), and with a breadth of about $\frac{1}{8}$ to $\frac{1}{10}$ its length ; it is somewhat curved or bent, and belongs, like the micro-organisms associated with some other diseases, to the order of schizomycetes or fission-fungi in the lowest scale of vegetable life. This bacillus has now

been extensively studied, and its characteristics as at present determined may be thus summarised.

It may be recognised microscopically not only by its shape and size, but by its behaviour to certain staining reagents.

When stained with aniline colours, such as fuchsin (a deep red), it will hold the colour and remain stained when treated with acids, which will decolourise most albuminous bodies.

Thus when sputa or tissues are stained with fuchsin, and then treated with sulphuric acid (25 per cent.) or nitric acid (2 per cent.), everything is decolourised except the tubercle bacilli, which still retain their red stain.

The bacilli multiply by division (fission), and apparently also by the formation of spores. Division and sporulation take place slowly, and thus colonies are of slow growth. These bacilli are also difficult of cultivation, because they will only grow in certain media and in the presence of a certain amount of moisture. They do not form spores in the air. The bacillus thrives only within a certain limited range of temperature (from 30° to 40° C. or about 95° to 105° F.); and though they may not be at once killed by temperatures above or below this range, they are rendered inactive and incapable of multiplication. The temperature most favourable to the growth of the bacillus is from 37° to 38° C. (98·5° to 100·5° F.), or about the temperature of the human body. They are destroyed by heat over 250° F., or by drying. A temperature of 107·5° F. continued for several weeks produces the same result. Their growth ceases below 82° F., but cold does not appear to kill the bacillus. The spores retain their vitality under conditions which are inimical to the bacillus itself.

The most important characteristic of these bacilli is their power of producing tuberculosis in susceptible animals, and this with unerring certainty: whereas the disease is not produced when the bacilli are absent.

When they are introduced under the skin or within the cavities of the body, tuberculosis is the invariable result, starting at the point of inoculation and spreading usually along the path of the lymphatics. In the tubercles thus produced similar bacilli are found, and in much greater numbers than were introduced originally, showing that they have multiplied in the body. Although the inoculation of

irritating and putrid substances will produce inflammation, none of these bacilli will be found, unless the animal has been exposed to other sources of infection: where those are scrupulously avoided, tuberculosis does not result, for it can only be produced by the inception into the body of the tubercle bacillus or its spores.

In 1843 it was shown that rabbits could be made tuberculous by the inoculation under the skin of tuberculous material from a dead animal.

Further experiments were needed to show that only tubercle can produce tuberculosis. The earlier ones by Wilson Fox and Burdon Sanderson were inconclusive; these led to the careful methods of Watson Cheyne, Salmonsen, Baumgarten, Sternberg, and others, demonstrating beyond the possibility of doubt that inoculated non-tuberculous material fails to produce tuberculosis in animals; whilst, on the other hand, tubercle can be produced with certainty in animals by inoculating them with tuberculous material or with bacilli which have been cultivated on simple broth or gelatin outside the body. Without investigations such as these, which prejudice opposes, the proofs of how tuberculosis is communicated would have remained obscure, nor should we have arrived at such an important position in our defences against so devastating a disease, as that now afforded by our knowledge of its infective nature.

Tubercle is by no means confined to the lung: it also infects other organs. It has been found in the skin and bones; in the brain and its membranes; in the lungs, liver, spleen, and kidneys; in the lymphatic glands, in the walls of the alimentary tract, and in other situations.

Tuberculosis affects many animals besides man, and is common in cattle, rabbits, monkeys, and in all animals which are kept caged or housed. It has been found in the pig, goat, horse, rabbit, dog, cat, cow, sheep, and in poultry. Dr Crisp stated that he had met with tubercle in more than 100 different species of animals—quadrupeds, birds, and reptiles. Tuberculosis is one of the most wide-spread diseases of domesticated animals, though it is rare amongst animals in their wild state.

In the human subject tuberculosis is common as a primary affection in the membranes of the brain (tubercular men-

ingitis); in the lungs (phthisis); in the alimentary canal (consumptive bowels); and in the abdominal lymphatic glands (tabes mesenterica); whilst secondary deposits are often found in other organs.

Lymphatic glands are frequent seats of tuberculosis, as in struma or scrofula: the skin (in lupus), and the bones and joints are often attacked.

In general tuberculosis many organs and tissues may be affected, either simultaneously or in rapid sequence.

Besides their invariable presence in tuberculous organs, the bacilli have been detected in abscesses, in the blood and lymph, in the milk, and in various secretions and excretions of the tuberculous.

Thus the *bacillus tuberculosis* is the essential factor of tuberculosis, and therefore of consumption or tubercular phthisis; and this disease owes its importance to its infectiveness, whereby it spreads in the body when once introduced, and is communicated throughout a community.

CHAPTER III.

The Spread of Consumption.

Proofs of the Communicability of Consumption—The Modes by which the Bacillus may gain Entrance into the Body—Hereditary Transmission—Infected Food—Infected Air—Inoculation—Other Modes of Infection—Auto-Infection—Modes by which the Bacillus is given off from the Bodies of the Sick—The Expired Air—The Expectoration—Natural Secretions and Excretions.

A belief in the infective nature of consumption is no new idea. Popular tradition—generally the outcome of observation, though uncorrected by logical reasoning, and therefore often leading to false deductions—has handed down for generations a half-belief in the communicability of consumption; and many physicians, from the time of Morgagni*

* Born 1682, died 1771.

onwards, have expressed their conviction of its infectiveness.

In some countries the belief has been so strong, that regulations have been framed on this basis to prevent the spread of the disease.

Evidence of its introduction into previously healthy localities is furnished by the immunity of savage races before their contact with Europeans, and the subsequent prevalence of phthisis on the coast before it is heard of inland.

In France, Alison * has collected some most instructive instances of the introduction of consumption into healthy villages. Individual members of healthy families, living in villages where consumption is quite unknown at the time under observation, visit other localities and stay with phthisical persons. They become themselves consumptive, and on their return home other persons in the village, *who are on terms of intimacy or who live quite close to them*, also become affected. In other cases a phthisical patient from elsewhere comes to live with healthy persons in a village previously free from phthisis, and those with whom he lives become consumptive. Alison concluded from his observations that phthisis, introduced into previously healthy districts by an affected person, spreads to those in close contact with the individual, and, having attacked the susceptible, disappears in that locality until reimported.

The following case, from this series of observations, may be quoted as full of interest:—

A man aged forty-four years, living in a village in which no deaths from phthisis had occurred during the previous ten years, was accustomed every year to visit, for a week, his brother-in-law who lived at another village 150 kilometres from his own home, and who had consumption (pulmonary tuberculosis). In 1880 the subject of this observation had pleurisy, and on his return from his visit next year to his brother-in-law, with whom he slept, he himself became affected with phthisis, and died in 1884. He infected two other persons in his native village who lived close to his home—a child of five (meningitis), and a boy of sixteen.

* *Archives de Médicine*, Sept. 1885.

Both these became affected in 1884, and both came of healthy families.

Here we see a healthy person sleeping occasionally with a consumptive without ill effects, until he gets pleurisy and so becomes predisposed, when on the next visit he becomes affected. He then becomes the cause of a further spread of the disease.

Granting, then, as we must, the infective nature of tuberculosis, it now becomes an important question as to what may determine the seat of the tubercular deposit: we may explain this point by considering the various modes by which the infecting bacillus may gain entrance into the body. We shall find that the mode of infection often determines the seat of primary deposit. The chief modes of entrance of the causative micro-organism are as follows:—

1. *By Direct Hereditary Transmission.*—We have to bear in mind that children may be born tuberculous. This would seem to be uncommon, but is sometimes the case, and has been demonstrated both in man and in the young of tuberculous animals. Here any or all organs may be affected with tuberculosis, either soon after birth, when general tuberculosis is the usual result, or possibly not until some months have elapsed. It has been suggested that the bacilli which are in the body at birth may not find suitable conditions for growth and multiplication, but yet remain undestroyed though inactive, until some weakness due to illness or rapid development of organs or tissues furnishes a suitable soil, or causes a diminished resisting power in some part of the body in which the bacilli can flourish and produce their morbid effects. If this be so, it might sometimes account for tubercular disease in bones and joints in growing children, but rarely if ever for tubercle in the lungs.

In pulmonary consumption, it is a *predisposition* to tuberculosis and not the disease itself which is inherited (see Chap. V., *Hereditary Tendency*), and the causative micro-organisms reach the body from outside after birth.

2. *By the Mucous Membrane of the Alimentary Canal.*—The proof of this means of infection is derived from experiment. Animals fed on tuberculous milk, or who have tuberculous material mixed with their food, become tuberculous.

In infants whose chief food is milk, there is much risk of infection by this means. This is especially the case if they are suckled by a consumptive mother; but hand-fed infants are subject to similar danger if the milk is taken from tuberculous cows and is not boiled before use. Here the path of entry of the infection is the alimentary tract, and the primary tuberculosis may start from the throat or begin in the intestines (consumption of the bowels), and in the abdominal lymphatic glands, which arrest the bacilli taken up in the absorbed nourishment. Tuberculosis of these glands causes the disease known as tabes mesenterica.

From these centres the bacilli may spread and give rise to general tuberculosis.

Infection by the alimentary mucous membrane probably plays a more important part in the tuberculosis of children than has yet been acknowledged. The path of infection of the lymphatic glands in the neck (scrofulous glands) is probably chiefly through the mucous membrane of the pharynx; and some recent experiments tend to show that not only strumous glands in the neck but also tubercular meningitis may result from infection of the lymphatic glands from tuberculous food. As tuberculosis is common in cattle, and affects pigs, rabbits, and fowls, and probably sheep and goats, it becomes an important question as to how far tuberculosis may be communicated to man by means of milk or flesh used as food. Communication by the milk of tuberculous cows has been experimentally effected in animals; and whether this is only possible when the udders are affected, or may occur wherever the seat of the tubercle may be, an additional reason is in either case found for the inspection of the cows kept for dairy purposes. In the *British Medical Journal* of January 5, 1889, a case is mentioned in which some pigs fed on the milk of tuberculous cows became affected with the disease. Galtier* concluded that cheese-whey prepared from tuberculous milk might be infective.

3. *By the Mucous Membrane of the Respiratory Tract and by the Air-cells of the Lungs.*—This is probably the most frequent mode of infection in pulmonary tuberculosis.

* *Comp. Rendus*, t. civ.

Experimental proofs of the efficacy of this mode of infection are numerous; and it has been found that tuberculous particles inhaled have more power to produce the disease than if swallowed.

The tubercle bacillus has been found in the air of rooms in which phthisical persons are living, and the dust from such rooms has been proved to be infective. Tuberculosis has been produced in animals by causing them to respire air vitiated by phthisical patients. I have recently had some glass slides covered with glycerine, placed about the wards of the consumption hospital to which I am attached, and there left for a few days, so that the dust settling from the air might be caught and held by the glycerine. Subsequent microscopical examination of these slides demonstrated the presence of tubercle bacilli derived from the air of the wards.

Pulmonary tuberculosis, as a primary disease, is uncommon in young children, though the lungs are often affected as part of a generalised tuberculosis.

In adults we most frequently find the lungs the seat of the primary tubercular deposit. Here the bacilli gain entrance into the body by means of the inspired air: other organs may become secondarily affected.

4. *By a Cut or Scratch through the Skin.*—This is a true inoculation, but such a mode of infection is necessarily a rare accident. Infection has resulted from a cut on the finger with a broken spittoon used by a phthisical patient, and in other ways. This generally produces a local tuberculous sore only, without any general disease.

In connection with the various possible modes of infection, we must mention the conveyance of tuberculous matter from a diseased lung to other and distant parts of the body, by which a consumptive patient may, as it were, infect himself. Thus the sputa may be drawn down the bronchial tubes into the opposite lung, and there set up a fresh centre of disease, or may lodge in the larynx, and produce tubercular ulceration of the vocal cords. So also if the expectoration be swallowed instead of being ejected, tubercular ulceration of the intestines may result. These accidents may be rendered less likely to occur when the cough is effectual, and when care is taken by the patient to expectorate all phlegm that rises into the throat or mouth.

Disinfectant respirators are useful with the object of preventing self-infection rather than as curative agents.

When the disease in one lung has become quiescent, and the patient is apparently cured, it occasionally happens that after a long period of good health the disease shows itself again in some fresh portion of the same or in the opposite lung. Here it is probable that the infective particles from the quiescent but not obsolete primary tubercle, have become dislodged, and have carried infection to the fresh situation. This infection of a distant part of the body from a tuberculous centre is known as auto-infection—the infection of a patient from himself.

Next in importance to the modes by which the bacillus may gain entrance into the body, is the inquiry as to the ways the infection may be given off by a tuberculous patient; for then we know in what manner the patient becomes a source of danger to others.

Most important of these is the giving off of infection from the lungs, for by this the air may become the carrier of disease.

Tubercle bacilli may possibly be expelled in the expired air in respiration, but if so they will not be carried far, for they will soon settle down in the dust; and as the temperature of the air is rarely sufficiently high to maintain the vitality of the tubercle bacillus, active infection is not carried far by the air. But there is risk from directly inhaling the breath of a consumptive patient, as might occur to a person sleeping with the invalid; and, without sufficient ventilation, the air of a room constantly occupied by a person with phthisis may become a source of danger.

A more potent danger is to be found in the expectorated matters, for these often contain large quantities of bacilli, which are surrounded with a material in which they flourish.

It has been found that dried phthisical sputum has retained its virulence—as tested by inoculating animals—for many months.

We have already mentioned that bacilli occur in the milk, and consumptive mothers, in suckling their infants, may communicate tuberculosis.

In pulmonary tuberculosis, the chief source of infection must be the air; and as this may be, and often is rendered infec-

tive by consumptive persons, it is obvious that consumption is most likely to be rife where the population is numerous and closely packed. We are, therefore, prepared to find, as we do, that consumption is most common in thickly populated places, in towns, and especially in their more crowded parts.

Knowing the modes by which infection is given off by the sick, and those by which it may gain entrance into the body of the healthy, we have the key to prevention of the disease. But we know that, although the entrance of the bacillus is the essential causative factor in tuberculosis, the danger of infection is not the same in all persons, and that a liability to suffer from the presence of the micro-organism forms an important consideration. This tendency or predisposition to tuberculosis has such an important influence on the causation of the disease, that we must examine it at some length; since to combat this predisposition forms an important part of all preventive measures.

CHAPTER IV.

Predisposition.

Meaning and Significance of Predisposition—General Predisposition—Lowered Vitality and Ill Health—The Protective Action of Healthy Living Tissue against Disease—Causes of General Predisposition — Illness — Overwork and Anxiety, &c.

We have shown that consumption or pulmonary tuberculosis depends upon the development within the lungs of a minute living particle, reaching the lungs from without, and usually in the inspired air—the *bacillus tuberculosis*. This specific micro-organism is always derived from persons or animals already affected with tuberculosis: consequently consumption is an infectious disease.

Seeing how wide-spread consumption is, it would appear that the infective particles must be almost everywhere

present when the population is numerous, and that the risk of becoming infected must be very general.

How, then, do so many escape the disease? The same question might be asked of all the infectious diseases—for scarlet fever, measles, and other infectious fevers are very frequently with us, but all are not at all times equally susceptible. And to some extent the same explanation will be found to account for the escape of some who are exposed to the infection of these fevers, and the immunity of so many from consumption in the midst of communities where phthisis is rife.

The infection of consumption is less intense than that of the acute infectious fevers, and many circumstances oppose the growth and development of the infective micro-organisms even when they have entered the body.

In the healthy body everything is against the bacillus, and some condition of **lowered vitality**, or of **injury to the tissues**, must generally occur before the micro-organism can effect a lodgment or find suitable surroundings and pabulum for its development.

These conditions of lowered vitality, or the like, cause a liability of the tissues to suffer from the invasion of the bacillus, and by increasing the susceptibility of the individual to the infection, produce a predisposition to consumption. This predisposition or tendency to consumption may depend upon a diminution in the general resisting power of the tissues against disease, or may be excited by alterations in certain organs from disease or injury.

The former constitutes a "general" or "constitutional," the latter a "local" predisposition.

We have said that the infection of consumption is less intense than that of some infectious fevers, but this expression requires some further examination. The intensity of infection in any case depends not only upon the readiness with which infection may be taken into the body, and the ease with which it adapts itself to its surroundings there, but upon the amount of infective material given off from the invalid, and its concentration. This concentration depends partly upon the rapidity with which the air is changed and other infection-bearing media (skin-particles, fomites, &c.) are removed, partly on the power of multiplication of the

infection in such media. In phthisis the infective bacillus is usually given off only from the lungs, by the breath and by the expectoration; and especially the latter, in which the bacilli are fixed until liberated on its drying and becoming pulverised. In most cases where a consumptive person is confined entirely to one room, the air becomes contaminated only by respiration, and that to a small extent; and as the bacilli soon lose their functional activity at ordinary temperatures, and therefore do not multiply in the air, a very little movement of the air prevents concentration of the infection. Nevertheless, in a small, ill-ventilated room, constantly occupied by a person with advanced phthisis, which is kept over-heated, and where cleanliness is unknown, the air may become poisoned with bacilli, and the infection be concentrated to an amount dangerous to even healthy and vigorous persons who breathe it. A person staying some time in such an atmosphere may contract phthisis without any special or innate predisposition to tuberculosis.

The following typical example of a not uncommon condition amongst the poorer tailors in London, is taken from an experience of several years' work in the Soho district, whilst physician to an old public dispensary in that neighbourhood.

A single room, containing less than 2000 cubic feet of air space, serves as the home for a family of six or seven persons, and as work-room for the father and his elder children. A large double bedstead seems almost to fill the room, and upon this lies the mother of the family dying of consumption. Her husband is at work before a fire (although it is summer) pressing a coat, the steam from which, as he passes the hot iron over the damp cloth, renders the close air humid. Beside him his grown up son sits stitching at some other garment, and near the bed is the eldest daughter with her sewing machine, probably waistcoat making; whilst two or three younger children play about on the floor. The single window is shut and cannot be opened, either because the frame is too rotten, or because from long disuse it has stuck too tight to move.

But short of prolonged exposure to such intense infection, healthy and vigorous persons live safely with consumptives, and danger from infection only comes with some constitutional or local enfeeblement.

Thus predisposition assumes a great importance in considering the etiology of phthisis, for though the bacillus tuberculosis is the essential and necessary cause of tuberculosis, the bacillus is virtually powerless for harm without a predisposition or susceptibility in the individual exposed to infection.

We will, therefore, now consider the general and local conditions which constitute this predisposition.

I am at present engaged in a series of observations, to show the effect of injury and disease of the lung in cases of exposure to tubercular infection. In my first series an interesting result was unexpectedly obtained. Some virulent tuberculous material from a cow's lung was sprayed into the throats of certain rabbits. Of these, one animal already had pneumonia, another catarrh of the throat, and a third some fluid in the pleural cavity. Two apparently healthy animals were taken direct from a stock at hand and subjected to the same spray. These latter were the first to suffer, for all of the stock from which they were taken were at this time very weakly and in bad condition, and, therefore, had a general predisposition to tuberculosis. The others were originally strong, but had been rendered locally predisposed to suffer from tuberculous infection. One result, therefore, of these observations is apparently to make us think that a general predisposition, or ill health, is more likely to lead to phthisis on exposure to infection, than local mischief in the lungs in an otherwise healthy individual.

General Predisposition.—Healthy living tissue has an inherent power of resisting the invasion of disease-producing micro-organisms. This fact forces itself on our acceptance from clinical observation, and has now been incontrovertibly established by experimental inquiry.

Before the nature of the infective poison in any diseases was known, it was frequently noted that infective matters introduced in small quantities into healthy tissues often failed to produce disease, even when sufficiently powerful to cause a local disturbance.

Clearly, then, the multiplication of the poison had been arrested within the body, even if the infective material had not been absolutely destroyed.

The disintegration and absorption of foreign animal

matters which had been introduced into wounds has, for some years, been known to take place, and was utilised in the surgical employment of catgut ligatures. Microscopical examination of such ligatures, which had been left amongst the tissues for some time, showed that they became invaded by cells (wandering leucocytes), which infiltrated the foreign body, and gradually led to its disintegration and liquefaction.

When the infective power of certain diseases had been traced to micro-organisms, which multiplied within the body to which they had gained an entrance, the behaviour of these micro-organisms within the body, and their relation to the structural elements of the tissues in which they developed, received careful and laborious investigation.

The irritant and specific effect of these foreign living particles was to produce a multiplication of the cell elements (*i.e.*, the active constituents) of the surrounding tissue, and apparently to attract leucocytes or wandering cells, similar to, and perhaps derived from the corpuscles of the blood and lymph. A struggle for supremacy is carried on between the cells and the micro-organisms, which latter may sometimes be seen within the cells. Will the cell digest the microbe, or will the living parasite of the cell cause its destruction? It is a trial of vital strength. If the cell gains the mastery, there is one invader the less; if, however, the microbe is the victor, the vanquished cell furnishes nutriment, as well as a suitable habitat for development and multiplication of the intruding germ, and the invading force gains an accession of numbers to carry on the struggle. This is no fancy picture conjured up by the imagination, but a description of facts observed under the microscope.

Metchnikoff introduced under the skin of a susceptible animal portions of the organs of a rabbit affected with splenic fever, and on examining the pieces after they had remained there a couple of days, found them covered with gelatinous exudation full of leucocytes. These cells contained within them the splenic fever micro-organism in various stages of degeneration. When the experiment was repeated at a high temperature (38° C. or 100·4° F.), the leucocytes, weakened by such a temperature, failed to destroy the bacilli, and the inoculated animal died from the infection. This process of destroying or "eating" the micro-organisms by the cells he

termed "*phagocytosis*," and the cells employed in the work *phagocytes*. Metchnikoff inferred from his observations that the body is protected from the harmful effects of infective particles which invade it by the phagocytic power of the wandering leucocytes.

But protection is also afforded by the blood. This has been known since 1874 to possess an extraordinary power of destroying micro-organisms. Thus, with the fluids and tissues of the body in full vigour, disease germs or microphytes are destroyed before they can produce harm.

But when functional vigour is lessened, the power of the phagocytes and of the blood to destroy micro-organisms from without is diminished, as was shown by Metchnikoff's experiment previously quoted.

Under such circumstances, disease-producing microbes, gaining an entrance to the body, obtain a firm footing for development, and infection leads to disease. This general resisting power of healthy living tissues against infection operates as a mode of safety against all infectious diseases, and its diminution causes a general predisposition to suffer from any infection to which the individual may be exposed.

In the case of consumption, this protective power of the cells and fluids of the body is a most potent safeguard; for as the tubercle bacillus multiplies slowly, there is time for any that may gain entrance into the body to be destroyed before they can develop and multiply. But if the vigour of the tissues is insufficient for them to withstand and destroy the bacilli, then tuberculosis results.

This general predisposition from lowered vitality of the body may be brought about by many different causes.

Thus it may be inherited from weakly parents, whether their weakness be due to tubercle or to any other constitutional defect. It may result from insufficient or improper food, either in infancy or in later life. It may follow from severe fever or prolonged illness. It is frequently induced by exhausting discharges from abscesses or wounds, or from excess of natural secretions, or from prolonged suckling. Profuse hæmorrhage will temporarily diminish the resisting power. Overwork, insufficient food, fresh air and exercise,

prolonged mental excitement or depression, worry, grief or anxiety, all tend to diminish the vigour of the body, and lessen its resisting power against disease.

Dissipation, with its tax on the energies, and the morbid depression that accompanies and follows satiety, is also a powerful general predisposing cause of phthisis.

Poverty—attended, as it often must be, with excessive labour and fatigue, anxiety, insufficient food and clothing, overcrowding and impure air—sufficiently weakens the disease-resisting power, without the damaging effects of drink, which is so often added in this country.

Finally, some occupations tend to general lowness of vitality or ill-health, either because of the long hours of employment or the mental strain or anxiety inseparable from responsibility, or through injurious materials or fumes used or generated in the work.

Some of these general predisposing causes of consumption may be more particularly considered—taking first hereditary tendency, and then the more common causes of acquired predisposition.

CHAPTER V.

Hereditary Tendency and Acquired General Predisposition.

Hereditary Tendency to Consumption.—The frequency with which sufferers from consumption can point to previous instances of the same disease in other members of the family, and especially to phthisis in one or both parents, or in either of their families, has led to a belief that consumption is hereditary, and is transmitted from parent to child. This belief has become so strong that it is often thought that a member of a consumptive family is almost sure to become phthisical: and a kind of fatalistic acceptance of the inevitable leads to a conviction of the inefficacy of any attempts to avert the impending disease; whilst, in fact, the power of hygienic means and suitable treatment is never more conspicuous than in defending delicate children from the inroads of tubercle. Very often the dread that consumption

must come is almost enough to ensure its development, for precautions which might have prevented it are neglected as useless, or over-caution leads to excessive clothing, want of ventilation indoors, and deficiency of outdoor exercise. With such a wide-spread disease as tuberculosis, some instances of its occurrence might be found in every family with diligent search, especially if we go back two or three generations and examine the collateral branches. Thus, in most cases, evidence of this kind would not be wanting in support of the theory that consumption is always inherited. But if we look at the matter in another way, we shall find more comforting facts. We shall find a consumptive parent has had healthy children, who again have had families with no consumptive members. In many instances also, where, in tracing back the medical history of a family, we have come across one case of death from consumption, we shall find this to be an isolated case in the midst of a large and healthy race. A single consumptive in two or three generations of a family cannot be taken as showing a phthisical taint, and should not be considered as evidence of hereditary tubercular tendency in future generations. Where we find one or more members of a family consumptive in each of several successive generations, we are forced to recognise a transmitted constitutional weakness which renders the members of that family liable to consumption. But this should lead to precautionary care, not to panic or fatalistic resignation. We must recognise that *inherited predisposition* is not *inherited disease;* and that with regard to consumption it is the predisposition or tendency towards the disease, and not the disease itself which is transmitted. Direct heredity—that is, transmission from parent to offspring of actual disease—does not exist as a cause of pulmonary consumption. It is true that tuberculosis may be thus transmitted, and that its causative micro-organism may be implanted in the child before birth; but the rarity of direct heredity in tuberculosis is evident when search is made through medical literature for recorded cases of tuberculosis in the new-born infant. When the disease is thus transmitted, it shows itself in very early life, and affects other organs before it attacks the lungs, or the lungs may remain unaffected throughout. Primary pulmonary tuberculosis—or pulmonary consump-

tion—rarely, if ever, comes on during the first few years of life: it is essentially a disease of young adults, commencing only after so long an interval from birth, that it is almost impossible that the bacillus could have been implanted in the body, and have still retained its power for harm for so many months or years. Are we to suppose that the tubercle has lain dormant throughout all the active period of the body's growth, and through all the storms of infantile ailments, dentition and the later illnesses of childhood, to appear only when the body is just becoming perfectly developed, and beginning to feel the strength of full maturity? May we not rather argue, from the period at which pulmonary consumption commences, that it is one of the dangers which we have to encounter when we take our places as men and women in the busy crowd of workers; and that, like other dangers which beset the young adult, it claims its victims from amongst the weaker ones. This is, in fact, just what our more perfect knowledge of the nature of consumptive disease would lead us to expect.

When we speak of heredity in consumption, we can only refer to an inherited predisposition to take the disease if exposed to the determining cause—a diathesis which may be modified or corrected by the mode of life of the individual. This tendency may be intensified, or it may be removed; but, however intense, it will not in itself cause the person to become consumptive. Herein lies the opportunity of preventive medicine; for the age at which consumption commences allows of sufficient time to correct the inherited tendency, by a careful attention to hygienic requirements during the developmental period of the individual. Tuberculosis may affect almost any or all parts of the body, and at any time of life; and, in this country at least, it is of all diseases the most prevalent. But the part affected depends upon circumstances which are more or less determinable.

Let us pursue this statement further. Tuberculosis is a specific inflammatory affection due to the action on the tissues of the *bacillus tuberculosis*. The causative bacillus may be implanted in the tissues during their development *in utero*, and produce disease before or immediately after birth. This may be distinguished by the term of "con-

genital tuberculosis," which may affect any organ or tissue, but is usually generalised—" general tuberculosis of infants." More commonly, the causative micro-organism gains entrance into the body from without after birth, the mode of entrance depending upon the age, occupation, and surroundings of the individual. All who are exposed to infection are not equally susceptible, a predisposition being necessary, unless, as may occasionally happen, the infection is very intense. This predisposition may be general or local, or both; in the latter case the local predisposition determines the seat of the primary manifestation of the disease. General predisposition—the most powerful—may be constitutional (inherited) or it may be acquired. The primary seat of the disease may depend partly upon the mode of infection, partly upon local damage, from injury or disease, in a particular organ or tissue.

In infancy infection is most frequently conveyed by the food, *i.e.*, in the milk of a consumptive mother, or from a tuberculous animal: the primary seat of the disease is then in the alimentary tract, and in the absorbent system leading from this. Once started the disease tends to become generalised: the lungs are rarely affected primarily. In childhood the mode of infection may depend upon some local predisposition in individuals with a constitutional tendency. Relaxed throats and tonsillitis offer a nidus for the bacilli in the mucous membrane of the fauces and tonsils, and strumous (tubercular) glands in the neck, are more common than abdominal tuberculosis. Primary pulmonary tuberculosis, though still uncommon, now begins to occur. The active development of the epiphysial ends of the long bones may account for the arrest of bacilli at these points, and so determine the onset of tuberculosis at the joints.

In later life, when the young adult goes out into the world, he may be exposed to air contaminated by phthisical fellow-workers. The lungs then become the primary seat of the disease, more especially if they are damaged by the inhalation of dusty particles. The micro-organisms which are always associated with this disease, are most numerous in the air where people are crowded together, and we find consumption most prevalent in localities where the popula-

tion is most densely packed. We, therefore, become most exposed to the infection when we get amongst the throng in business places. The cares and anxieties of responsible work, especially if attended with the worry of uphill struggles, of themselves tend to impair health, and will have their greatest effect in those who are constitutionally feeble. So, too, when we start in the world, we are to some extent removed from the watchful eyes of parents, who noted any sign of ill health and petted us back to strength; or we are impatient of expressed solicitude over apparently trivial ailments, and the first sign that increased care is required may be neglected. Whatever be the sources of infection to which an individual may be exposed, his liability to be harmed thereby will depend chiefly upon the hygienic conditions under which he lives, and partly upon his constitutional strength or weakness—his resisting power against disease: and this latter, as we have already mentioned, is often hereditary. Thus, although the predisposition to pulmonary consumption may be inherited, the disease is acquired in later life. The hereditary tendency necessitates increased care against the more immediately determining causes, and calls for a choice of residence and occupation in which close and constant mingling with consumptives may be avoided.

We must grant, then, that a constitutional weakness, which in itself predisposes the individual to suffer from tubercular infection, is often inherited; and though we may dismiss the theory of direct heredity in consumption, there still remains the fact, that consumptive parents may, and do, transmit to their offspring a tendency to contract the disease. Children of weakly parents—whether this delicacy is due to consumption or to any other cause—are themselves likely to be constitutionally feeble, and to this extent predisposed to consumption if exposed to the cause of the disease, *i.e.*, to tubercular infection. But so long as the disease itself is not implanted, it may be warded off and prevented by avoiding the direct cause, and by strengthening the resisting power of the individual. The tendency may be corrected or the sources of infection may be avoided; and the knowledge of such inherited weakness gives no grounds for panic, but rather furnishes a warning

of danger which should go far to ensure safety to the wise: to be forewarned is to be forearmed.

Most physicians have met with families, the members of which if exposed to the infection of scarlet fever are almost certain to catch the disease, and always suffer from it severely. They do not "inherit" scarlet fever, but those who belong to such families should most carefully avoid exposure to infection. So also persons with an inherited tendency to contract tuberculosis should carefully avoid the infection of tuberculosis. Those in whom the constitutional weakness is slight can, by attention to hygienic rules, counteract and remove the predisposition. Those whose family antecedents indicate an exceptional liability to suffer from tuberculosis should avoid exposure to infection, and select their residence and occupation with this object in view.

Alcoholism, like other forms of neurosis, may often depend upon an inherited predisposition; but we all recognise that careful training, and complete abstinence from alcoholic beverages from childhood (*i.e.*, avoidance of the determining cause), will prevent the constitutional weakness from developing in this particular form. Some other form of neurosis may develop, but not alcoholism with its degradation and disgrace. So with the constitutional weakness which predisposes to consumption; we cannot ensure that the individual shall become robust and enjoy a long life, but we may guard him from becoming consumptive, and, by so doing, not only benefit him, but avoid a centre of infection to others. Every individual saved from consumption is a direct benefit to the public health.

Having acknowledged the fact of hereditary predisposition to consumption, let us now inquire into the extent and intensity of this factor in the causation of the disease.

The belief in the influence of heredity in consumption rests largely on the fact that, in a large proportion of cases in which the disease occurs, it is found that other members of the patient's family—it may be one or both parents—have suffered from the same complaint. This is almost to be expected, apart from any theory of heredity, with such a wide-spread disease as consumption. Formerly the belief in heredity was such that this was looked upon as the most important factor, and members of a family in which consumption had already

claimed victims, almost considered themselves as hopelessly doomed to an early death from this disease. It was not until about the middle of the present century that the influence of heredity was shown to be less than had till then been supposed; and Walshe pointed out that in only half of the cases of consumption could any evidences of hereditary predisposition be established. Now we find the proportion of cases in which some hereditary predisposition may be assumed, stated to be about 30 per cent., or less than one-third of the cases.

There are two important considerations to be examined with regard to the hereditary tendency to consumption.

First:—Is the inherited taint specific? Most probably it is not. Weakly parents, whatever the cause of their weakliness, are likely to produce delicate offspring. The special danger of consumption in the parents depends upon the fact that their weakly children are constantly exposed to infection from their parents. There is thus the double danger—an individual with small resisting power, and constant exposure to infection. If the delicate child is early removed from close association with its consumptive parents, half the danger is removed.

An inherited constitutional weakness which renders a person liable to tuberculosis, may be transmitted not only by those who are themselves tuberculous, but by such as are debilitated by other conditions.

In addition to this general constitutional debility, we must include under hereditary tendency that peculiarity which is found in some families showing itself in a special liability to contract any disease to the infection of which the individual is exposed, and to have every ailment in a severe form.

We notice this susceptibility often with regard to scarlet fever and other of the eruptive fevers, or in connection with the whole class of infectious fevers. We see, for example, an individual who had always been looked upon as particularly strong and robust, completely prostrated by an attack of scarlet fever or diphtheria, whilst a weakly delicate person, who has perhaps caught the infection from the same source, escapes with a mild attack; and we hear that the family to which the former person belongs "always take

scarlet fever badly." This susceptibility, not dependent upon the robustness of the individual, nor on the rapidity of growth, is thus distinct from the constitutional debility and general ill health which is transmitted from weakly parents.

Such predisposition, hereditary or not, is a kind of susceptibility not very easy to explain, and is often referred to as "idiosyncrasy,"—a term which may embrace all the inexplicable causes of disease in the individual.

The second point is to determine, as far as possible, the extent of the influence of heredity. Here we have to rely upon statistics—a mode of inquiry which is universally acknowledged to be full of fallacies. When we examine critically into the matter we find that the evidences of heredity, even in the 30 per cent. of cases in which this seems to exist, are not so clear as would appear to a casual observer. In some of the cases the parents did not become consumptive until some years after the birth of the subject under notice. Occasionally we find that a mother becomes consumptive after nursing a consumptive daughter; yet if some years later the daughter were to mention to a medical adviser unacquainted with the family that her mother was phthisical, he might include this case amongst the instances of heredity. It is often difficult or impossible to obtain reliable information as to the date at which other members of a patient's family became consumptive, or of any special causes—occupation, &c.—which may have determined the onset of pulmonary tuberculosis in certain members of the family. It may be that a man's occupation has been the cause of his becoming consumptive, and that one of his sons following him in the business also becomes phthisical, whilst the remainder of the family escapes. Here again we might be misled into assuming that we have an instance of heredity. So, too, in tracing heredity, we generally start from phthisical patients and trace their family history backwards. To get a more correct result we should start with the consumptive and trace the history of succeeding generations. The figures obtained in the ordinary manner probably give far too high a proportion in favour of heredity. To take a few illustrations from my hospital case-books:—Out of 500 consumptive patients, one or both parents had

been consumptive in 154 cases, showing possible heredity in 30·8 per cent., and no phthisis in the parents in 69·2 per cent. This gives a possible chance of heredity in about one-third of the cases; and this amongst hospital patients whose mode of life is unfavourable and unhygienic. In 250 of these cases, in which the family history is more fully stated, one or both parents were consumptive in 62 cases, or only 24·8 per cent. In these 62 families the total number of children amounted to 374, of whom 108 became consumptive —again about one-third. Here we are only dealing with families in which consumption has shown again in the second generation, so the proportion is higher than it should be; for if we could include the families of consumptive parents where all the children have escaped the disease, the number of individuals would be increased whilst the number of consumptives remained the same.

In the above 62 cases, the father was consumptive in 28 cases, and these 28 families contained 185 children, of whom 43 became consumptive, or about 1 in 4. In 24 other cases the mother was consumptive, the total number of children was 152, of whom 47 became consumptive, or nearly 1 in 3. In the remaining 10 families both parents were consumptive, the total number of children was 37, and of these 18, or nearly one-half, became consumptive.

This is a small number of cases on which to found general deductions, but they seem to show that where the mother is consumptive, the hereditary tendency to the disease is slightly more intense than when the father alone is phthisical. When both parents are consumptive, not only is the number of children much reduced, but the hereditary tendency is increased. Against the theory of hereditary predisposition in these cases we have to remember the closer connection of the mother with her family both in infancy and in sickness.

The influence of heredity in the causation of consumption, if over-estimated, is a source of great anxiety to many who have lost relations from this disease. It is time that we did our utmost to teach such persons that the knowledge of the family weakness may serve as a timely warning to prevent them suffering as their relatives have done, but is by no means an indication of un-

avoidable doom. Consumption is a preventible disease, and those who know that they have inherited a special predisposition are most in need of attention to the means of prevention.

Acquired General Predisposition.—This includes all those causes of diminished disease-resistance, affecting the body as a whole, which are not inherited. Many of these have been mentioned previously. But we may discuss more fully some of the more common ways by which a predisposition to tuberculosis is acquired.

Improper or insufficient food, by preventing nutrition of the tissues, diminishes their vigour. This is a factor to be largely taken into account as a forerunner of tuberculosis in young children, and its after-effects constitute a liability to pulmonary tuberculosis as they attain adolescence. The influence of improper feeding during infancy cannot therefore be overlooked even if we confine our attention to pulmonary phthisis, for not only will rickets (partly caused by unsuitable food) often distort the chest and so give some local tendency to lung mischief, but the child whose development has been checked during its first year or two is likely to grow into a weakly and delicate youth. This improper or deficient feeding is not confined to hand-fed children, though perhaps these run most risks. Children nursed by a weakly mother, or kept at the breast beyond the proper age for weaning, may fail to obtain the necessary elements of healthy growth, though the quantity of food may seem ample.

Though pulmonary tuberculosis is uncommon in the very young, the predisposition to it is often acquired and fixed by arrested nutrition in infancy. No child can be safely left to exist on unsuitable food, with loss of weight, or some diminution of growth-rate, without serious injury to the tissues then in course of development, the evil effects of which only appear at a later period. Rickets, the direct effect of imperfect nutrition, is not caused by impeded respiration, but is itself the immediate cause of respiratory troubles, such as the spasmodic bronchial affection attributed to teething, and the laryngeal spasm called "croup." This ailment also, by altering the growth of the ribs, interferes with healthy recovery of the lung from the effects of any

subsequent attack of whooping-cough or measles. It causes other distortions of the chest which give a local tendency to lung mischief, whilst it interferes with healthy expansion of the chest walls, and prevents the free expiratory efforts that should clear the lung of injurious secretions in the various disturbances to which they are liable. These respiratory disturbances are the result and in no way the cause of rickets.

Growing children require a good proportion of nitrogenous food for tissue formation, which is not always adequately supplied during the nursery and school period.

Want of food in adult life, as a cause of susceptibility to disease, requires no comment; but it is too often poverty, and not ignorance of the consequences, which leads to insufficiency of nourishment, and then warning as to the dangers incurred is useless and unkind. But a word of caution may be given to those who neglect their proper meals during hard work, merely because they grudge the time necessary for food. Excessive work, mental or physical, cannot be safely attempted without a proportionate supply of nourishment.

Insufficient air-supply is as potent a cause of diminished vigour as insufficient food. Sunlight and fresh air are essential to healthy life, and both are often deficient in dwellings or work-places in the larger towns. The want of fresh air has an influence in the causation of rickets, as well as the insufficiency of nourishment; and anæmia is largely due to this cause. It is a mistake to imagine that anæmic persons are not susceptible to phthisis.

Overcrowding is often considered to be a condition peculiar to the poorer classes, and certainly it is most frequent and most marked in the poorer quarters of towns. But overcrowding is to be found in well-to-do houses, where nurseries and bedrooms are hardly large enough for the number of occupants, and ventilation is neglected; the servants' quarters also are often arranged for convenience rather than with any regard for health. In some schools, and especially in charity schools and institutions for children, the dormitories are overcrowded.

Exhausting Discharges.—The drain on the constituents of the body from suppuration, or from excessive albuminous

discharges, must be looked upon as increasing the liability to suffer from infection. And in this category we must give special prominence to prolonged lactation.

It is common amongst the London poor—and probably also elsewhere—for a mother to continue to suckle a child, partially or entirely, until pregnancy again occurs. Eighteen months is not at all an uncommon period to continue to give a child the breast, and I have known it done for four and a-half years. My observation leads me to endorse the opinion that this is a potent predisposing cause of consumption amongst the mothers of the poorer class, and of the children so ill-treated.

Rapid child-bearing is also another cause of debility which increases the susceptibility to infection. Any of the excessive secretions that often accompany anæmia produce a similar effect.

Depressing emotions produce in time a lowness of health which is injurious. Continued anxiety, prolonged grief, and constant worry thus become predisposing causes of phthisis. The tendency of lunatics to become consumptive is well known. A person who broods over the misery of the poor, and perhaps has an habitual religious melancholy, should be dissuaded from working hard as a visitor in crowded slums, where consumption is usually prevalent.

Another form of depression is to be found in those who are given over to dissipation; and this, alternating with excitement, late hours, hot rooms, and alcoholic excess, predisposes to tubercular as well as to other diseases.

Apart from reprehensible dissipation, the constant late hours, close rooms, and excitement incidental to the gaieties of a London season, are injurious to any one, and especially so to the health of a delicate girl.

Alcoholism is, I believe, a powerful predisposing cause, not only by interfering with the amount and regularity of meals, and with the proper assimilation of the food, but also by its directly injurious effects on the tissues of the body, and by the nervous exhaustion it produces.

Previous Illness.—The general diminution of resisting power which is left after severe or prolonged illness renders the individual more liable then to suffer from any infection which gets into the body; and that this is the case with

regard to the infection of tuberculosis is seen in the large number of young patients who date this malady from one of the acute eruptive fevers.

But when the tuberculosis in these cases attacks the lungs, we may often find that these organs suffered during the previous illness, and thus the development of infective particles which may gain entrance has been favoured.

We shall, therefore, refer to the illnesses which chiefly predispose to consumption, when we discuss the local or special predisposing causes of phthisis.

We must, however, remember that some general diseases produce a tendency to phthisis, with or without any special lung complication. Amongst these diabetes and syphilis must be particularly mentioned as also causing diminution of resisting power.

The effect of unhealthy occupations in predisposing to consumption will be referred to in a later chapter.

CHAPTER VI.

Local or Special Predisposition.

Local or Special Predisposition in the Lung.—Pleurisy—Pneumonia—Bronchitis—Catarrh—Measles—Influenza, and injuries as Predisposing Causes.
The Injurious Influence of Dusty and of Sedentary Occupations.

Any diminution of the general resisting power of the tissues against disease favours the development and increase of the bacilli within the body, and so predisposes to tuberculosis on infection. But in addition to this general want of resistance there are local conditions which facilitate the retention of inhaled bacilli and their development or extension; and surface injuries or morbid alterations of the lining membrane of the air-passages or in the lungs, permit of the retained bacilli living and flourishing. There are certain states of the air-passages which favour the entrance of the bacilli into the lung and facilitate their lodgment or hinder their expulsion. These morbid conditions constitute a special or local predisposing cause of consumption.

In the healthy condition of the respiratory apparatus, bacilli

which may be inhaled do not easily reach the lung, and are probably expelled from the air-passages before they can cause mischief. The sticky mucus which moistens the mucous membrane lining the trachea and bronchi, catches and holds minute solid particles such as bacilli, which are drawn in with the inspired air, and then the ever-moving cilia of the healthy bronchial and tracheal epithelium gradually pass the particle upwards towards the mouth and so keep it moving until it is expelled by the rush of air in expiration, or is carried out in a pellet of mucus by a cough.

The microphyte, on first coming in contact with the healthy mucous membrane, has its entrance into the tissue barred by vigorous living cells, and even if retained within the air-passages it finds no pabulum and no suitable site in which to settle and develop. But where the air-passages are lined with thick tenacious mucus, which covers or impedes the movements of the cilia, and especially when the lining membrane beneath is inflamed, the bacillus may be retained and secure a habitat in the inflamed and less resistant mucous membrane, where it can develop and multiply and whence the new colony may spread and attack the lung.

Hence we see how it happens that certain diseases of the air-passages of the lungs are followed by phthisis and that some general diseases, which are complicated by lung mischief—such as measles and influenza—prepare the way for tubercular infection, and thus lead to subsequent consumption. So also dusty occupations predispose to phthisis by the injury caused to the air-passages and lungs.

When a general predisposition exists there is a double reason for avoiding, if possible, the causes of a special local susceptibility.

Diseases of the Air-Passages and Lungs which may favour the Development of Consumption.—Though healthy organs offer no suitable nidus for the development of such bacilli as may reach them from without, these micro-organisms become a real source of danger when they attack an organ weakened or damaged by disease, and most of all when the general health is deteriorated. The spores of the tubercle bacillus, carried about in the air, more easily reach the lungs when the respiratory movements—especially expiration—are deficient, and are more readily retained when the epithelium of the air-passages is damaged, or when sticky mucus coats the walls of the tubes or plugs the air-cells; and being retained under such circumstances, they find a suitable soil for development in the morbid products in which they rest.

At first sight it would seem as though all pulmonary diseases

would be likely to lead to phthisis, but we find a great difference between them in this respect; some, like pleurisy, being frequent antecedents of phthisis, others, such as general emphysema, being only infrequently associated with tuberculosis.

We may expect to find that infection from tubercle is favoured by diseases of the respiratory system, which interfere with the movements of respiration, either as a whole or in some portion of the chest, or which lead to inflammatory exudation in the air-passages or in the air-cells; and more especially by those affections which are chronic in their course, or which leave behind them a more or less permanently damaged condition of the tissues.

We may thus make a rough classification of those conditions of the respiratory system which directly predispose to pulmonary phthisis. First, those which act by interfering with respiratory movement; secondly, changes occurring in the tissues, by which a suitable nidus for the bacillus is formed.

Some morbid conditions interfere with the respiratory movements as a whole; and although morbid changes in the chest walls are not pulmonary diseases, they cannot be ignored as direct causes of the latter. It is sufficient here to notice the important influence on the respiratory movements of such conditions as deformities of the chest—as from rickets and spinal curvature—ossification of the costal cartilages, and paralysis of the muscles used in respiration.

But respiratory movements are also affected by alterations in the lungs themselves, such as emphysema and fibrosis of the lung; whilst pleural adhesions and collections of fluid or of air within the pleural cavity are classed with pulmonary affections. Some of these conditions limit the movements of portions of the lung, and may thus determine the *seat* of the primary deposit of tubercle.

It would seem, from my observation of cases, as though causes which lead to unequal expansion of different parts of the lung had more effect in favouring phthisis than those which affect the movements of all parts of the lung equally. This may be noted in deformities of the chest, as well as in emphysema, pleurisy, &c.

Finally, as causes of phthisis, we have diseases of the air-passages and lungs producing local changes which may favour the development of the tubercle bacillus, such as bronchitis, pneumonia, and pleurisy.

Though perhaps not the most important as causes of phthisis, we may first consider interference with respiratory movements. It is impossible entirely to separate interference with respiratory

movements from tissue changes in the lungs as predisposing causes of phthisis, for in most of the affections we are now considering both these causes are combined.

Fibrosis of the Lung.—This occurs frequently as a result of chronic tubercle in the lung, but it is found under many other conditions. Thus it may be part of a generalised fibrosis of many organs of the body, either resulting from the degeneration of advancing age, or being induced by some special condition such as chronic alcoholism or syphilis. It may also occur in the lung alone from the local irritation of inhaled particles—as in miners and stone-masons, and in others engaged in dusty occupations.

Fibroid overgrowth in the lung, therefore, often exists apart from tuberculosis ; and though it cripples the lung and gives rise to shortness of breath and cough, and may even produce cavities in the lung (chiefly by dilatation of the bronchi from the contraction of the fibrous tissue), it is not then properly called "phthisis." But it is a common clinical experience that persons with fibroid lungs are the subjects of tuberculosis ; and we may consider that a fibroid lung is particularly prone to become tuberculous when the person is exposed to tubercular infection. This is largely due to the loss of elasticity of the lungs, which prevents their rebound after distension, with a consequent impairment of expiratory force.

Fortunately the spread of tuberculosis in a fibroid lung is slow, and breaking down of tissue with consequent excavations is not the rule ; so that the *chronic* nature of the fibroid lung affection is not altered by the addition of the tubercle, and the detection of bacilli in the expectoration is of less prognostic importance than in some of the more acute diseases.

It is difficult to select cases in illustration of tuberculosis following fibroid disease ; for fibrosis, both before and after the onset of tubercle, runs a very chronic course, and it is impossible to say exactly when tuberculisation first occurs. Fibroid disease in its early stages produces but slight symptoms, and patients rarely seek advice until the fibrosis in the lung has made considerable progress. Moreover, a negative result of examination of the sputa for bacilli is no proof that there is no tubercle.

Emphysema.—When general throughout the whole of the lung, emphysema has a similar *mechanical* effect on respiration to fibrosis, with which it is frequently associated. We might, therefore, expect that general pulmonary emphysema would be a favourable condition for the development of tubercle, especially as, with the dilated air cells, there is a general diminished vascularity of the lung. Yet we know that phthisis following general-

ised emphysema is uncommon, though it does occasionally occur; and this condition is not preventive against phthisis as has been supposed.

Localised emphysema is very frequently found co-existent with tubercular deposit, but here it is usually a result of the phthisis—*e.g.*, from coughing—rather than a cause.

Pleurisy.—That pleurisy is a not infrequent antecedent of phthisis becomes abundantly evident in looking through a series of hospital cases. Pleurisy may act in several different ways in predisposing to phthisis. The lung may be compressed and the movements of the chest interfered with by fluid in the pleural cavity, and this may favour tuberculosis of the apex; or the pleuritis is complicated with pneumonia—a common occurrence—and the inflamed portion of the lung is the susceptible part; or adhesions left between the two layers of the pleura lead to unequal expansion of the lung, and perhaps localised emphysema.

In looking through a number of my hospital cases of phthisis, I was struck by the fact that, in the majority of instances in which pleurisy was mentioned as an antecedent illness, the tubercular deposit apparently commenced at some distance from the seat of the pleuritis—in the apex of the same or of the opposite lung. Where there has been much effusion we can understand how the apex of the lung on the affected side might be rendered more prone to tuberculosis; but how are we to explain the connection between pleurisy at the base of one lung and tubercle later in the apex of the opposite lung? A similar condition is to be noticed also in relation to pneumonia, and it was probably observation of this fact which led Louis ("Rècherches sur la Phthisie") to disbelieve in the predisposing influence of pleurisy and pneumonia. What the exact connection between a pleurisy on one side and tuberculosis of the opposite lung may be I am not prepared to say; but given an attack of pleurisy in a delicate person, and I should prefer to get him well away from the neighbourhood of consumptives for some time. We know that any febrile illness may act as a predisposing cause to phthisis from the general debility produced. We may therefore say that pleurisy and pneumonia act as predisposing causes of phthisis by their debilitating effects on the individual, and that in some cases these diseases may in addition determine the seat of the tubercle by their local effects on the lung.

The following cases will exemplify the direct effect of pleurisy in favouring tuberculosis:—

Case 1. Charles B., æt. 25, packer. No phthisis in the family. Admitted January 1892. With the exception of scarlet fever when six

years of age, the patient was quite well until June 1891, when he attended St Bartholomew's Hospital with pleurisy in the left side. I have ascertained from the house physician at St Bartholomew's that he had no sign of tubercle at that time. On admission into my wards in January he had breaking down tubercular deposit in the left apex, and a cavity with surrounding deposit at the left base. Tubercle bacilli were numerous in the sputa. He improved considerably during his stay in hospital.

It is not often that one is fortunate enough to find so clear a case as this one, for here the patient was attended at a large hospital for his pleurisy, and on examination of his lungs there he apparently was at that time free from tubercle. Yet six months later there was undoubted tuberculosis.

Case 2. William G., seaman, æt. 26, was in Plymouth Hospital for five months in 1885 with pleurisy on the right side. On leaving hospital he caught cold, and was again laid up for three months. He had a third attack about 18 months later, and was an in-patient at Brompton in 1887. He came under my care in April 1888, and there was then softening tubercular deposit throughout the whole upper lobe of the right lung. There was no history of phthisis in the family.

Here we may fairly assume that the first attack of pleurisy was not tubercular, for the man came of a healthy family and was following an outdoor occupation. The condition of his lung when I saw him did not suggest a tuberculosis of as long duration as three years. The first attack of pleurisy evidently weakened the lung, for he soon got a second attack, and later a third. It is possible that he had become tuberculous before the last pleurisy.

Case 3. William B., æt. 33, baker. Mother died of phthisis. Three years before admission into the North London Consumption Hospital under my care, he had pleurisy of the right side which was tapped. The side filled again and was tapped in all six times, the fluid on each occasion being clear. He had, when I examined him, tubercular deposit in the right apex. Twelve months later he was again in my wards, the disease had increased at the right apex where excavation had occurred, and there was some deposit in the left apex also.

We must not forget that many pleurisies are themselves tubercular in origin—a result, not a cause, of tuberculosis. Pleurisy in a delicate person is always a matter of anxiety, and if repeated, or when slow in resolving, should suggest tubercle. In many of my cases of phthisis in which pleurisy is mentioned as an antecedent illness I am disposed to think that tubercle was present in the lungs before the date of the pleurisy, and was the exciting cause of the latter.

Case 4. Fanny W., parlour-maid, æt. 22. Good family history. Admitted April 1890. Diphtheria in 1887. Pleurisy on the left side in

February 1889, and again on the opposite side (right) in July 1889, and in January 1890. She had felt pains in the chest off and on since the first attack of pleurisy, and on admission to hospital had extensive deposit throughout the left lung.

This is a good example of the difficulty met with in determining what relation the pleurisy may bear to the phthisis. With a bad family history, one would have felt certain that the pleurisy followed rather than caused the phthisis.

When the effusion remains unabsorbed and becomes purulent, we have a general as well as a local cause for susceptibility. For the debility common in empyæma reduces the defensive power of the system generally, and this intensifies the risk to the damaged lung. Thus we find that empyæma is not uncommonly followed by phthisis. Nor is the risk in this direction much lessened by free opening, for the partially collapsed lung is liable to suffer from tuberculosis.

CASE 5. *Empyæma as an antecedent to Phthisis.*—Richard W., traveller, æt. 29. One sister died of phthisis, and the patient himself had always been delicate and had a piece of bone removed from the ankle when he was twelve years old. In August 1890, he caught cold, which was followed by pleurisy on the left side. Later paracentesis was performed, the fluid being thick (purulent). He came under my care in July 1891, and then had a cavity about the level of the left scapula, with deposit and softening extending to the apex.

Pneumothorax.—Air in the pleural cavity is a result of phthisis. In the rare cases in which it is antecedent to phthisis, it is rather the accident which caused the pneumothorax which leads to phthisis, than the occurrence of air in the pleural cavity.

The second group in our classification includes those diseases of the air-passages and lungs which predispose to phthisis mainly by producing a local nidus for the bacilli, such as catarrh, bronchitis, bronchiectasis, and pneumonia.

Catarrh.—Many patients date the first symptoms of what we discover to be phthisis from a common cold, which instead of disappearing in the usual way remains and imperceptibly develops into the more serious illness. In many of these cases, we may assume that the "cold" which we are told preceded the phthisis was in fact part of the disease; in other words, the patient mistook the early symptoms due to tubercle in the lung for a simple cold. But there is little doubt that neglected catarrh may predispose to subsequent tuberculosis, and by some authorities this is considered one of the most potent predisposing causes. Tuberculosis of the lung induced by catarrh is exemplified in the following cases.

Case 6. John W., æt. 20, labourer. Good family history. Always healthy and well until present illness. About twelve months before admission he got wet and caught cold, but took no particular notice of it. Has had a cough ever since, and night sweats for six months. On admission (May 1890), there is deposit in the left lung, with excavation at the apex.

Case 7. James M., æt. 40, gardener. One brother died of phthisis. Quite well until the present illness, with the exception of enteric fever when twelve years of age. Got wet nine months before admission, and caught cold. Has had a cough ever since. On admission (January 1890), there was deposit and softening throughout the left lung, with cavity at the apex.

Case 8. Robert M., æt. 33, gardener. One sister died from hæmoptysis, aged 34. He attributes his illness to catching cold two or three months before admission in January 1892. After this cold he had "influenza," and has had a persistent cough since. On admission there was deposit (early) at the right apex ; bacilli were found in the sputa.

The three preceding cases improved considerably in hospital, and as far as my observation goes phthisis following catarrh may be expected to do well unless there is a bad family history, probably because the lung was little damaged before becoming tuberculous.

Bronchitis.—Acute bronchitis is less likely than the chronic ailment to form the starting-point of tubercular disease, for the illness is comparatively short, and the patient usually is kept at home during the attack and away from tubercular infection.

In the following case, however, phthisis appears to have been started by an attack of acute bronchitis, during the latter part of which there was exposure to intense tubercular infection.

Case 9. L. E. D., æt. 27, a nurse at a provincial hospital for consumption, was laid up with an attack of bronchitis. Examination of the chest at this time gave no suspicion of tubercular deposit in the lungs. Before she was quite recovered from the bronchial attack, a bad case of phthisis in the wards required special nursing, and she was put on duty to attend to this patient, whom she nursed until his death soon after. Three months later, after she had left this hospital, I examined her and found tubercular deposit in the left apex, and in seven months more she died from acute phthisis. There was no family history of phthisis.

It may be that there was tubercle in the lung before the bronchial attack, although, as the chest was examined by one of the physicians to a consumption hospital who failed to detect any signs, this is not likely.

Chronic Bronchitis or winter cough is sometimes antecedent to chronic phthisis. A person may suffer for several years from winter cough, and then the cough becomes persistent throughout the year, and tubercle bacilli are found in the expectoration. In

such cases, although the winter cough may have been the starting-point of the tuberculosis, the emphysema and fibroid degeneration in the lungs, due to the chronic bronchitis, will usually prevent the rapid destruction of the lung from the tubercular process. For, as we have seen, general emphysema, though not commonly associated with phthisis, is not incompatible with tubercle, and fibrous tissue does not readily break down. The large *râles* of bronchitis occurring in the course of phthisis often mask the signs of tubercular mischief, which may then be overlooked if reliance is placed on a single examination of the chest.

Bronchiectasis, or dilated bronchus, as a starting-point of phthisis is well illustrated by the following case :—

Case 10. George T. L., æt. 20, seaman. No family history of phthisis. Patient was quite well until three years before his admission into the hospital in December 1888. At that time he caught cold, which was followed by cough and pain in the right side which "caught his breath." He was found on admission to have a greatly dilated bronchus forming a cavity at the right base, but no tubercle. About twelve months later the patient was again under my care, and had then tubercular softening in the right lower lobe, and deposit in the upper lobe on the same side.

Pneumonia.—Acute idiopathic lobar pneumonia, terminating in complete resolution, is not a likely cause of tuberculosis. But when the inflammatory products are long in being absorbed there is more risk from tubercular infection. In cases of phthisis in which there is a history of antecedent lobar pneumonia we often find the tuberculosis starting in some distant part of the lung, as I mentioned when speaking of pleurisy.

Case 11. Clement C., æt. 27, carpenter. Good family history. Strong and well until eleven weeks before admission, when he had an attack of pneumonia at the right base, and was confined to his bed almost up to the time when he came to the hospital. He was found to have early tuberculosis of the right lung, which later attacked the left apex. He died ten weeks after leaving the hospital, where he had been for six weeks.

Case 12. Some time ago, I was asked to see, in consultation at Clapham, a young man who had acute phthisis, and whose lung disease dated from an attack of acute pneumonia a few weeks previously. Here there was no question of the pneumonia, which had followed upon his getting wet and over-fatigued during a long bicycle ride.

Sometimes an attack of "inflammation of the lung" mentioned by a patient, in giving the previous history, really refers to the acute febrile stage of tuberculosis. This was evidently not so in the above case, but it may have been so in the following :—

Case 13. Annie B., dressmaker, æt. 37, dates her illness from an attack of inflammation of the lung four weeks before admission. She gives a

history of four previous attacks all on the left side, and has had a cough for several years. One sister died of phthisis. This patient had softening tubercle at the left apex. Several similar cases might be quoted.

When the upper lobe of the lung is the seat of pneumonia we are often led to expect the presence of tubercular deposit as a cause of the inflammation. But apex pneumonia occurs without tubercle. The two following cases are interesting in this connection :—

Case 14. *Apex Pneumonia without Tubercle.*—Mrs M., the wife of an army medical officer, was taken ill four years ago with fever, cough, and great prostration. Examination showed pneumonia involving the apex of one lung. For some days she was dangerously ill, but eventually the lung cleared completely, and has remained healthy up to the present.

Here there was apparently no tubercular deposit, for I have had several opportunities of examining the chest since, and have found no evidence of mischief in the lung. There was a history of a similar attack of pneumonia, also at the apex, some years before this one.

Case 15. *Apex Pneumonia with Tubercle.*—In the spring of last year I saw, with Dr Watson, of West Hampstead, a young married lady (Mrs R.), who had clear signs of pneumonia at one apex without any marked illness, but with a good deal of cough. There was no history of a sudden onset, but the patient had been ailing a week or two before she sought advice. I expressed the opinion that the pneumonia was probably started by a patch of tubercle in the apex of the lung, which would be detected when the surrounding pneumonia cleared up ; and as the only certain way of deciding the presence of tubercle I suggested the microscopical examination of the sputa. Bacilli were found in the expectoration, and as the apex cleared large crackling râles became audible. The disease rapidly increased, and the patient went abroad to avoid the English winter.

When possible the sputa should always be examined for bacilli in pneumonia of the apex, as this frequently is caused by tubercular deposit.

There is a subacute variety of pneumonia which may take a long time to resolve, and which is specially liable to be associated with subsequent tubercular disease. This variety may follow whooping-cough, measles, or influenza.

The following is a case of this kind of pneumonia, which fortunately has not as yet been followed by tuberculosis :—

Case 16. Hilda W., æt. 12, had whooping-cough last August at the same time as the other members of the family. She had for years suffered from spasmodic asthma, and was longer in getting rid of her cough than the other children, cough attended with whooping persisting until November. By Christmas she seemed quite well again, but early in January she was

listless and feverish, and then was found to have dulness of the left base as high as the angle of the scapula, with tubular breathing. The temperature reached 103° F. ; respirations, 44. There was no rigor or marked sign at the outset. The dulness and other signs gradually disappeared, but the lung was not clear until the end of February.

Here we have a pneumonia which takes a long time to resolve, and which but for the previous whooping-cough might have suggested a tuberculous origin, until its complete resolution negatived such a supposition. This case, following whooping-cough, is mentioned as an example of a condition which is very likely to favour subsequent tuberculosis of the lung, although fortunately there appears now to be no tubercle.

Catarrhal pneumonia is more frequently a cause of phthisis than lobar pneumonia, and it is this variety of lung inflammation which often follows whooping-cough, measles, or influenza. These three diseases are frequent antecedents of phthisis, and here we have the marked general debility which lessens the resisting power of the individual, as well as the special predisposition due to the morbid condition of the lung. The case last mentioned illustrates the predisposing lung mischief after whooping-cough, whilst those which follow show phthisis after measles and influenza respectively.

Case 17. *Phthisis following Measles.*—Lydia W., æt. 14, had measles four years before she came under my care, and had suffered from shortness of breath and cough ever since. She began to cough up blood soon after the measles, and was in Brompton Hospital twice before she was admitted to the North London Consumption Hospital in August 1888. She then had extensive tubercular softening in the right lung, and deposit in the left apex.

Phthisis following Influenza.—During the last two years a large number of patients have come under my notice with phthisis, who attribute their illness to influenza. And when we consider the extreme debility produced by this ailment—often lasting a long time—there can be little doubt of its predisposing to tuberculosis. The pneumonia which occurs as a complication or sequela of influenza may be long in clearing away, and then a local as well as a general predisposition is established. In both the cases I have selected to illustrate phthisis following influenza there was some lung complication with the attack.

Case 18. John S., æt. 41, gardener, had influenza with pleuro-pneumonia in February 1890, since which he has had cough, shortness of breath, and pain in the chest. He was admitted to my wards in February 1891, with tubercular deposit in the left lung.

Case 19. Emily H., æt. 21, ladies' maid, had influenza with pneumonia in January 1890, and was admitted under my care in the following July with slight deposit at both apices.

Hæmorrhage in the Lungs is often an indication of tuberculosis, even when no physical signs are detected. The sputa, if any, should be examined for bacilli. Pulmonary hæmorrhage from heart disease or congestion from any cause, may be the starting-point of tuberculosis in the lung.

It has been stated that mitral disease is antagonistic to phthisis, but I have records of many examples of the co-existence of these two morbid conditions.

Injuries to the Lung.—Injuries to the lung may induce phthisis, either by the hæmorrhage, or later by the adhesions of the pleura.

In the following cases an injury to the lung may have had some effect in determining the subsequent phthisis, or at least the seat of primary deposit:—

Case 19. Richard H., æt. 43, labourer. Fracture of left clavicle twelve years ago. Dates his present illness from a cold caught five months before admission. Tubercular deposit at left apex.

Case 20. John E., æt. 43, formerly hawker. Fell down a cellar about three years ago and broke his ribs, bringing up blood as a result of the accident. Nine months later he commenced to spit blood, and has since been a constant inmate of hospitals. He has softening at right apex, and slight deposit on the left side. He has an alcoholic history, but gives no family history.

Case 21. Arthur C., æt. 29, coachman. Good family history. Quite well until five years before admission, when he was thrown from a horse and struck the left side of his head and chest. Cough began three or four months after the accident, and has persisted. Tuberculosis of left lung with cavities in upper lobe.

Case 22. W. B., æt. 23, painter. Good family history. Quite well till four years before admission, when a blow on the left side caused him to cough up blood immediately afterwards. The bleeding soon ceased, but has recurred several times since. On admission, in 1888, there was tubercular deposit at the left apex. Two years later he again came under my care, the whole left lung was then involved, and there was deposit in the lower lobe of the opposite lung.

Case 23. George B., æt. 35, painter. No phthisis in family. Admitted November 1890. Fracture of left clavicle seventeen years ago; was stabbed in the upper part of the chest on the right side about twenty years ago. Fifteen years ago fell off a scaffolding and had bleeding from nose and mouth. In 1888 brought up a pint of dark blood, and has not been well since, having cough, expectoration, pain in chest, and sweating. On admission, softening at right apex. Here possibly adhesions where he was stabbed determined the seat of the deposit of tubercle many years later.

The cases in which the above-mentioned pulmonary affections appear to have been the starting-point of tubercular mischief are

few as compared with the numerous examples where one of these diseases occurs in the course of a pre-existing phthisis. It is important, however, that we should recognise them as possible causes as well as frequent complications of pulmonary tuberculosis.

In conclusion, what are the practical deductions to be drawn from the recognition that non-tuberculous affections of the lungs predispose to the deposit of tubercle? Perhaps the most important is that we must exercise a careful supervision of such patients as have become thus rendered liable to consumption, and make careful examination of the lungs when any persistent cough, raised temperature, or continued depression of health point to the possibility of tubercular infection. Tubercular disease may be curable in its early stages, but becomes more and more difficult to check as the mischief increases. Thus the importance of the early recognition of tuberculosis is essential; and as the early signs are not easy to detect, it is necessary that a careful examination of the chest should be made whenever there is any suspicion of ill-health. It is not enough to listen through clothing, or to wait until large deposit or softening render the nature of the disease obvious to the most casual observer. The chest must be bared, and examination made in such a way that slight divergences from the normal can be detected; and a clear knowledge of the indications noted is necessary in weighing the evidence obtained by careful investigation, in order that the early presence of tubercle may be recognised. Microscopic examinations of the sputa should be made when there is cough with expectoration. It would be well to recommend a periodical and systematic examination of the chest at intervals for a year or two in all cases where bronchitis, pleurisy, or pneumonia have occurred in delicate persons; especially where there is any tubercular tendency, and more particularly in young persons during the period of development. The same advice may well be given where the health has been lowered by whooping-cough, measles, or influenza.

The Influence of Dusty and Sedentary Occupations.—The influence of occupation as a predisposing cause of phthisis has long been recognised, and is of the utmost importance, not only because it operates so widely, but because it is one of the causes which it may be found possible to control and diminish. The large incidence of phthisis upon those who follow dusty employments has attracted much attention from observers. Dr Greenhow * calculated that forty-five thousand deaths occurred

* E. Headlam Greenhow, M.D., *On the Prevalence of Certain Diseases in different Districts in England and Wales.* Papers relating to the Sanitary State of England to the General Board of Health, 1858.

annually from this cause in England and Wales, and he believed that the whole of this mortality was preventable by the introduction of better methods of ventilation and working. The improvements introduced since these statements were made have already had an appreciably good result. Dr Pollock* also gives good evidence of the predisposing influence of certain indoor and dusty occupations. In these cases the susceptibility to phthisis evidently arises from the inhalation of fine irritating particles into the lungs, and the consequent impairment of these organs, rendering them more susceptible to the invasion of the bacillus which readily finds a suitable nidus in the damaged tissue. Amongst those who follow dusty occupations, stone-masons, coal-miners, knife-grinders, and needle-polishers, chaff-cutters, and those employed in hackling flax, carding cotton, grinding steel, porcelain and pearl for buttons, mattress-making, and cleaning, &c., afford instances of the effect of dust in producing a large mortality amongst those who follow these callings. Amongst the potters in Staffordshire, phthisis caused 18·1 per cent. of all deaths for males, and 11·5 per cent. for females †; and the effect of the occupation is well shown by comparing the proportion of cases of phthisis amongst the potters who were admitted to the North Staffordshire Infirmary with that amongst other classes.

The potters showed 20·9 per cent. for males and 16·96 for females suffering from phthisis, whilst the males who were not potters gave a proportion of 13 per cent., and the females 11 per cent.‡ In cotton factories, few men who enter certain rooms ever live to attain thirty-eight years of age.§

Apart from the irritating effects of dust, the influence of occupation is found in the large amount of phthisis amongst those who follow indoor and sedentary occupations of whatever kind. Here we have to take into account insufficient exercise and the want of fresh air, not only from the large amount of time spent indoors, but from the frequent overcrowding of work-rooms.

Amongst tailors, Dr Edward Smith || found that consumption and other forms of chest-disease constitute two-thirds of all the causes of death; but this computation would appear to be too high, for in the ten years from 1871 to 1880 the mortality from phthisis and diseases of respiratory and of the circulating system amongst tailors does not constitute two-thirds of their total mor-

* *The Elements of Prognosis in Consumption*, 1865.

† *Report on the Staffordshire Potteries to the Med. Dept. of the Local Govt. Board*, 1872, Appendix B., p. 44.

‡ Dr Arlidge, *Social Science Congress*, Leeds, 1871.

§ Pollock, *The Elements of Prognosis in Consumption*, 1865.

|| *Report of Med. Officer to Local Govt. Board*, vol. vi, 1863, p. 429.

tality.* The proportion is more nearly one-third. Dr Ord † noticed the prevalence of phthisis amongst dressmakers and milliners, and attributed it to the long hours, want of exercise, and deficient ventilation of work- and bed-rooms. Although the Factory Act allows of the inspection of work-rooms where numerous persons are employed, overcrowding is probably still rather the rule than the exception. Each work-room should be licensed to hold a certain number of persons for so many hours a day, the number being determined in each case by taking into consideration not only the cubical contents of the room, but the means of ventilation; and some penalty should be enforced if the number of workers is exceeded. But perhaps the most serious class of cases, and certainly the most difficult to bring under control, is that large body of persons who take the work to their own homes. Amongst the home-workers it is not uncommon to find a single room serving as living-room for a whole family, and work-room for the older members.

Mr Lakeman, Inspector under the Factory Act for the Northern District of the Metropolis, in his evidence before the Select Committee of the House of Lords, lately sitting to inquire into the sweating system, is reported to have suggested that all places in which work was done should be registered; even if a father, mother, and two or three daughters were working in their own cottage in the country for someone else, he would have the cottage registered. Such a plan, however desirable for some reasons, would tend to strike at the privacy of home-life, and could not be tolerated unless inspection were carefully restricted to certain hours of the day. A new addition to the factory and workshops' regulations contains provision for some control of domestic workshops or places where one family lives and works. In future these dwelling-rooms and work-rooms will be visited by the medical officer of health, and if the children work with their parents they will be subject to the law with reference to hours, which applies to children in other work places. Children and young persons working in "domestic workshops" must be allowed a fixed period of one hour and a half for meals, out of the twelve hours worked. The evils of home work, entailing as it does continuous occupation of small living rooms, might be further diminished—in the same way that public wash-houses have removed the necessity of filling a room with freshly washed

* *Supplement to the Forty-Fifth Annual Report of the Registrar-General*, 1871-80, p. xxxix.

† *Report of Med. Officer to Local Govt. Board*, vol. vi. 1863, p. 362, Appendix 10.

linen hung up to dry—by the establishment by local authorities of public work-rooms, where for a small sum a man might take his work and find conveniences and appliances for his occupation, besides companionship. A women's room would probably attract a large number of poor seamstresses and waistcoat-makers.

The influence of dust is added to the want of ventilation in the predisposition to phthisis which is so marked amongst printers. Dr Edward Smith * found that amongst the printers of London, phthisis, in proportion to other diseases, is twice as prevalent as even among the general male population of London, and furnishes 46 per cent. of all the causes of death in the men who follow this employment. The want of ventilation is most marked where unsuitable buildings have been adapted to suit the trade, and less where the premises have been specially built for the business. In the compositors' rooms where the window is the chief provision for the entrance of air, a difficulty arises from the type-frames being placed immediately under these, so as to be in a good light. The men then find the draught too great when the window is open, and therefore keep it closed. Such rooms should be provided with some ventilating inlet which diffuses the incoming current of air, and so prevents draughts.

Amongst unhealthy occupations we may also include that of bakers, who suffer from the effects of inhaling flour dust, of bad hours, and of exposure to extremes of temperature ; and carpenters who inhale wood-dust. Actors, also, and persons employed behind the scenes in theatres, suffer from dust, bad hours, and draughts. Inn-keepers were found by Alison † to present a high proportion of phthisis cases, which he attributed partly to alcoholic excess ; and billiard-markers suffer a similar liability from this cause, in addition to long hours in a bad atmosphere.

* *Report of Med. Officer to the Local Govt. Board*, vol. vi. 1863.
† *Op. cit.*

PART II.

THE PREVENTION OF CONSUMPTION.

CHAPTER VII.

General Principles—Preventive Hygiene in Infancy and Childhood.

Direct Infection.—The natural history of tubercular phthisis shows, as we have seen, consumption to be due to the taking into the lungs of a specific micro-organism which is derived from persons or animals who are suffering from tubercular disease; yet it also shows how little is the danger of infection for a person of sound constitution living in fresh air and in homes where attention is paid to hygienic requirements. Though there are many *possible* ways in which the germ of tubercle may gain entrance into the body, there are but one or two which are at all common causes of consumption; and even when the tubercle bacillus enters the body, it will generally do no harm unless there is some weakness of the tissues which allows of its settlement and multiplication.

The healthy individual, living in a healthy environment, has thus little to fear from the tubercle bacillus. But when from constitutional weakness, or from unhealthy surroundings, an individual is rendered more susceptible to infection of tuberculosis, it becomes important to consider in what manner the susceptibility may be combated. With certain precautions, persons of feeble constitution may, and do, live amongst consumptives with impunity. And, first of all, let us thoroughly understand that sufferers from consumption need not be shunned as dangerous to their neighbours, nor isolated like small-pox patients. Direct infection is rare, and only possible under certain easily avoided conditions. A moment's consideration of the circumstance essential to

the life of the disease germ or tubercle bacillus will make this clear. (1) The bacilli live and multiply in the lung of the consumptive invalid, they have some weight, *i.e.*, they are heavier than air; thus, when set free from the lung tissue, they tend to remain in the lowest strata of air within the lung. They are consequently not exhaled in any quantities by ordinary breathing, though they may be expelled by cough. (2) They lose their vitality at temperatures below that of the body, and so become harmless after a short time in the external air. Therefore, unless inhaled direct—straight from the patient's breath before it gets cooled by the outer air—they are not actively dangerous; and direct infection is unlikely except in cases where there is continued close contact with a consumptive invalid—as from sleeping in the same bed. (3) The bacilli cannot multiply in the air at ordinary temperatures, and with good ventilation they will be quickly distributed, and never become numerous in the air of the room. (4) Even if inhaled, they get caught by the sticky mucus of the air-passages, and will rarely remain long enough in these passages to get warmed and revivified. (5) If they reach the lung, and are retained, they are usually destroyed by the healthy living cells before they can cause harm. The experience of the nurses at the Brompton and other large consumption hospitals may be taken as a proof of the small risk of direct infection, and of the absence of danger to healthy persons in continued residence amongst consumptive invalids, so long as due hygienic precautions are followed out. The most frequent source of danger appears to be from the spores of the bacilli, for these retain their vitality in the temperature of the air and under other conditions which would destroy the bacilli themselves; but spores are probably not largely exhaled in the breath.

The **expectoration** of phthisical patients is, however, a much greater source of danger than the expired air. The expectorated matter is seen by the aid of the microscope to be teeming with bacilli, which are here in a suitable medium for development and spore formation. As long as the expectoration is moist these bacilli are held fast in it, but when the sputum dries and becomes pulverised the dried powder or dust may be carried by the air and so

convey the germs of phthisis. And although the bacilli themselves may have been destroyed by the drying, the spores remain active.

In fact, the most frequent and powerful agent in the dissemination of consumption would appear to be the **dust from dried expectoration,** in which the spores of the tubercle bacillus are carried through the air with which they may be inhaled. A little care should minimise this common source of danger.

Precautionary Measures.—The consumptive should be taught that he may, from simple carelessness, be a danger to others, and should accustom himself to take precautions to avoid such a contingency.

On the other hand also, those who, from inherited constitutional weakness or from acquired predisposition, are specially susceptible to the infection of tuberculosis, may often escape consumption by intelligent care in self-management. Those persons who come of a consumptive family, knowing their liability to contract the disease themselves, should avoid crowded towns and those occupations which are known to predispose to lung disease; and all who have a general predisposition to suffer from tubercular infection should take precautions to keep free from special predisposing causes. But we should be careful not to let this apprehension of a possible danger weigh upon the mental and physical powers and so overwhelm the individual as to increase the liability we would avoid.

What is required is a reasonable appreciation of the risk, and a careful consideration of the possible and probable places where it is most likely to be met with; so that by guarding against the known sources of danger we may perform our duty with the consciousness of safety which belongs to those who are forewarned. It is the hidden dangers which are most to be feared, not those for which we are prepared.

Consumption spreads not by the virulence of its infecting agent, but through ignorance of its mode of extension. Knowledge of the causation, and a more general application of such knowledge by individuals and communities, might, and will, diminish very largely the prevalence of consumption. The advance of preventive medicine has

already diminished and almost stamped out plagues which claimed more victims than consumption does now.

Let us consider, first, the precautions which may be adopted by individuals, and then endeavour to indicate the lines on which preventive measures may be constructed by communities for mutual protection. When there is a hereditary tendency to consumption in the family, it becomes important to each individual to avoid all those habits and occupations which are known specially to predispose to the disease.

By a knowledge of the predisposing causes of consumption, and a careful avoidance of these, a person with strong hereditary tendency is enabled to escape.

It cannot be too strongly insisted upon that consumption is *not* inherited. Tuberculosis is rarely inherited, and pulmonary phthisis practically never; it is the predisposition only that is to be considered, for in certain families the liability to contract the disease is greater than in others, and, in these, consumption once acquired is less easily checked than in those who have no such inherited weakness.

There is, therefore, a double reason for care on the part of those who belong to a consumptive family. As this care may have to be continued throughout life, and is especially required during the period of growth and development, it will be well to mention the hygienic points which require attention at different ages; and this may be best done by giving the precautions necessary in the case of the child of a consumptive mother.

By tracing such a child through its infancy and childhood, and then mentioning the requirements for a susceptible adult, we shall get rules for the management of all ages. The early period of life, when growth and development are most active, deserves primary consideration. Without healthy growth in infancy and childhood, the individual may be unfitted to perform his part in after-life. During those few years the body grows and the character is formed, and neither bodily health nor mental and moral training can be neglected without damage; deficiencies in the one will have their influence on the completeness of the other. With proper attention to hygienic details, the weakly infant may develop into the strong and healthy man, and escape the

infirmities which afflicted his parents. Without such care, inherited defects will develop into disease as growth proceeds; and faulty management or surroundings may cause a healthy infant to grow up into a sickly and useless invalid. During these early years of life, whilst growth is progressing, tissue change is rapid and functional activity great. A growing child, therefore, requires its full share of fresh air and of nutriment; and in proportion to its size and body-weight more of these is required than for an adult. Development does not take place simultaneously with equal activity in all directions. At first the child increases in weight and length; when the teeth are forming growth is less rapid. So, too, the rapid gain of muscular strength is opposed to mental attention, and the young, growing child must not be over-crammed with lessons. Children grow by leaps, rather than by regular and even advances; there may be a gain of two inches in one quarter of the year and only one may be added in the next nine months. But the general tendency should be progressive, and if weight is not gained, the teeth will be arrested; or if the teeth are bad, growth and strength of muscle and bone may be checked. The healthy child, which weighs about 7 lbs. at birth, should double its weight in the first five or six months, and treble it by the end of the first year. As a consequence of the active tissue change in early life, the body temperature is kept up, but heat is readily lost from the surface unless the temperature of the air is kept warm, or the child protected by warm clothing. As the child grows, both food and clothing must keep pace with the altering requirements; less frequent sleep and more exercise are required, the occupations are made more purposive, and education commences. The conditions of school-life will receive full inquiry later. Then comes the important selection of future occupation, and the commencement of special training for the chosen business or profession.

Our task, then, is to see how the hygienic requirements of the different periods may have special influence in counteracting a tendency to tubercular diseases, and especially consumption.

But, first, it may be as well to say a few words about the mother before the birth of the child.

The Mother.—It would be best if advanced consumptives would not marry; but such self-sacrifice is not to be expected, although, certainly, persons with *active* tubercular disease are not in fit condition to marry and have children.

During pregnancy the advance of tubercular disease in the lungs may be temporarily arrested, only to advance again with increased rapidity after delivery. The risk of the lung disease becoming doubly active after a confinement is much lessened if care is taken to keep up the mother's strength well, and if the child be not suckled. Even with those who were previously healthy, prolonged suckling is a frequent predisposing cause of consumption, especially if this be carried on with insufficient food. Should the mother be suffering from active tubercular disease during her pregnancy, there is a possibility that the child may be born with tubercular disease—though not of the lungs. This result, however, is rare, and we may take it for granted that the child commences its life free from actual tuberculosis of any organ, though strongly predisposed to suffer from tubercular infection. Children are rarely born tuberculous, so that the child of a mother with advanced consumption is not necessarily tuberculous; but coming from a weak stock it may be wanting in stamina, and needs exceptional care. Our aim is, therefore, to keep the child free from all sources of infection, and to increase its powers of resisting this by means of attention to hygienic management.

The Feeding of the Infant.—The two probable modes by which infection may enter the system are by the air and by the food, and against these we must specially guard. The infant should not remain in the mother's bed, but should be cradled in another room. If the mother has active tubercular disease, she should only have the child with her for short periods, and should submit to having the infant tended by others for the first few months at least. Perhaps it would be as well to kiss the child's forehead instead of its mouth. This will prevent the risk of the child taking the infection direct from the mother's breath. To prevent direct infection through the digestive canal, the mother must not suckle her infant. It has been shown that tubercle bacilli may be present in the mother's milk; and

from the fact that tubercular disease is far more common in the alimentary canal and the lymphatic glands of the abdomen in infants than in later life, and attacks these parts far more frequently than the lungs in these young children, we may infer that in these cases the infection gains entrance to the body by means of the food—that is, by the milk. Thus if the mother does not suckle the child one great source of danger is avoided. There are, of course, some dangers in hand-feeding, for no food will suit the child so well as mother's milk. Therefore it is perhaps best to get a wet nurse, taking the precaution to have her examined by a competent physician to insure that she is herself free from pulmonary and other disease. Where hand-feeding is resorted to, it is advisable to have the milk boiled before it is used, especially if cow's milk be used; for, though tuberculosis attacks animals and especially stalled cattle, boiling would destroy any bacilli or spores which might exist in the milk.

Condensed Swiss milk is likely to be free from this danger. Hand-fed infants are, however, exposed to certain dangers from the want of their proper food, and the milk must be prepared so as to resemble the composition of mother's milk as nearly as possible.

Cow's milk contains the nutritive elements in different proportion to that required by the infant, and is, therefore, not readily digested. There is more casein and fat and less sugar in cow's milk than in human milk, and the former therefore requires dilution with one-third water and the addition of sugar to make it suitable for young infants.

Asses' milk more closely resembles human milk, and is useful in early infancy.

Goat's milk, though containing more casein than even cow's milk, may sometimes be used instead of the latter. Goats are far less prone to tuberculosis than cattle.

The so-called "Humanised Milk," sold by the Aylesbury Dairy Company, appears to be carefully prepared and well suited for infants.

Some of the infant's foods, such as Nestle's or Mellin's, may safely be substituted for cow's milk.

Amongst the conditions of mal-nutrition which may result from improper feeding—and influenced largely also by want

of fresh air—rickets claims special attention because of its effects on the growth of the bones, and thus on the conformation of the chest. The deformity known as "pigeon-breast," which results from early rickets, cramps the lungs and interferes with the proper movements of the chest in respiration, and thus predisposes to tubercle of the lung in after-life.

The Nursery.—If attention to food is important, so also is adequate provision for fresh air; for with active tissue change a large supply of oxygen is essential. We deprecate tight bands round the chest, and any covering over the face when the child sleeps, as tending to diminish the respiratory movements or to restrict the passage of air to the lungs. And, whilst allowing free play to the respiratory organs, we must take care that the air taken into the lungs is pure, and that the supply of fresh air is sufficient for all requirements of healthy growth. Thus the size and ventilation of the nursery are of great importance; and seeing how much of the infant's time is spent indoors, the nursery demands our careful attention. One room for all purposes for the child is not sufficient, as no opportunity is allowed for opening the windows freely and thoroughly airing the room. At first the child sleeps much, and although the cot must be shielded from draughts, it should not be curtained in so as to exclude the air. Covering the face with a handkerchief, when the child is sleeping, adds something to the work of the respiratory muscles in drawing air into the lungs, and should not be permitted. As the child grows older, two rooms are needed; one for play and feeding, and one for rest. The bed-room should be as well aired as the play-room.

It is not every house that can provide two apartments entirely set apart for the children; but there will almost always be two rooms into which the children can go, and these should be used alternately, the windows of the one being opened whilst the children are in the other.

Both day and night-nursery should be airy and well-ventilated, and the child should have a daily outing in the open air, except in severe weather. What may be termed the "hot-house method" of rearing children is always a mistake, and more especially so when there is a hereditary tendency to chest disease. The child accustomed to over-

heated rooms is more liable to catch cold when it goes out, or even on going into less-heated rooms. A temperature of 65° F. is quite high enough for the day-room, and the room should not be allowed to exceed this temperature from artificial heating. It is well to have a thermometer hung in the nursery (not too near the fire), to be consulted when the room feels warm. Without this, it is difficult to distinguish between over-warmth and closeness. If a room feels too warm, and the thermometer does not indicate a temperature over 65° F., the room is probably close—that is, the air is overcharged with the products of respiration.

In this case the window should be thrown open, and the fire may be made up to assist the draught to the chimney, and so remove the vitiated air quickly.

But whilst the hot-house method is not good, the exact reverse—or "Spartan method"—is also risky. A delicate child cannot be "hardened" by undue exposure, as by keeping the nursery cold and the child too lightly clothed.

The "Spartan method" of rearing would result in the "survival of the fittest," not without injury, perhaps, that lessened the expected benefit to the nation; but we are interested in the survival of the individual, who, if at present hardly to be classed amongst "the fittest,"—certainly not amongst the strongest,—may yet become a beneficent force in the future.

The nursery should be the brightest room in the house, both in appearance and in the life of its inmates. The day-room should be large, light, and cheerful, with good windows arranged so that the children can look out. It should have a sunny aspect, for sunlight is hardly less important than fresh air.

The sleeping-room, also, should, if possible, catch the sun during some part of the day; a room into which the direct sunlight never comes is less healthy than one which receives the purifying effects of the sun's rays.

Let toys be put away at meal-times, and before preparing for bed. If the room is kept clean and neat, the child will grow up to look on tidiness as home-like, and will consequently prefer it to disorder and dirt.

Be especially careful that no ventilating-pipe from the drains opens near the nursery windows. Children are

quickly affected by insanitary surroundings, and if sewer-gas finds its way into their part of the house, they soon suffer.

Anything which lowers the health will render the child more susceptible to tuberculous infection.

Clothing.—In the clothing of the infant, too, there are points to which attention may, with advantage, be directed.

The clothing must be sufficient for warmth, equably distributed over the body, and not interfering in any way with the free movements of the chest. We must remember that in young children the framework of the body is yielding, and easily moulded by external pressure; tight clothing may not only cause temporary discomfort, but produce permanent deformity. A tight binder round the lower ribs and the abdomen is harmful, for the soft yielding bones are pressed inwards, and the expansion of the lungs in breathing is hampered.

A loose, soft, flannel garment with sleeves, covering the whole body, and coming well below the feet, will keep the infant warm, and may be covered with any outer garments that fancy may suggest, so long as all are of similar loose make to the first. The long skirts should not be turned up so as to keep the infant's body and legs in a kind of bag. At night a similar flannel garment makes a good night-gown, for the child can then kick about as it likes without getting uncovered, and for older children loose combinations of flannel may be used.

As the child grows older, further care is required in ensuring a plentiful supply of fresh air, and the child may be assisted to get full advantage of the fresh air by exercises which expand the chest. Any tendency to stooping or round shoulders is better corrected by timely rest after short brisk effort, than by enforcing the upright position for long together. In playing, games which require movement should be encouraged, rather than toys which keep the child sitting at the table. The clothing should still be loose and the limbs covered. All garments should hang from the shoulders, so that the waist may be free from tight bands. If the body and skirt are not made in one piece, the skirts should fasten to a loose bodice by means of buttons or tapes. In the winter, long-sleeved, woollen combinations make good underclothing for young children

of either sex. See that all damp boots, stockings, or skirts are taken off as soon as possible. For girls the same style of clothing as that suggested above should be continued as they grow up.

Food.—As the child becomes able to digest other food than milk, the diet should be regulated so as to provide plentiful nourishment without over-taxing digestion. Growing children require a full supply of nitrogenous food, such as meat, eggs, fish and fowl. Fatty foods also are most useful, but we often find that the delicate children who most require fat are the very ones who take least of it. The child should be encouraged to eat the fat with the lean, and suet puddings, or bacon occasionally, will augment the fatty food supplied by butter and milk. During the autumn and winter, delicate children are often benefited by taking cod-liver-oil after meals, even where there is no actual illness.

Exercise must never be neglected, and gymnastics in addition to out-door games are good for girls as well as boys.

For those who have a tendency to lung disease, one of the main objects to be attained is to increase the capacity of the chest, so that all parts of the lungs may get distended in breathing. Even children who are too delicate to join gymnastic classes, or to take part in the rougher games, may, by a systematic use of extension movements or Swedish exercises, increase the size and capacity of the chest.

But, apart from the special effect on the chest, well-regulated exercise tends to aid the nourishment of the whole body and increase the strength, thus rendering the body more able to resist any disease infection.

Exercise pushed to the extent of producing exhaustion is harmful; it should always stop short of fatigue. During exercise, respiratory movements are quickened and deepened, as more oxygen is required for the activity of the muscles.

Therefore exercise should be taken in the outer air or in a large, well-ventilated room, free from dust, so that the increased requirements of the body for air may be satisfied.

The costume for exercise must be loose, so as to allow of perfect freedom of movement. It must also be light, and made of an absorbent material. For boys the usual flannels

meet all requirements. For girls a woollen vest with a loose blouse over it with short skirt, or a kind of long tunic and knickerbockers, is the most suitable dress, such as is usually worn in ladies' gymnasia. With such a costume young girls at school might well play cricket or hockey if a suitable play-ground or field is available. After violent exercise the whole of the clothing should be changed.

Children's Ailments.—It is hardly to be expected that a child shall be spared all the illnesses which attack children, however carefully he be guarded from infection. With delicate children especial care must be taken to keep them from the infection of such diseases as whooping-cough, measles, or scarlet fever. The longer they escape such infection, the more likely they are to get safely through any of these illnesses if they do take them. All these ailments are more dangerous the younger the patient is. One sometimes hears, even now, of parents knowingly exposing children to infection with some such ignorant excuse as that it is well to get the disease over early, as it will probably come sooner or later; or, as one child in a family has the illness, it will save trouble to let all have it at once; or they will let the child visit a slight case so as to get the disease, in a mild form as is erroneously supposed. To expose any person unnecessarily to infection is culpable folly, but with such children as those we have now under consideration it is almost criminal; and it must be distinctly understood that the severity of the disease depends rather upon the individual attacked than upon the source of the infection, and therefore that a child may get a severe or fatal attack by infection from a very mild case.

In addition to the injurious results from the weakening effects of a febrile illness, especially in children with tubercular tendency, whooping-cough and measles have their special dangers in predisposing to consumption.

The violent expulsive efforts during whooping-cough in children whose ribs are soft and yielding often leads to damage of portions of the lung, and to permanent deformity of the chest which leaves the cramped lungs additionally liable to tuberculosis.

In measles the congested condition of the lining membrane

of the air-passages during the disease (as well as the tendency to bronchitis and pneumonia during convalescence), produces conditions eminently favourable to the retention and multiplication of the tubercle bacillus. We must also mention influenza as a predisposing cause of consumption, which has lately furnished considerable evidence of its potency in this direction. During any of these acute illnesses, and until convalescence has passed into complete restoration to health, the child should be kept away from crowded places and communication with consumptive persons. Thus, if the mother has active phthisis she is not a fit person to undertake the duties of nurse, nor should she accompany the child if change of air is recommended during convalescence, and close companionship should be postponed until the strength is fully restored.

CHAPTER VIII.

School Life.

Growth of Mind and Body.—As the period usually spent at school is one of active growth and development, it is important to see that during that time hygienic requirements have due attention. In choosing a school, much must depend upon personal considerations, but a few main points may be alluded to.

Though we naturally think of mental development as the primary object of school life, we should not forget that physical growth is active throughout the period of life passed at school, and that both these must progress together. Mental and physical development, actively advancing at the same time, will mutually influence one another, and neither can be neglected without detriment to the other. Even the moral character may be warped by deficiencies in physical growth, and the weakly and deformed are often morose or hasty in temper.

When the child is markedly delicate, we should remember that the first consideration is the simple one that he should

grow up—not that he should grow up clever: in such a case the school will be selected for some other characteristic than that of hard work.

In any case, outdoor games and athletics should form a recognised part of school routine, for bodily development and mental training must advance together, and either will suffer if the other is not attended to. This applies to girls as well as to boys: a girls' school without a play-ground, or at least a lawn-tennis court, is incomplete. In all schools the class-rooms should be airy and well-lighted, as well as sufficiently warmed; they must not only be large enough but be kept well ventilated. The sanitary appliances should be efficient and simple, so that they are not easily put out of order. The drainage should be good—there should be no offensive smells anywhere in or near the building. It is best that the closets, &c., should be detached from the school-buildings, with which they may be connected by a covered way. The dormitories should be large, lofty, and well ventilated, windows being kept wide open during the day, and only closed at dusk. A good dormitory is furnished by having a long room with a central passage, on either side of which are separate compartments or cubicles, each containing a bed, and each provided with a window. The partitions should not reach to the ceiling, and the doors might be replaced by curtains. The windows at the ends of the passage could be kept open all night for ventilation.

Supervision of dormitories by the teachers is, of course, necessary.

The Class-Rooms.—In all school-rooms the air space should be large, and the ventilation sufficient.

The light must be good, and the desks so arranged that it falls on the books, and not into the children's eyes. The best light is that which comes from well above the level of the eyes, and it should come from the left side of the desk, so that the shadow of the head or hand does not fall on the work. The type of the books must be good, more especially for young children. Short-sightedness may be produced by constant straining of the eyes from small print or bad light, and a cramped or stooping position whilst reading or writing may tend towards rounded shoulders and narrow chests.

The desks and seats require attention. If the book comes

too close to the face, the straining for near accommodation may injure the eyes; if the desk is too low, stooping results from the necessity of bringing the eyes nearer to the book; and if the body has to be twisted to get a good light on the work, the straightness of the spine may be endangered.

Mental Strain.—The amount of mental work must be proportionate to the capabilities of the children. Whilst growth is active, you cannot have great mental power exercised: children cannot work for such long hours as do adults, nor can they keep their attention on one subject for long at a time. If eight to ten hours' mental work a day is sufficient for an adult when it has to be kept up, children should not be expected to keep at lessons more than from four to six hours a day. Below the age of twelve years four hours a day are probably sufficient, and below ten years three or three and a half, and no evening lessons should be allowed for children under ten years of age.

So, too, each lesson should be short—say half an hour—for, if prolonged, the attention wanders, and no good is gained. A few minutes' interval between each lesson may be permitted with advantage, during which the class-room should be cleared, the windows opened, and *everyone sent out into the fresh air.*

Meals.—A sufficient interval for meals should be allowed. Children require plenty of food; and if too short a time is allowed at table, there is a tendency to eat fast, and so to swallow the food imperfectly masticated. No lessons should be allowed before breakfast, and work should not begin too soon after a meal. When a great demand is made on one set of functions, others must remain in comparative abeyance; and when digestion is active, brain work cannot be well done.

We repeat, work should never begin directly after food has been taken, and a full hour should intervene between dinner and afternoon school. If work has to be done before breakfast—and this is not advisable—a cup of milk and a biscuit should be given first. The class before breakfast is often only wasted time, and may spoil much of the rest of the morning's work.

Growing children require plenty of food, and some meat with breakfast is useful.

If bread and butter is the only food at tea-time, a simple supper is needed. It is better to choose a school where the feeding is plentiful than to have to make arrangements for extras—for the boy who is treated differently from the rest has to pay for the indulgence by undesirable notice. It is nearly as bad for a boy to be looked upon as delicate by masters and school-fellows as it is to be bullied as a "special boarder." Where all receive the same care, both these disadvantages are avoided.

For the less hardy boys, it is better for them to live in a master's house where there are few boarders than to be in the big school where individual supervision is more difficult.

Out-Door Games should be encouraged, rather than the habit of reading indoors on half-holidays and between school hours. There is no harm in the rougher games—such as foot-ball—so long as the players are of similar size and strength.

A gymnasium is an important addition to a school; but there should be supervision during practice as well as systematic teaching. Swimming is a healthful exercise, but boys have often a way of staying too long in the water, which must be checked.

Position of the Body.—Means of easy and complete rest in the intervals of exertion should be available during the rapid growth of youth; stooping and contraction of the chest may become habitual unless care is taken to prevent this both in the hours of work and of play. With children, much can be done by calling their attention during times of activity to their tendency to stoop, and getting them to hold themselves erect; whilst gymnastic exercises and drill strengthen the muscles which support the head and trunk and accustom them to the required position.

Amongst the causes of stooping in older girls the wearing of corsets is to be remembered. When ignorance or neglect has resulted in producing round shoulders and a narrow chest the evil may be remedied by a properly adapted course of gymnastics, and this acquired predisposition to chest diseases may be removed. But as prevention is better than cure, it would be well for all girls as well as boys—and especially those who have a tubercular tendency—to strengthen the muscles by gymnastic and other exercises. By changing the leg on which while standing

the weight of the body rests, fatigue during a lesson may be prevented, and so the muscles of the spine, as well as of both sides of the body be strengthened.

So also it is important to enforce a correct position of the body in sitting at a desk, either for reading or writing. This necessitates the regulation of the height of the desk to the size of the individual. In writing, the body should be square to the desk and not twisted. Children should be discouraged from poring over a book with both elbows on the desk and the head supported in the hands. The desk-seat should always be provided with a back-rest. A cramped attitude in reading or writing is bad for any one, but most injurious for young children whose ribs are still soft and yielding. With delicate children, we should aim at increasing the size and capacity of the chest, and therefore their position when sitting requires special attention.

Amount of Mental Work.—As all depressing emotions, if long continued, act injuriously, especially on those who are delicate, more work must not be expected of a child than he is capable of doing well. Otherwise he is liable to become depressed and unhappy. It is doubtless beneficial to learn to conquer indolence, and therefore some pressure may be required where there is a tendency to laziness. But it is harmful to endeavour to get as much work as possible out of a child. Those schools which aim at making a reputation by successes at examinations—such as those of the University Local or the College of Preceptors—are unsafe places for delicate children. Over-worked children often sleep badly, and the want of recuperative rest soon tells on the physical strength. Headaches and lassitude, with indisposition for exercise, soon show that the health is suffering.

So, also, it is better to keep a boy in a lower form than to punish him repeatedly for not being up to the standard expected from his age. It is generally the more weakly children who feel most acutely the disgrace of punishment. It is now recognised that the hope of reward—whether prizes or commendation—is a more healthy, as well as a more efficient stimulus to work than the fear of penalties. Punishment should be inflicted only for wilful wrong, not for failure in attempted right. Unwonted dulness or

stupidity at lessons on any day may be due to illness rather than to temper or laziness; and it may often be advisable to excuse further lessons until the state of the child's health has been inquired into. If habitual depression of spirits or melancholy reserve be noticed in a child, every endeavour should be made to discover the cause, and to remove it. In all children—though more especially in girls—any sign of hysterical tendency must be checked at once. Self-control can be strengthened by judicious training, but is weakened or lost by habitually giving way to emotions. The loss of self-control is the essential factor in hysteria, which, when confirmed, constitutes in itself a predisposing cause of consumption.

Late Hours.—When children are living at home and attending school as day scholars, they should not be permitted to work late at night. If preparation is not all done at school, the home work should be so arranged as to be completed before supper. During term time, evening parties and all late and exciting amusements should be avoided. These should be reserved for the holidays, when fatigue can be followed by a day's rest. For boarders, too, public entertainments are best visited in the holidays, for then if any infectious fever, such as measles or scarlet-fever, is contracted, the child can be nursed at home, and not run the risk of infecting others at school.

Late hours and excitement tend to sleeplessness and late rising. If school commences early, the breakfast is hurried or neglected in the rush to avoid arriving late. Children should not be allowed to hurry the morning meal, or to go off to school without food. If a child is unable to eat his breakfast, he is unfit to do his school work. But as absence may entail disgrace, it is certainly unwise to risk this for the sake of an evening's amusement.

Boarding Schools.—Boys may generally with advantage be sent to a boarding school, where the close contact with others counteracts the "spoiling" of home, and helps to fit them for the hard knocks of after-life. Our large public schools, however, though affording perhaps the best training that can be obtained in the world, are not always suited to delicate boys. "Fagging" is by no means an unmixed evil, and for the robust youngster serves as a useful discipline;

but for a weakly boy it may be injurious, unless under an indulgent senior. Boys are not given to make allowances for delicacy, which is often miscalled effeminacy. The system of giving the elder boys a certain amount of authority over the juniors is good in principle, and encourages self-reliance by entailing responsibility on the seniors and discouraging sneaking amongst the younger ones. But delicate lads require the supervision of those who are able to proportion their work to their strength, and who can consider their health as well as their attention to school duties. There are differences in the management of the various houses at all public schools, and if a weakly boy goes into a house where the master exercises careful personal supervision, he escapes the drawbacks of a large school, whilst participating in its advantages.

In the matter of food, there would seem to be still room for improvement in some of the large public schools: though here also all houses are not alike. The quality of the food, and the cooking, are not always above criticism. The quantity, again, may be sufficient, but the distribution faulty. Where the boys have to help themselves, the bigger ones get a full supply, whilst the weaker or less pushing youngsters may have to go short of vegetables or butter. Books should not be allowed at a meal, and if no one were allowed to leave the table within a stated time from the commencement, the slow eaters might be able to finish their food. Supervision of meals by a master is required, as well as occasional inspection of food before and after cooking. It might be well to inquire, now and then, if there are any complaints as to the food from the boys themselves.

The quantity of extra "grub" purchased at the "tuck shop" may not always indicate an insufficiency of food at meals; but the consumption of sweets and tarts at odd times spoils both appetite and digestion. There should be no necessity for supplementing the school diet out of the boys' pocket-money.

Many girls—especially if delicate—are often better with the maternal supervision only possible at home, and if their education is not entirely conducted under home governesses, day schools are certainly preferable to boarding schools for them.

In his recent oration on sex in education, Sir James Crichton Browne, after showing that the physical differences between the sexes are accompanied by differences in temperament and by intellectual disparities, concludes that the *method* of education cannot be exactly the same in the two sexes. Girls are more affected by stimuli to work, and competition with them easily engenders over-pressure. He considers that competition is "intellectually and morally injurious to them, and disturbs the equilibrium of health," and says that "emulation should be banished from their education, and marks, places, and prizes tabooed, and examinations, too, which harass and agitate, should be as much as possible avoided." These he thinks the drawbacks of the high school system, and is satisfied that a very large proportion of high school girls still suffer from headache, that neuralgia is common amongst them, that they display multifarious indications of nervous exhaustion, and that many break down in the middle of term. This is partly due also to evening work, when the mastering of a fresh subject is attempted with a fatigued brain. He believes that no girl of from ten to seventeen years of age should have any forced brain-work to do after seven o'clock in the evening; and whether or not we accept entirely his special reference to high schools, all must agree with this proposition.

The above extracts, with which in the main I entirely agree, may be fittingly completed by a further reference from this lecture, which shows how the effects of school-life are held to influence the spread of consumption. Sir J. Crichton Browne draws attention to the fact that, though for all other ages the mortality from phthisis is greatest amongst males, it is far more fatal to females from the ages of ten to twenty than to males at these ages.

He then concludes as follows:—"If it were our object to secure an abundant harvest of phthisis, I do not know how we could better set about it than by providing for general over-pressure in high schools for girls. Keep a large number of town-bred girls in a constant state of nervous tension, so as to abbreviate sleep and impair appetite, deprive them as much as possible of fresh air, insist on their writing and poring over books for prolonged periods,

and scatter amongst them a few cases of tuberculous disease, and you will inevitably, in the fulness of time, have a rich growth of phthisis."

Let us hope that the indictment against high schools for girls is unmerited. It is nevertheless true that inattention to the hygienic requirements of both brain and body during school-life is likely to have most serious results in those who have any predisposition to consumption.

CHAPTER IX.

Adult Life.

Precautionary Measures.

Phthisis is essentially a disease of young adults. It comes on frequently between the ages of eighteen and twenty-five, and thus the period of adolescence requires continued care, so that the later years of growth may be healthy, and the resisting power of the body maintained.

Although consumption attacks the two sexes in almost equal proportions, the disease seems to come on at an earlier age in girls, when growth is more rapid with them than with boys, and, beginning thus early, often runs a more rapid course. During youth and in the earlier years of adult life, we must aim at a general strengthening of the frame, and endeavour, for those with a tendency to lung disease, to increase the capacity of the chest and to amplify the respiratory movements. The important hygienic requirements are a sufficiency of fresh air and judicious exercise; but attention should be given also to the clothing and diet.

Muscular Exercise is of great importance in strengthening and consolidating the frame, and has also a most beneficial effect on the lungs. But exercise demands a free supply of fresh air and of food.

For both sexes, healthy outdoor exercises should be encouraged; and since the somewhat delicate are often dis-

inclined for active movement, we may have to entice them to exercise, or make it a systematic part of training. With those who have inherited a marked tendency to phthisis, we shall more often have to encourage outdoor exercise, than to restrain their activity for fear of injurious fatigue. It is precisely those who lack the energy to take walks or play games who need the exercise, and for them a graduated course of gymnastics may be most useful. The proper development of the chest is specially important in those with a phthisical tendency, and it is therefore essential to attend to the proper carriage of the body, to prevent stooping, and to correct round shoulders.

If a child has grown fast, and the strength has been exhausted by rapid growth, stooping generally follows, and in later years it may result from prolonged sedentary employment. This tendency can be corrected by proper drill, and by attention to the position of the body. It is well to see on which leg the weight of the body rests while standing, and to change on to the other for a time: the old position of "attention" with heels together and toes turned out should never be long sustained. Young persons should be made to hold themselves well whilst standing and walking; so, when sitting upright, a broad seat to come well forward and a back-rest to the chair or form is to be preferred to a narrow seat; a foot-rest is needed with a high seat. Still the body should be held straight, and if this easily fatigues the muscles then occasional rest in a special lounge chair or in the recumbent position should be allowed. Alternation of complete rest, with vigorous muscular effort for such periods as the age and strength of the individual may suggest, is the way to increase tone. The upright pose of the head and trunk, at first maintained with much strain and fatigue, soon becomes easier as the muscles get strengthened by use, and at last becomes habitual and is sustained without effort. The proper carriage of the head and shoulders does much to throw out the chest and increase its capacity; the muscles of respiration acting at better advantage with a correct position of the head and trunk, breathing is deeper and more effectual. For all young people of either sex drill is useful in imparting an upright bearing, with grace and elegance in movement. For

vigorous exercise of the kind that stimulates the circulation and respiration, however, not only the gymnasium but the play-ground is needed. Girls are in a great measure debarred from the boys' games of cricket, hockey, and foot-ball, but lawn-tennis and boating for the summer, and brisk walks or skating for the winter, are open to both. There are even times when rounders or the skipping-rope are useful.

Military Drill for men and youths is most suitable, and may be kept up by joining a volunteer corps, whether as a cadet whilst still at school or afterwards in some ordinary corps. For those who are not strong, field-days and manœuvres must be avoided at first, and the more exhausting part of military duty must be left until training has fitted the frame for bearing fatigue. So also it would obviously be unwise for a delicate man to join an artillery corps, and over-tax his strength in working heavy guns.

A good position and carriage, with precision and smartness of movement, however unnecessary for campaigning, are nevertheless important as matters of training, and should receive a large share of attention in all cadet corps.

Physical drill, which forms a part of the course of training in the regular army, might with advantage be more practised in the volunteer force. We have, in fact, in this force an organisation which is of immense national importance even from a hygienic stand-point, and which might be turned to still further use in improving the physical development of the whole male population.

For the other sex military drill is unsuited, and physical training may be encouraged by lawn-tennis and Swedish exercises or by dancing; but all require fresh air and loose clothing, and efficient instruction and supervision. All these exercises should take the form of recreation, and stop short of fatigue.

Respiratory Exercises.—Besides attending to the development of the chest, we may increase the capacity of the lungs by what have been termed respiratory exercises. These, in their simplest form, consist in enforced deep respirations, by which, as a greater amount of air is drawn into the chest, the lungs are fully distended even in those parts which are least affected by ordinary respiratory move-

ments. Consumption most frequently commences in the upper parts of the lungs, in that part which extends above the ribs into the root of the neck. Expansion of the bony framework of the thorax in breathing exerts less influence on this extreme apex of the lung than on the parts which lie under the ribs; and it is largely on account of the less free exchange of the air within these parts that the deposit of tubercle most readily commences in the apex of the lung. By forcible deep inspirations the air-cells in these regions become distended, and free "ventilation" of all parts of the lungs is aided. The additional amount of air which can be taken into the chest by a forced inspiration is considerable. The average amount of air taken into the lungs at each breath in ordinary quiet breathing is only 30 cubic inches, or about a pint, though the total capacity of the lungs is something like 330 cubic inches, or over a gallon. This 30 cubic inches of "tidal air"—as that which enters and leaves the lungs in quiet breathing is called—may be augmented by a further 100 cubic inches, nearly three pints, by a forced inspiration, making about four times as much as is usually inspired.

Expiration after such a deep inspiration would naturally expel the 180 cubic inches which had been drawn into the chest. Even then, there would still remain another 200 cubic inches, or nearly six pints of air in the lungs, only about half of which could be driven out by forced expiratory effort, leaving about three pints of "residual" air which must always remain in the lungs.

The purification of the air in the lungs is thus brought about in ordinary breathing by the 30 cubic inches of tidal air which is taken in at a breath, and which gives up some of its oxygen to the residual air in the air-cells. The quantity of air taken in by an ordinary breath, and the extra amount which can be exchanged by forced breathing, can easily be shown by the *spirometer*, an instrument for recording the breathing capacity.

By voluntary deep breathing for short periods, two or three times a day, it will be found that by degrees the capacity of the chest is permanently increased.

The capacity of the lungs, as measured by the spirometer, bears some proportion to the height of the individual, and is

smaller in women than in men of similar height. The air capacity is diminished considerably in consumption, even in the early stages.

The following table gives the average quantity of air expired after a full inspiration for different heights in health, compared with that which can be expelled by persons of similar height in the early stage of phthisis:—

Height.	Health.	Early Phthisis.
5 ft. 5 in.	214 cub. inches.	143 cub. inches.
5 „ 6 „	222 „	149 „
5 „ 7 „	230 „	154 „
5 „ 8 „	238 „	159 „
5 „ 9 „	246 „	165 „
5 „ 10 „	254 „	170 „
5 „ 11 „	262 „	176 „

It will be seen that the amount here given for health at 5 feet 7 inches is that which has been stated as the normal quantity in the previous remarks. It will be obvious, from the foregoing facts, that by voluntary forced inspirations we can more fully expand the lungs, and thus tend to purify more completely the air which remains in those parts of the lungs which are least affected in quiet breathing. In this way it is sometimes useful to practise forced breathing for some minutes at intervals during the day, but this should be done in the open air to get the full benefit. In the same way singing, properly taught, is a useful exercise in promoting deep respirations; but room must be allowed for free expansion of the chest. The painfully constrained elevation of the shoulders, in attempting to get a full breath, which may sometimes be noticed when a tightly-laced lady sings at an evening party, shows that the lungs are prevented from expanding to the extent required. Such efforts cannot be beneficial to the performer, and to the listener the enjoyment of the music is marred by commiseration with the struggling singer.

The importance of full expansion of the lungs has been recognised in various suggestions for the treatment of early consumption. Compressed air has been forced into the lungs; or the patient has been immersed up to the neck in a chamber in which the air is rarefied and the pressure on the walls of the chest thus diminished, whilst the air

passing into the lungs through the mouth remains at the ordinary pressure. The breathing of the rarefied air of mountain elevations also tends to quicken and deepen respiratory movements.

General Hygiene.—But whilst attaching great importance to increasing the respiratory capacity of the chest, and paying attention to everything which may aid the full expansion of all parts of the lung, it is essential to attend also to the general health. Every organ of the body is to some extent influenced by the condition of other organs, and faulty digestion or a weak circulation need attention as well as deficiency in the respiratory function. A good muscular development makes exercise a pleasure; and active movement deepens the respirations, sharpens the appetite, and aids digestion. On the other hand, if there be little inclination for food, or if indigestion interferes with the proper assimilation of nourishment, the whole body suffers, and all functions are imperfectly performed.

Those whose circulation is weak easily feel the cold, and being readily affected by changes in external temperature are specially liable to catarrhs or bronchitis. This liability to catch cold may to some extent be counteracted by care in dress and the wearing of suitable underclothing. But the tendency may be diminished by strengthening the resisting power of the body by judicious training. The necessity for exercise and fresh air, with suitable food and clothing, by no means ceases with the advent of adult age. The weakly child may, with proper care, become a strong and healthy man; but care is still needed to ensure that health is maintained. There are, however, many who only attain maturity because of the attention bestowed on them in their earlier years: they live to reach adult age indeed, but never become strong. The advance of hygienic knowledge has resulted in the survival of many who in more primitive times would have succumbed in infancy or early childhood, but who, with a fuller appreciation of the laws of health, now live to become useful though fragile members of the community. It is amongst these that many of those finer qualities of human thought and feeling are evinced, and the whole world benefits by the survival of a Pascal or a Wesley. For such as these, continued attention to

hygienic rules is essential; at present they help to swell the numbers of the adult consumptives. With due care even these may escape; but their mode of life, the locality in which they live, and the occupation they select, should be governed by a knowledge of their danger, and of the circumstances which favour or counteract a disease to which they are particularly liable.

With adult age comes a liability to certain risks from which childhood is exempt. The anxieties and responsibilities of business or of the household, pecuniary worries, and numerous other troubles, tend to lower the health, and demand some compensating relaxation. The busy man cannot afford to forego his necessary holidays, and the careful housewife requires an occasional change. Responsibility weighs most heavily on those who have not yet become accustomed to bear it, and in the first years of business or professional life the health may suffer from over-anxiety. Over-study is rarely a failing during school-life, but may have to be checked later. The young man has other temptations which tend to lower the health.

Special Ailments of Young Adults.—It is during the period of adolescence, when development is reaching its completion, that certain departures from health are frequently noted.

Anæmia.—In towns especially, anæmia may occur in either sex. The pallor, even noticeable in the lips; the shortness of breath on exertion, as on running upstairs; the tendency to faintness from slight causes, are sufficiently well known, and are generally easily enough referred to their proper cause. But there is a special danger in the case of anæmic persons that this condition may be considered a sufficient explanation for any complaints of ill-health they may make. A girl with obvious anæmic appearance complains of lassitude, shortness of breath, and perhaps a slight cough. The anæmia may be considered enough to account for these symptoms, and no examination of the chest is deemed necessary. It has been stated that consumption is unlikely to occur during the anæmic condition, but this is by no means correct. On the contrary, I frequently meet with early tubercular deposit in cases which were looked upon as simply anæmic; and I would emphasize the impor-

tance of a skilled examination of the chest whenever the shortness of breath is accompanied with persistent cough, or where there is fixed pain in the chest. This is specially needed where there is a family tendency to consumption. It is gratifying to be assured by examination if there is nothing amiss; but if the lung becomes affected, it is essential that it should be recognised early; for in the early stages consumption may be arrested, and is often curable, while the hope of recovery lessens as the disease advances.

The following instructive case may be quoted. A young lady sixteen years of age, whose mother died of consumption, had for some months whilst at school complained occasionally of lassitude, and sometimes had a slight cough. Anæmia, with some hysterical tendency, had been considered to sufficiently account for the symptoms. Later, a fixed pain in the upper part of the chest came on, but received little notice, until during a short visit to some relatives, who thought her not looking as well as usual, an examination of the chest was made, and the real cause of the trouble detected. I was then asked to see her, and found active and already somewhat advanced consumption, although but a fortnight previously she had been playing lawn-tennis and passing for a healthy school-girl. The disease rapidly extended, and within three months she died.

In those who have a strong family predisposition to consumption, it is wise to have the chest thoroughly examined by a competent physician, even if there be no signs of illness, about the ages of fifteen to eighteen years; for at this period the disease may commence insidiously and may develop rapidly. As the signs of the early deposit of tubercle are slight and not readily distinguished, the examination must be systematic and complete—preferably made by an expert in chest diseases—and the chest must be thoroughly uncovered. It is not enough to listen through the clothing, nor to examine one part of the chest when the neighbouring parts are still covered, for increased respiratory movement in one part may be caused by deficiency at another, and the rubbing of the clothing may mask important sounds in the lung.

Hysteria.—At the period of adolescence also, hysterical or emotional outbursts may occur. It is important to repress

at once, if possible, any hysterical tendency, for the malady grows with indulgence, and, like a bad habit, it is more easily acquired than discarded.

The mental depression so commonly associated with hysteria increases a predisposition to phthisis. Apart from the emotional disturbances which are sufficiently intense to come under the designation of hysteria, there may be on the one hand undue excitability of temperament, or on the other excessive depression of spirits, which, if habitual, may be injurious. In the former case it will be necessary to avoid excitement, and such amusements as theatres and dances may have to be temporarily forbidden. In the latter, cheerful companionship should be sought, and solitude must be avoided.

In both conditions congenial employment for mind and body is the best remedy.

The individual whose mind is occupied and interested is unlikely to become the plaything of emotions or the slave of sentiment. Interest in work must not be allowed to interfere with necessary relaxation, or fatigue, with consequent loss of interest in the occupation, results. We may advantageously divide the day into three sections of eight hours each—eight hours for work, eight hours for relaxation, meals, and exercise, and eight hours for sleep. When the individual is robust, or the work light, the hours of labour may be prolonged without danger, but the more delicate must let their motto be—"Moderation in all things."

CHAPTER X.

Exercise, Clothing, and Diet.

The chief hygienic requirements for those who, with no actual disease, have a predisposition to consumption, are in the main applicable also to those who have already slight tubercular deposit in the lung.

With regard to exercise and diet, the person who has to combat a consumptive tendency may consult his own tastes,

and with some general directions may be allowed choice of exercise and food, as long as both are sufficient in amount. When, however, there is actual disease of the lung, special directions are necessary under periodic supervision. Exercise must be much restricted as long as there is any fever, and should be taken during the non-febrile portion of the day. Suitable clothing is as necessary for those with a tendency to chest disease as in cases of early consumption.

Exercise.—For perfect health, every organ requires its due share of functional activity; without this, nutrition suffers, and the organ wastes and eventually degenerates. Excessive activity, also, if continued, ultimately results in degeneration. The term exercise is usually restricted to the action of the voluntary muscles.

The activity of almost all organs is influenced by that of the voluntary muscles, and therefore a due amount of exercise increases the vigour of the body as a whole, and is essential to the maintenance of health. A most important effect of muscular exercise is that produced on the lungs: the pulmonary circulation is accelerated, and the quantity of air inspired and of carbonic acid gas eliminated is greatly increased. This is due to the more active oxidation in the muscles, as a result of their increased functional activity. The increased tissue change in well-exercised muscles demands an increased supply of oxygen and more rapid removal of waste products; and exercise thus promotes increased and invigorated circulation of the blood. The heart beats more quickly and more powerfully. The supply of oxygen is kept adequate by more rapid breathing, fuller and deeper respirations are taken, and the lungs become expanded and the respiratory muscles strengthened by the extra work they have to perform. If the supply of oxygen be inadequate, and if the carbonic acid produced be not quickly removed from the muscles, their action will be weakened or lost; therefore muscular action requires unimpeded respiration. It is evident, also, that during exercise the movements of the chest must not be restricted and the dress must be loose. Not only so, but a sufficient supply of fresh air is essential, and active exercise is best taken in the open air, or, failing this, in large and freely ventilated buildings. As exercise increases the action of the heart, both in

force and frequency, the circulation is strengthened. Excessive exercise produces embarrassed action of the heart, which then becomes rapid; a weaker stroke has to be made up for by quicker action, which then becomes unequal or irregular. This cannot but be injurious. When the exercise is over, the heart-beats become slower again, but a prolonged rest is required to restore regularity and tone. The increased force and rapidity of the circulation tell on the vessels; this effect is soon seen in the skin, which becomes red, and perspiration is increased. If evaporation from the surface is restrained, the body heat rises, and excessive languor results. Cleanliness of the skin is therefore important. There is little danger from chill whilst exercise continues; but when exertion is over the body temperature falls, and the risk from cold is considerable. The evaporation of perspiration from the surface of the body during exercise leads to loss of heat, and is important in regulating the body temperature. Appetite is promoted by exercise, digestion is rendered more perfect and absorption more rapid. The increased tissue change creates a demand for more nutriment, whilst the invigorated circulation aids digestion and assimilation by the greater blood supply to the digestive organs.

Excessive exercise, by producing exhaustion, diminishes appetite and lessens the digestive power. It is a sign of over-exertion when a person after a long walk, or other active exertion, cannot eat his dinner. The more active metabolism in the body during exercise produces heat, and keeps the body warm. The chilly sensation and ready susceptibility to cold, of the delicate and weakly, is greatly lessened by exercise, for thus they create warmth within the body and become less affected by external cold. All vital action is accompanied by a process of oxidation or combustion. The combination of the prepared food stored in the various organs, with the oxygen brought by the blood from the lungs—like the similar combination of oxygen from the air with the coal in the fire—produces heat which raises and maintains the body temperature. Whenever an organ is brought into functional activity some oxygen is used up, carbonic acid is produced, and heat is evolved by the combustion (oxidation). This process of oxidation is

slow but lasting. Whether we are exercising our brain or our muscles, we are helping to keep ourselves warm. Thus a brisk walk, or some sustained occupation, is a better way of getting warm than dreaming over the fire. In the latter case the surface of the body is warmed, but heat is readily lost when we get into cooler air, unless carefully protected by wraps; in the former, we produce heat in a natural furnace within, and the warmth is equalised throughout the body by the blood stream. Cold, then, has less effect on our sensations, for the heat lost to the air is replenished by that produced in the tissues.

Rest.—After exercise, rest is needed and appreciated, and thus sleep is promoted.

Rest of function allows of recuperation of substance, and rest must, therefore, alternate with exertion, neither being unduly prolonged. During sleep the diminution in the rate of the heart-beats, and the lessened force of its contractions required to send the blood over the recumbent and quiescent body, gives the heart its necessary rest. The temperature of the body is always lowered during sleep, and if this be profound, or the hours of rest be unduly prolonged, the heat of the body is considerably depressed; so that food or some warm restorative may be needed before dressing in a cold room by those whose circulation is weak. The exercise of dressing always raises the temperature of the body, and, provided too long a time without food has not elapsed, is a powerful means of restoring the body heat.

A good circulation is of the utmost benefit to the lungs, for an ample supply and renewal of blood to all parts of these organs aids their resisting powers against morbific organisms, such as the infecting bacillus of consumption.

Advantages derived from Exercise.—Exercise, therefore, holds an important place in the hygienic management of those who are predisposed to consumption, and of those also who have already become tubercular. Exercise is useful not only as a means of strengthening the body generally, and thus adding to its resisting power against all diseases, but by increasing the functional activity of the respiratory system, the lungs are rendered less liable to suffer from tubercle; nor is it less necessary when the germs of tubercle have already gained a footing, but then exercise

must be carefully proportioned to the strength of the individual, and may with advantage be specially directed to the expansion of the chest.

Many of those who have inherited a constitutional weakness from phthisical parents have their tendency to consumption further increased by the narrowness of the chest, and consequent "cramping" of the lungs.

So, too, it is the less robust who are most prone to stoop and become round-shouldered, whereby the expansion of the chest in breathing is still further restricted.

Muscular exercise has effects on the body beyond the mere strengthening of the muscles themselves.

The acting muscles require more rapid supply of nutriment and removal of the waste products of their activity; hence during muscular exercise the force and rapidity of the heart's action are increased and the circulation strengthened. As the blood circulates more quickly, it takes less time to pass through the lungs—to become aerated: but, as tissue change is more active in the muscles, an increased amount of oxygen is required, and to supply this the respirations become quickened and the breathing deeper. The lungs get more fully expanded, and, as we may say, more freely ventilated.

Thus all muscular exercise has a beneficial effect on the lungs: and the increased functional activity of respiration and circulation leads to a general increase of strength and health. Appetite is increased and digestion improved, and thus more food can be taken and assimilated.

But, apart from the effect of general exercise on the respiratory system, there may be great advantage in exercises which directly affect the movements of the chest wall. Rowing, for example, expands the chest at each stroke, and swimming also; and many gymnastic movements are specially adapted to the expansion of the lungs. The increased requirements of the body for oxygen, in all active exercise, throws extra work on the muscles of respiration, and so helps to strengthen these muscles as well as to expand the lungs; and similar results may be obtained by occasional voluntary forced respirations, and by breathing rarefied air, as in the mountains.

Even for those who have only a predisposition to con-

sumption, and whose lungs are sound, it is well to regulate the amount of exercise—and perhaps also its character—according to the strength and requirements of the individual. For those who have already some mischief in the lungs, it is essential that exercise should be carefully proportioned to their capacity; and if gymnastics are recommended, the nature of the exercise should be prescribed and its effects watched.

Exercise should be varied; for if the same kind of exercise be persisted in from a feeling of duty when the want of variety has taken away all zest, it becomes a toil which will be willingly neglected.

Walking.—To get the full benefit from walking as an exercise, the movements should be perfectly free. The head should be held up and the arms allowed to swing easily. It is better to look at distant objects, especially such as are above the level of the eyes, than to fix the eyes on the ground; this will help to keep the head erect. The free swing of the arms is checked by some forms of ladies' cloaks which have no sleeves and no arm-holes, or by keeping the hands in a muff.

It is generally an advantage to have pleasant companionship. A solitary walk easily degenerates into a hurried task or a fatiguing crawl.

If a walking tour is taken, the distances should not be too long, and a knapsack which cramps the chest should be avoided. Hill climbing is a good form of walking exercise, if regulated to the strength of the individual, for the exertion of the ascent enforces deepened respirations. The effects of hill climbing in expanding the chest may be aided by walking with a long staff—such as an alpenstock, which is grasped above the level of the shoulder. Good exercise may be obtained by a day's shooting.

Running quickens the breathing, and is beneficial if the pace and distance are systematically regulated.

Cycling may be a good exercise; but the stooping position of many bicyclists is to be avoided. This ungainly and harmful position is more easily avoided on a tricycle. If a bicycle or tricycle is to be used as a means of assisting the health, there should be no attempts at making "records," either in pace or distance.

Rowing is one of the best exercises, provided that the strength is not over-taxed and that the correct style of rowing is attended to.

The chest should be well expanded by the stroke, and therefore it is important to sit upright, with the back kept straight and the chest thrown out. In going forward for the stroke the back should be kept erect, the shoulders down, and the reach not too long, so that the chest may not be compressed by bringing the shoulders too far forward. The head should be held up.

In pulling, when the muscles of the legs and back have brought the body erect over the seat, the stroke should be completed by bringing the hands well up to the chest, the elbows being kept close in to the sides. In this way the chest is expanded. There is no advantage to be gained from rowing with a rounded back and cramped chest. The rate of stroke should not be too fast, and the body carried forward as slowly as it swings back with the stroke; otherwise the breathing becomes hurried and the lungs imperfectly filled at each breath. Sculling is better than rowing with a single oar, as with the two sculls the swing of the body is more easily kept straight, and the hands more widely separated for at least a part of the stroke. Thus the expansion of the chest is more complete. The sculls should be well balanced in the rowlock, and the weight of the boat proportioned to the strength of the rower. Even children may derive advantage by pulling with a light pair of sculls, an adult sculling with them to do the work and set the time.

Rowing against time should not be permitted.

Canoeing is not so beneficial an exercise as rowing, as the position of the arms in paddling does not allow of free expansion of the chest, but tends rather to cramp it.

Swimming is also good exercise, and brings into play almost all the muscles of the body. The chest stroke is the best, but should not be hurried. A short stay only in the water must be permitted. Only the robust can bathe before breakfast.

Riding also employs all the muscles of the body, and horse exercise makes a good change from other active outdoor recreation. The rider should keep the body erect

and not stoop in the saddle. The rapid movement through the air tends to quicken and deepen the respirations, and the chest should be allowed free expansion to benefit from this.

Children may get some of these advantages by donkey rides.

Out-Door Games which do not exert too great a strain on strength or endurance should be encouraged. Cricket, lawn tennis, hockey, &c., are all healthful exercises in moderation. Even football may be indulged in by boys if all the players are of similar size and strength. All active games may injuriously tax the strength or endurance if the player be opposed to others of much greater skill.

Skating and Sliding in the winter afford good out-door exercise, but extra wraps must be at hand to prevent chill after exertion.

Dancing would be a healthy recreation if it could be indulged in in fresh air, in suitable costume, and at some more rational time than the middle of the night. Dancing in a crowded ball-room, which increases respiratory movements in an impure atmosphere, cannot be good for weak lungs, and the heat of the room adds to the risk of chill when sitting out in a cooler place.

Costume for Exercise.—Whatever exercise is taken, the dress should be loose enough to allow free play to the muscles, and the chest should not be constricted. Woollen material should be worn next the skin, that the moisture of the body may be quickly absorbed, and this should be changed as soon as the exercise is over. The skin may, at the same time, be well rubbed with a dry towel.

The loose tunic and knickerbockers, with woollen combinations underneath, which forms the usual gymnastic dress for ladies, is a good type of what is required for the more active exercises.

To take such violent exercise as lawn tennis in tight-fitting costume, and then to sit about for the rest of the afternoon, and perhaps the evening also, without change of clothing, is not healthful and cannot be comfortable. Men take their flannels for a tennis party, and it would be a good thing if ladies could follow this example.

For young girls, especially in the country where much of

the day is spent in rambling about, it is of great advantage to have a costume which permits of perfect freedom, and which would allow of their tumbling about with their small brothers. Even for girls up to the age of thirteen or fourteen, black cloth or velveteen knickerbockers under a single skirt makes a good substitute for the usual attire for the home grounds or the woods.

I have been much struck with the contrast between a girl in such a costume and one of similar age dressed in ordinary style, rambling about the grounds of a country house. The one exhibited the free activity natural to young creatures, and was brimming over with the enjoyment of life; the other, restrained by the proprieties, had to keep her natural activity subdued, and walk sedately. No one could doubt that the former got most benefit from the fresh air and exercise. Yet in the drawing-room both were equally quiet and elegant.

Carriage Exercise.—When, for any reason, active exercise is impossible, benefit may be derived from carriage exercise. The movement of the vehicle necessitates some muscular exertion to balance the body and to counteract the swing or jolt of the carriage. Thus some of the physiological effects of muscular exercise are obtained with less fatigue than would follow voluntary movements. The rapid movement through the air helps to amplify the respirations, and is beneficial. To get the full advantage from a drive the carriage should be open, or, if the debility of the invalid or the state of the weather render a covered carriage necessary, one at least of the windows should be kept down. There is no benefit to be derived from a drive in a closed carriage, in which the air soon becomes vitiated by respiration.

In the warmer weather a similar kind of modified exercise might be pleasantly obtained by being gently rowed on river or lake in a boat. The steady way of a steam launch gives less exercise to the muscles, but gives constant variety of scene with the advantage of fresh air.

For those who are good sailors, a short sail on the sea affords a fair amount of muscular exertion in maintaining the position of the body against the constant movement of the vessel.

These more passive kinds of exercise may be indulged in as an occasional change from the more active forms by those who are fairly robust, but should not replace voluntary muscular exercise except in those who are too weak for the latter.

The Time for Exercise.—The best time for outdoor exercise depends partly upon the temperature of the air and the amount of sunshine; in a variable climate such as that of the British Isles, this will differ greatly with the season.

In the warmer weather, the earlier part of the morning and the late afternoon are more suited to exertion than the middle of the day. In the cold seasons the more favourable time for outdoor exercise is restricted to between the hours of 10 or 11 A.M. and 3 to 4 P.M.

For all but the most robust, active exercise before breakfast must be forbidden, as this is likely to be followed by undue fatigue, and possibly by a feeling of lassitude throughout the remainder of the day. A rest of an hour should follow each meal, after which exercise may be best commenced. In the warmer weather, even rest should, where possible, be taken out of doors. A hammock slung in the garden makes a comfortable resort when tired, or for the repose needed after taking food.

In any case, as much time should be spent in the open air as the weather will permit. Wraps and warm clothing will make this possible even in the cooler seasons of the year.

GYMNASTICS SPECIALLY ADAPTED FOR COUNTERACTING A PREDISPOSITION TO CONSUMPTION, OR FOR ASSISTING CURE IN EARLY PHTHISIS.

When gymnastics are recommended with the special object of diminishing a constitutional predisposition to consumption, the exercises must be specially selected according to the strength and requirements of the individual. It is unwise to put a delicate child or adult into a class where the work is suited to stronger persons. Individual attention is required not only to see that the strength

is not over-taxed, but to make sure that the exercises are properly performed. Many exercises, valuable when properly executed, may be useless or perhaps injurious if not done correctly. The chief aim should be to expand the chest and increase the respiratory capacity of the lungs, and this will be more efficiently attained by gentle exercises than by violent gymnastics.

When we wish to develop particular groups of muscles or special parts of the body, it is convenient to arrange exercises specially adapted to the object in view. These special exercises may be classed together under the name "gymnastics."

Some gymnastic exercises require proper apparatus, others may be used without any appliances. Amongst the latter are certain exercises with the arms, such as those which, under the name of "extension movements," used to form an important part of the physical training of the soldier.

Amongst those which are useful in expanding the chest are the following:—

1. Bringing the hands together with the arms extended in front of the body on a level with the shoulders and swinging them back as far as possible—even to touching the finger tips behind the back.

2. Arms fully extended as before in front of the chest and the hands brought back sharply to the shoulders by bending the elbows, then sharply extended laterally and brought again to the front to repeat the movements. The exercises may be performed with or without dumb-bells. If these are used, they must be light in weight, and preferably made of wood rather than of heavy metal. It is a good plan to practise regularly some such extension movements before going to bed, and again on getting up, when they are not interfered with by clothing.

3. Another exercise which helps to expand the chest is to support the body at full length on the ground by the hands and tips of the toes, and then raise and lower the trunk several times by means of the arms.

4. A similar exercise may be practised, with less exertion, standing and leaning forward against the wall; or, when stronger exercise is required, the feet may rest on the

ground and the hands be placed on the seats or backs of a couple of chairs between which the body may be lowered and raised. If measurements of the chest are taken at intervals, it will be found that the size of the chest may be considerably increased by these simple exercises.

The advantage of exercises which need no apparatus is that they can be used at home and may be employed daily. It is, however, well that the exercises should be performed under supervision at first, so that the movements may be properly executed. The exercises may be progressive both in character and in duration. By this means advances in strength are imperceptibly gained, and at length exercises are easily performed which would previously have overtaxed the endurance. It must be borne in mind that the object to be attained is not to see how much can be done; it should be left to the professional gymnast to exhibit feats of strength and endurance or to perform fancy tricks of skill and agility; the object with persons we are here considering is to train a frame less robust than that of the majority up to the average strength, and to keep the strengthened body healthy.

There is often a tendency, amongst young people especially, to attempt at once showy exercises on the various appliances they find in the gymnasium. They want to circle the horizontal bar, perform on the parallel bars, or wield the heavier clubs and dumb-bells as soon as possible. But, for the weakly ones, this must not be permitted. Parallel bars especially are hardly safe things for a person with a weak chest, as the distance between the two bars is not likely to bear the correct proportion that is required to the width of the chest. The exercises which constitute the Swedish system of Ling, seem to be admirably adapted to increase the respiratory efficiency of the chest. They are graduated and progressive. Through the courtesy of Madam Oesterburg I have had the opportunity of witnessing the Swedish exercises at the gymnasium in South Hampstead. The movements are graceful and carefully thought out, and care is given that each individual performs the movements correctly. The effect on the chest, as ascertained by measurements, is to increase its capacity in a marked degree. I am confident that much benefit would be derived

by those with narrow chests, rounded shoulders, and a constitutional tendency to consumption by a special course of Swedish exercises under a careful instructor.

It is probable also that even those with slight tubercular deposit in the lung would be benefited by a carefully-selected course of such exercises, under the supervision of a physician.

CHAPTER XI.

Clothing.

The important requirements for clothing are warmth with lightness.

Whilst fulfilling these requirements, the clothing should permit free movement of the limbs, and should not cause interference with the proper performance of the vital functions of the body. The respiratory movements must not be restricted, the digestive organs must not be cramped, circulation must not be impeded, and the action of the skin must not be checked.

All parts of the body require to be kept warm, and the clothing should be equably distributed over the trunk and limbs: it is unwise to cover a portion of the body with excessive clothing and leave other parts lightly and insufficiently clad. In a climate so variable as ours, it is important to guard against sudden changes of temperature. We vary our clothing between summer and winter, but a succession of warm days may give place to cold and damp, whilst a hot sun may accompany a biting wind. The clothing, therefore, requires to be adapted to the day rather than to the season. There are people who regulate their clothing, as they do the use of fires in the sitting-room, by the almanac; but the winter underclothing discarded in June is not to be despised on a cold and damp day in July, especially if this follows a spell of hot weather. To shiver in cottons because it is summer may do for the robust, but is more than imprudent for a delicate girl. The principal point in the arrangement of clothing would seem to be that

the body should be protected by a non-conductor of heat, so that changes of external temperature might less easily affect it, and that loose outer garments should be added when the weather is colder, so that they may be easily removed when oppressive, and as readily replaced if required. We need, in fact, warm underclothing, and jackets, overcoats, shawls, or other wraps to put on when we go out or when the air is cool.

Underclothing.—For the underclothing, wool, being a non-conductor of heat and at the same time light in weight, is the best material; and woollen material has the additional advantage that it is a good absorber of moisture, and diminishes the loss of heat from evaporation when the body is heated. Objection is frequently taken to the wearing of woollen material as underclothing, on the plea that it irritates the skin, and doubtless it is at first uncomfortable to those who are not habituated to its use. But all clothing is an artificial addition to the body, and only becomes tolerated by use. The naked savage would probably complain of irritation if he were clothed for the first time in a suit of muslin or the softest silk. If worn next the skin from infancy, flannel or woollen clothing would be continued without discomfort. From its power of absorption, woollen material is the best for summer underclothing also, the thickness being reduced to suit the warmer weather. If the introduction of Jäger's underclothing has led to the more general adoption of woollen material for this purpose, it will have done much good. Of late the English natural wool fabrics, well suited to every kind of use, have certainly increased in variety and are more widely worn. The so-called cellular clothing is warm and inexpensive.

Woollen underclothing should be worn not only by all who have a tendency to phthisis, as well as by those who have already developed consumption, but to some extent by everybody everywhere: in hot climates it guards from sudden chills, and in all places it is a defence against damp, and a protection against all kinds of internal congestion.

The thickness of the material may vary with the weather, but such underclothing should never be discarded altogether. Wool, being a poor conductor of heat, the temperature of the body is maintained, and a cold atmosphere does not so

readily affect it. From its power of absorbing moisture, woollen clothing next the skin prevents a chill when the body is perspiring, and also restores to the body a great part of the latent heat of perspiration. The wool fibres have a large power of taking up moisture, and thus perspiration is absorbed instead of being rapidly evaporated. The abstraction of heat which attends evaporation would cool the body, and is the cause of the chill felt after exercise, if the moisture is not absorbed. Woollen clothing prevents this; and feels warmer to the skin than linen or cotton. Silk possesses this property, but in a less degree than wool, and impedes free transpiration. Some kind of woollen night-dress is desirable, and a second should be handy for a ready change at any time. No portions of the clothing which have been worn throughout the day should be retained during the night.

Some of the chief advantages of woollen material for clothing are lost when a layer of linen is placed between it and the surface of the body. It is a mistake to imagine that a piece of flannel over the chest outside a linen or cotton garment will replace woollen next the skin, though it may be some protection against cold. The back requires protecting as much as the chest, and the limbs as well as the trunk. If the body be encased in a closely fitting garment of woollen material, much outer clothing is not required, and warmth is ensured without inconvenient weight of dress. Freedom of movement must also be permitted. Tight sleeves restrict the swing of the arms in walking, besides impeding the circulation in the surface veins, and thus tending to produce cold hands in winter. It should not be necessary to insist on the importance of allowing free movement of the chest in respiration for those with any tendency to consumption, but the vital importance of this freedom is sometimes forgotten in the blind subservience to the dictates of fashion. Tight waistbands are not advisable: any constriction round the waist, even if not tight enough to displace the abdominal viscera, will restrict the descent of the diaphragm by interfering with the movement of these organs. Skirts, &c., should therefore be suspended from the shoulders, or fastened to the bodice or corset.

Allowance must be made for the necessary distension of the stomach after taking food, without encroachment on the cavity of the thorax. With many young women free respiration is only possible during the hours of sleep, when the respiratory movements are feeble, and the freshness of the air is becoming gradually impaired.

Clothing should be light in weight; warmth is essential, but this can be obtained without overburdening the person with heavy clothing. We often see persons who are anxious about their lungs wearing innumerable layers of clothing which are chiefly piled on the chest. A large chest-protector of flannel, or perhaps wash-leather, covers the front of the chest, and possibly also the back, then comes a thick woollen vest, a flannel shirt, or possibly two, a waistcoat or cardigan, two coats and an overcoat, while the legs may be left with only thin trousers, worn more for appearance than for warmth.

A similar excess of covering for the upper part of the body is often to be found in women amongst hospital patients; but in women of the better classes the fault is usually in the opposite direction, and the chest is covered but not clothed.

Excess of clothing is harmful in more than one way. It induces perspiration on the slightest movement, and, without more care than is always met with, the excreting function of the skin is interfered with. Persons who are over-clothed, like those who live in over-heated rooms, easily catch cold. The weight of clothing throws extra work on the chest-muscles, and respiration is restricted, when, on the contrary, everything should be done to make it more effective. The patient's strength also is partially wasted in carrying about unnecessary weight. If the material for the clothing is properly selected, and the covering of all parts of the body suitably adjusted, the necessary warmth may be obtained without great weight.

On the other hand, there are disadvantages in an unequal distribution of clothing, where some parts of the body are insufficiently protected. Thus, the evening costume of ladies entails certain risks if due care be not exercised; and as the enjoyment of a dance will be somewhat lessened if precautions have to be constantly considered, it is better for

delicate girls to modify the full dress and keep their shoulders and neck covered.

Impervious Clothing should be avoided. Wash-leather chest-protectors should be replaced by flannel, and wash-leather waistcoats or bodices discarded in favour of knitted cardigans or spencers. For girls the dress should be kept free and loose as long as possible, and warm underclothing should be worn. A loose costume need not be unsightly, as are some of the so-called "rational" dresses. It is a woman's right, as well as her pleasure, to give some attention to personal appearance, and to make herself as attractive as possible; but the face is, after all, more attractive than the dress, and the expression may be pleasing even if the features are not perfect. The pinched and agonised expression—besides the injury to the complexion—which soon follows undue cramping of the internal organs by tight-lacing, more than counterbalances any triumph of the dress-maker's art. On the other hand, those advanced dress-reformers who exhibit hideous garments and divided skirts as the penalties to be paid for health in dress do much to retard the endeavours of all who would relieve women from some of the evils of fashion. If the choice is to be between a short life of beauty, and a longer existence in hideousness, what young woman will hesitate to risk the former?

Stays and Corsets should not be allowed for young girls, and are certainly never needed before twelve years of age. Even after this age, if they must be allowed, they should be loose and without the unyielding busk. Corsets are injurious in two special directions for those with a tendency to weak lungs. First, by their interference with full expansion of the chest, especially of the lower part; and secondly, by producing a tendency to stooping and round shoulders. As is well known, any muscles, or groups of muscles, which are not used, soon waste or atrophy. The support afforded to the trunk by the firm corset partially relieves the back muscles of their work of upholding the trunk, and they consequently become wasted and weakened and unable to perform their function efficiently. Thus we so often see girls sitting "all of a heap," and hear women justify the use of the corset by saying that they cannot keep upright without this support, and feel as though they would

break in two when the stays are taken off. The necessity for the corset is thus induced by the wearing of it, and is unnatural. When growth is fully completed, and the bones fully formed and set—say after 21 years of age—corsets will do less harm than before this time, but the necessary support of the figure may be obtained without a tight waist, and without an unyielding case strengthened by steels.

Knitted corsets without steels will give the necessary support and warmth at the same time. The so-called "platinum anti-corset" appears to be a satisfactory substitute for ordinary stays. It is a bodice fitted with metal "bones" which are easily removable, and has no piece of steel down the front. Buttons on the lower part are provided to which the skirts are intended to be attached, and the weight of these is thus largely borne by the shoulders.

Corsets should be frequently cleaned, especially if they are only separated from the skin by thin wool or cambric. It would be well if they were more often made of pervious material. The limbs should be warmly covered in winter as well as the trunk. Winter vests and combinations should have long or half sleeves.

Respirators are usually unnecessary, and restrict proper breathing. They may be useful in making the wearer breathe through the nose because of the difficulty in drawing air through them; but this result could be obtained by keeping the mouth closed out of doors, if cold or damp air is feared. When a thick muffler or shawl is placed over both mouth and nose, breathing is injuriously impeded and the air supply restricted, if the obstruction is long retained. During thick fogs a respirator may be an advantage, but it will require to be cleaned before using it again. People with consumption are better indoors during the fog.

Bed Coverings.—As with the clothing worn during the day, the coverings needed at night to keep the body warm during sleep should not be too heavy. And just as the body clothing absorbs moisture and organic matter from the body, and so requires frequent changing and cleansing, so the bedding becomes gradually impregnated with emanations from the body, and must be changed; even the mattress

should be occasionally cleaned. The night-dress and the bed-clothes also absorb much moisture from the body, and become impregnated with organic impurities. They therefore require to be frequently changed and cleansed. For those who perspire freely at night, a woollen night-dress or sleeping suit is to be preferred. Linen sheets feel colder to the body than cotton, and more warmth can be obtained by new blankets than from an equal weight of older ones, which have become closer in texture by cleaning.

Additional warmth can be provided by a light down quilt which is easily thrown off and replaced if required. If hot bottles are used in the bed, they must be covered with flannel to prevent burning the skin if they are touched.

Where there is a deficiency of blankets, additional warmth can be obtained by placing some paper somewhat crumpled between two of the other coverings of the bed. The crumpled paper, though not very warm in itself, encloses air which is a bad conductor of heat, and this layer of air adds warmth to the coverings. It would probably be found that an inexpensive and useful substitute for a down quilt would be furnished by filling the quilt with crumpled-up tissue-paper instead of eider down. It is better to have the bed-room warmed, and to use light bed covering, than to have an excessive amount of clothing on the bed. If the air of the bed-room is cold, there is sometimes a tendency to draw the bed-clothes over the head or face, and thus interfere with the air supply to the lungs.

CHAPTER XII.

Diet.

When a weak constitution renders an individual liable to consumption, the value of adequate nourishment is considerable, and will be duly appreciated without any special knowledge. Where it is all-important to ensure, as far as possible, healthy growth, and to maintain or increase the strength, it is obvious that plenty of nourishing food is

required. Food is necessary not only to build up tissue, to replace the wear and tear of the body, and to add new tissue where growth is going on, but also to serve as fuel to provide the various forms of vital energy, muscular and mental activity, and to supply heat to the body.

During rapid growth a larger proportion of the flesh-forming foods are required; when growth is completed, and work (mental or muscular) becomes the important business of life, more of the energy-producing foods are necessary. These latter, being also heat-producers, are needed in full measure for those who, being feeble, are easily affected by external cold. Meat may serve as the type of the albuminous or flesh-forming foods; starchy foods and fats supply energy and heat with little effect in tissue formation, but they prevent the waste of tissues already formed; whilst the metamorphosis of fatty foods serves to keep up the body-temperature.

Meat is the great flesh-forming food, and a sustainer of energy, but some elements of combustion are also required to make it a quite wholesome nutrient. Could meat be deprived of fat, it would no longer be a complete food; and, as it is, needs some vegetable addition: the fibrin alone will not long sustain life.

Classes of men who eat no meat—Hindoos, for instance —select a vegetable food containing some flesh-forming constituent. All corn seeds (cereals) and even rice contain some albuminoid material. Potatoes, being composed almost entirely of starch, are insufficient alone to maintain health, and cannot take the place in the dietary that oatmeal, maize, and lentils do in that of some races. The absence of albuminous and fatty material in potatoes may be supplied by the addition of such foods as cheese, lentils, beans, bacon, or butter.

If we consider the physiological uses of the different kinds of food, we see how, in warm climates and amongst the energetic races, a diet rich in the elements of combustion and poor in the flesh-forming constituents suffices; whilst the reverse holds where cold has to be resisted and fatigue has to be borne.

Just as an ample supply of varied food is needed, both in times of healthy rapid growth and afterwards, when growth

is completed, to sustain the mental or muscular energy of active maturity, so in illness additions to the diet may be necessary in order to prevent wear and waste of the body. Moreover, the weak and delicate, who endure cold badly, require full measure both of the sustaining and of the heat-producing foods.

In selecting a diet for those who need special care, it is well to remember the physiological uses of the different kinds of food, so that we may regulate the diet to the requirements of the individual.

Milk is the type of a perfect food: it forms the only food of the rapidly-growing infant; and whilst it will sustain the strength and activity of the most robust and active adults, is easily suited to the requirements of the invalid. It contains both flesh-forming and energy or heat-producing elements; but the proportion of the former—the casein or albuminous constituent of milk—is large, as compared with the sugar and fat or cream which come in the latter class. These constituents have, therefore, to receive some addition during illness. Milk is at first necessary to children. A growing child needs the nitrogenous or flesh-forming elements of meat as well as his bread and butter; and his diet may, with advantage, be supplemented with milk, either as a drink or in the form of milky puddings. Containing, as it does, all the necessary elements of food, milk comes to be a most important addition to other foods for all who are unable to take a sufficiency of nourishment in other forms. Unfortunately many persons—often those who most need some extra nourishment—express a prejudice against milk. They say it does not agree with them, and that they find it "heavy" and indigestible. In the majority of cases this is nothing more than a prejudice, and if they are persuaded to take it, or it is mixed in cocoa, or given with soups or farinaceous food, they are found to digest the milk well. In other cases it is necessary to boil the milk, or to add a little barley-water, lime-water, or soda-water to it before it can be taken in large quantities without discomfort. Out of a large number of persons who have expressed their inability to drink and digest milk, I have very rarely met any who did not find it suit them well when they had persevered in taking it.

As long as a person can eat well, and has a good digestion, there is little difficulty in ensuring that sufficient nourishment is taken; and there is no necessity for special dieting. Our ordinary meals—the outcome of experience, habit, and common need—combine the various foods in a manner that satisfies the physiological requirements of the body. We supply the fat which is wanting in bread by spreading butter upon it. The deficiency of starch in meat is made up by eating potatoes at the same time; and when fat is deficient in the meat, it is added as an accessory; we cook some bacon with the fowl, and take melted butter with the fish.

Appetite is tempted by the modes of preparing the food; savoury odours stimulate us to taste the meat, whilst the various dishes are served so that the food looks inviting. These details of cooking and serving the food may seem trivial and unnecessary to those whose appetites are sharpened by an active out-door life, but are important to the more delicate and fastidious. It is best to have so good an appetite that we care not how the food be served so long as it is plentiful. But when the appetite is poor the meal must be inviting, or little is eaten. A sufficient time must be allowed for eating, with quiet and pleasant surroundings; attention should therefore be paid to the refinements of the table, and appetite often requires to be provoked by culinary expedients. But cooking is useful also in assisting digestion. The potato, boiled until the swollen starch grains burst their envelopes, is more easily digested than when the starch is protected from the saliva by its capsule. Hurried eating often is injurious, as it does not give time for that complete mixing in the mouth with saliva that is needed for the digestion of farinaceous foods. So, also, efficient mastication is a necessary preliminary to the easy digestion of albuminous matters in the stomach.

Next to the ability to take sufficient food comes the power of digesting fully that which is eaten; and the ready assimilation of the products of digestion is of equal importance. Regularity in the times for taking meals has to be observed. The active out-door life, which makes the appetite keen, generally leads also to good digestion, and aids assimilation. But the best digestion is as liable to be damaged by hasty or irregular meals as by improper food,

or abuse of alcohol, tea, or strong condiments. For those whose mode of life or constitutional weakness renders appetite precarious, and digestion slow or imperfectly performed, not only should the preparation of the food receive attention, but anything which might interfere with digestion must be avoided. The more digestible foods should be chosen, and their preparation should aim at assisting their solubility in the digestive juices. It is unwise to over-tax the digestive organs by taking large quantities of food at one time, but, by giving small quantities at short intervals, we can supply the necessary nourishment to the body without undue strain on the digestive apparatus. Only the robust, at their time of best vigour, can do their work well on two meals a day. Whatever the interval for meals, they should be taken, each day, as far as possible, at the same hour.

Meal-times.—By taking food at certain definite hours a kind of physiological habit is developed, and not only is the want of food felt as the accustomed time for the meal comes round, but the stomach is ready for its work, and digestion is well performed.

The feeling of "sinking," and of hunger, which occurs when the proper meal-time is past without food, indicates that the stomach is prepared for the work of digestion, if supplied with material. If this intimation is neglected, it may be that when food is taken the digestive apparatus is not ready to fulfil its office. Besides irregularity in meal-time, hurried meals should be avoided. Rapid eating usually means imperfect mastication: the stomach is quickly filled with food which is incompletely broken up, and digestion is rendered difficult. If possible, meals should be taken in company, so that pleasant conversation may prevent pre-occupation of the mind by business or other matters. A solitary meal is either hurried, or is prolonged by reading the paper or a book. It is a physiological rule that no two functions of the body can be well performed at the same time; reading or deep thought may prevent proper mastication, and when the brain is being taxed, the digestive function will not be so active.

The same reason shows the necessity for a short period of rest after taking food. An interval of quiet should intervene

between the meal and the resumption of business or study, in order to allow the early stage of digestion to be satisfactorily performed. Our difficulty, in the case of those who have a predisposition to consumption, lies in the fact that, whereas they need a full supply of nourishment, they are often indisposed to eat, or unable to digest the ordinary foods in sufficient quantity for their requirements. This is specially the case in those who already have some pulmonary weakness. The appetite is poor, or it is capricious, and must be tempted by variety, and by consulting the taste. Often those who would benefit by extra fatty food dislike fat meat, and must have their supply of fat increased by extra butter or cream. They are so fastidious that they pick over their food before touching it, and send the plate away, having eaten little or nothing. Such persons require looking after, so that, when a poor meal has been taken, some additional nourishment may be given after a short interval, without waiting until the next meal becomes due. Exercise and fresh air will often improve the appetite, and medicinal aid is here most helpful. Where other means fail, change of air and scene, with new surroundings, and perhaps different food, will often stimulate appetite.

Supplementary Foods.—Where appetite is poor, or digestion feeble, care is required in selecting the diet, and the supplementary articles of diet and modes of feeding require attention. A basin of bread and milk, just before going to bed, is useful when the evening meal comes three or four hours before bed-time. If dressing in the morning causes fatigue, especially with ladies who have to spend some time in doing the hair, it is well to have a glass of milk, or a cup of tea with a biscuit or piece of bread and butter, before rising. Tea alone is not good the first thing in the morning, but, where its effects as a nerve stimulant are not injurious, a cup made by infusing some for five minutes in a warmed teapot with half a pint of freshly-boiled milk will be found sustaining. For those who can take it, a plate of porridge, made with milk, forms a good basis for a breakfast; and bacon with this meal is a useful way of taking fatty food. A glass of milk, with biscuits or cake, or a cup of soup, may be taken between breakfast and the mid-day meal, especially if little food is eaten at the former. The

afternoon cup of tea, with bread and butter, tea-cake, or hot buttered toast, divides the interval between lunch and dinner.

Milk and eggs—alone, or in the form of puddings—bread and butter, soups, and lentil or oatmeal gruel, find their necessary place in a dietary for those whose appetites are poor. The various meat-extracts are also valuable additions to other foods. As accessories to the food, oils or maltine are often useful, and should be taken after or near the end of a meal.

Of the oils, it is preferable to use those which are most easily digested: thus the animal are more suitable than vegetable oils, and cod-liver-oil, being easily digested, is commonly and advantageously employed. Much fatty matter can be taken with the ordinary food in the form of butter, cream, and bacon, or of oil with salad.

Maltine is used as a substitute for cod-liver-oil when this cannot be taken. For this purpose we use the thick, creamy maltine, which is not only nutritious in itself, but aids the digestion of starchy food. The Hamburg malt-extract is a brownish liquid, and acts rather as an aid to appetite: it is practically a kind of beer.

Alcohol may be taken in the form of beer or light wine with meals, if required to assist the appetite and add relish to a meal. The stronger forms of alcohol are not often necessary, and should only be taken under medical orders. It should be remembered that alcohol, in excess, increases the predisposition to phthisis, by lowering the general disease-resisting power of the system.

When tubercle has actually developed, special care is necessary in arranging the dietary; for appetite either fails or is very capricious, and digestion then becomes seriously impaired. As the disease progresses, inflammation of the stomach or intestines increases the trouble. Where fever is present, there is extra burning up of the tissues, and food is required to replace the loss.

Here the lighter foods are useful, and small quantities require to be given at short intervals, so that a sufficiency of food may be taken.

In some early cases there may be an advantage in forced feeding, gauging the amount of food by the power of digestion of the patient and not by his appetite.

CHAPTER XIII.

Choice of Profession or Occupation.

Influence of Occupation on Health.—The influence of occupation on health is universally recognised, and the subject has attracted attention from sanitarians of all countries. But perhaps in no disease has the influence of occupation been more marked, or obtained greater recognition, than in the case of consumption. The subject received considerable attention from the Medical Department of the Privy Council some thirty years ago, and in the reports for the years 1860 and 1863, and again in 1872, may be found some most valuable results of the inquiries which were then instituted. In these reports it was clearly shown that the prevalence of consumption amongst those employed in certain trades and manufactures, was out of all proportion to the incidence of the disease on other members of the population. For example, amongst potters, miners, grinders, and file makers, wool-carders, and those occupied in other manufactures where much dust was caused, consumption was found to be responsible for an excessive proportion of deaths. The mortality from this disease was also found to be great amongst printers, tailors, and dressmakers. So conclusive, in fact, seemed the connection between the prevalence of consumption and the exercise of certain trades, that in 1860 the Medical Officer to the Privy Council felt justified in summing up the results of investigations in these words :—" In proportion as the male and female populations are severally attracted to indoor branches of industry, in such proportion, other things being equal, their respective death-rates by lung disease (phthisis) is increased."

Since that time, and in great measure as a consequence of these reports, many of the injurious effects of certain manufactures have been removed by improvements in machinery, or in the mode of working. Wet grinding for metals, or the use of fans to remove the dust, and more complete ventilation in workshops and mines, have lessened the risks formerly attending certain trades, and have taken away the

point of much which was insisted on by writers thirty years ago. I have lately been informed by a needle pointer that, in the old days of hand-grinding without fans to remove the dust, he had known of as many as a hundred men having to give up their work as grinders in one factory (employing about sixteen pointers) in the space of about two years. Speaking to another man in the same district on the subject, he said that where one used to know forty consumptives you will not now find one, and added that the difference in the amount of consumption was so marked that no one could fail to notice it.

But, though much has been successfully done to diminish the risks of certain dusty occupations, those employments which necessitate a sedentary indoor life, especially if the rooms are close and the position cramped, still furnish a large proportion of consumptives.

This is exemplified in the following list, extracted from the Registrar-General's 45th Report :—

Comparative mortality from phthisis of males working in air of different degrees of purity :—

Fishermen,	108
Agriculturists,	115
Coal Miners,	126
Grocers,	167
Carpenters and Joiners,	204
Bakers and Confectioners,	212
Masons, Builders, and Bricklayers,	252
Wool Manufacture,	257
Cotton Manufacture,	272
Tailors,	285
Drapers,	301
Quarrymen,	308
Cutlers,	371
File-makers,	433
Printers,	461
Earthenware Manufacture,	473
Cornish Miners,	690

Those who have a predisposition to the disease should carefully avoid such occupations as are found to furnish a large proportion of deaths from chest diseases. Not only because their predisposition would be increased, though this is a sufficient reason ; but as they follow an employment in which consumption is comparatively common, they are more

liable to be brought into contact with sources of infection amongst their fellow-workers.

Sedentary occupations in ill-ventilated rooms, and all trades or manufactures in which much dust is produced, must be shunned, and preference given to those employments which demand or permit of much active out-door work. The care which was exercised during the earlier years cannot be safely relaxed in later life. This need for continued care is well shown by the following history of a family, which is recorded by Dr Herman Weber in his Croonian Lectures on Chronic Pulmonary Phthisis (1885).

The family consisted of seven children, whose parents had both died of consumption, having themselves belonged to consumptive families. Of these children the second died young, from tubercular meningitis. The others—namely, four boys of twelve, nine, seven and two years, and two girls of five and one year old respectively at their mother's death—were then fairly healthy, except the youngest boy, who was rachitic.

After their mother's death, the children went to live with relatives in the mountainous district of Silesia. The eldest son kept well with much out-door exercise, but, at the age of twenty-three, he took to close study, worked day and night, and neglected exercise. In less than eighteen months from that time he died from rapid consumption. The second son took to farming, and remained in good health till he was twenty-nine years of age. He then entered a commercial house, and worked in an ill-ventilated office. After two years of this life he had an attack of hæmoptysis, and died within two years more.

The third son became a cavalry soldier, led a judicious life, and remained strong and healthy. The elder girl married and remained healthy. The youngest son, farming in Canada, was a strong and healthy man, and his youngest sister, living with him, also kept well.

Dr Weber remarks:—"The history of this family is very instructive. It shows that, by favourable circumstances, even a strongly-marked family tendency may be neutralised; and this becomes still more manifest when I add that by far the majority—viz., nine out of eleven—of the cousins of these children have died from consumption before the age

of twenty-eight. It further teaches the serious lesson, that if the stringent rules of health are neglected, even after the constitution has become satisfactorily developed, the disease may suddenly show itself and run a rapid course."

Thus the choice of occupation needs consideration not only in the case of those who remain delicate, but for those also who have grown up strong and apparently robust; for the previous care may be counteracted by the effects of injudicious or unsuitable employment.

Choice of Occupation.—The selection of a calling becomes, therefore, one of the most important events of adolescence from the standpoint of health, as well as from other considerations. Amongst the labouring classes, and for some professions—such as the naval service—a decision must be arrived at before childhood is well passed. The considerations which enter into the decision of the future occupation or profession are necessarily numerous, but we have here only to discuss the influences which may affect the health. The social position and the pecuniary resources of the parents, the business or professional interests of the family, will narrow the selection in individual cases. The character and proclivities of the youth must also be taken into consideration, for a distasteful calling is rarely a successful one, and want of success cannot but engender anxiety and disappointment, which would make an occupation otherwise suitable a source of danger to the health.

The most healthy occupation *per se* may be injurious in a particular instance if non-success breeds anxiety and worry; and the successful follower of an unhealthy profession may counterbalance the disadvantages of his occupation by his ease of mind, and the facilities secured by wealth for periodical rest and change.

We cannot always ensure success when selecting a profession or business; but failure may be rendered less likely if due care is taken, when choosing a calling, to consult the tastes and predilections of the individual.

As a general principle, out-door employment is preferable to an in-door and sedentary occupation; country life is better than residence in a town; and dusty occupations must be avoided. When the hereditary predisposition is pronounced, we should select an out-door life in a sparsely-

populated district, with residence on a dry and well-drained soil, and, if possible, in a dry and equable climate. Where absolute freedom of choice is impossible, we should bear in mind the desiderata, and endeavour to select an occupation offering as many of the above conditions as possible.

It is obviously impossible to discuss all the various callings here; we can do little more than lay down the principles which may guide us in a selection.

We may, however, say a few words about some of the chief professions.

The Naval Service offers, on the whole, a healthy mode of life, and is by no means out of consideration for boys of a phthisical family. Much of the time on board ship is spent in the pure air, but the accommodation below is somewhat confined, and overcrowding is not unknown. But, though the close packing of the sailors between decks in some of the ships in the navy favours the spread of pulmonary tuberculosis, when once introduced amongst the crew, such a danger is unlikely to befall the young officers. The life in the fresh air, and the active exercise necessitated by the duties of the nautical profession are advantageous; and the exposure to all kinds of weather, in all varieties of climate, is not in itself a bad thing. But the constant companionship of a consumptive in the close quarters of a ship's cabin is to be avoided, if possible.

Military Service, in all ranks, may also be classed amongst the healthy occupations, if we except the overcrowded barracks and the lazy monotony of a gay garrison town at home. Riding, cricket, tennis, boating, and out-door exercises of all kinds should fill in the intervals of military duty, rather than the seductive attractions of the club or of the canteen.

The Clerical Profession may be suitable for a delicate man if it is possible to select the conditions of work.

A naval or military chaplain, a country clergyman with a small parish or with comparatively few poor parishioners, may be as well situated as his health could demand; but the anxious and laborious duties of a poor town parish, the anxieties inseparable from an ill-paid curacy, or the asceticism of a ritualistic enthusiast are dangerous to one with a tubercular tendency.

The period of training and preparation for the ministry demands self-denial and mental introspection as well as study, and to a delicate or over-conscientious man may cause a break-down of health. The rigorous routine of some training colleges is only fitted for those with strong constitutions.

On the other hand, a country clergyman's life is well fitted to counteract a tubercular tendency. I may instance a country vicar whose mother died of consumption soon after his birth, and who, though delicate as a child, is now a healthy man.

Although **the Medical Profession** is not necessarily an unhealthy one, those with consumptive tendency who propose to enter it should content themselves with the less exacting qualifications, and should avoid long residence in hospital. They should choose a country practice or an appointment in the army, navy, or mercantile marine in preference to town life. Most of us can look back on fellow-students who developed consumption under the heavy strain of responsible hospital appointments; but of these a certain proportion have recovered, and have kept well in country practice.

The conditions of the **Solicitor's Life** approximate more to that of the commercial man, for much time must be spent in the office. Office work is not suited to those who have a tubercular predisposition. The sedentary life is unfavourable, and is made more dangerous where the office is close or ill-ventilated. I have met with several cases of consumption which seemed to have originated from confinement for several hours a day in crowded offices, sometimes under ground, where artificial light was always required. If one consumptive is introduced into such an office, the other clerks run an increased risk.

Shop Assistants sometimes suffer from the dust and closeness of the shop, as well as from the overcrowding of the sleeping-rooms. The introduction of the electric light into shops should lessen the vitiation of the air in the evenings.

Women's Occupations.—For girls the choice of occupation is much narrowed. Many women must, of necessity, seek employment as a means of livelihood; others require occupation to prevent *ennui*. Of the unhealthy occupa-

tions, we may mention specially those which entail long hours in close rooms, as with dressmakers or milliners, especially if the attitude is cramped and the work dusty. Sick-nursing is not an advisable occupation for those with a phthisical tendency, for the period of training in hospital demands hard work, not only in the wards, but with lectures and reading in addition; and the work is depressing when fatigue or ill-health make the nurse impressionable.

For delicate young women district visiting in poor districts is to be discouraged, and the morbid depression which sometimes accompanies or alternates with religious enthusiasm should be avoided.

Young women with strong phthisical tendency should not choose occupations which necessitate close and continuous relation with young children, such as nursery governess or nurse.

School-teachers add to the disadvantages of a sedentary life, the ill effects of prolonged study and sometimes of insufficient rest and sleep. The teaching in school needs previous preparation, and the work of the pupils has to be corrected. This must be done out of school-hours, and generally in the evenings. The training necessary for success as a school-teacher often leads to over-pressure, and is dangerous for a delicate girl.

Amongst dressmakers and milliners consumption is unduly prevalent. Long hours sitting at work, the want of exercise, and deficient ventilation of the work- and bed-rooms, combine to make the occupation unhealthy.

Domestic Service is only unhealthy where the servants' rooms are small and ill-ventilated, and when opportunities for getting fresh air are unduly restricted. Though it is chiefly in the smaller houses that the servants' bed-rooms are cramped and unhealthy, this fault is not always absent from the mansions of the wealthy.

I have at present in my hospital wards a young man, seventeen years of age, belonging to a consumptive family, but himself well-grown, and always strong and healthy up to the age of sixteen. He then went into service as a footman in Edinburgh, and shared with another servant a small attic bed-room, with no fireplace, and only a small window which was rarely opened. After a few months in this place he developed consumption.

Occupations promoting Indulgence in Alcohol.—In certain occupations there is a special tendency to alcoholic excess, which in itself would increase or even produce a predisposition to consumption.

Wine and spirit merchants, brewers, and their employees, are exposed to some risk from this cause. Publicans, brewers' draymen, barmen, and billiard-markers have every opportunity of getting more liquor than is advisable; and waiters are similarly situated.

Amongst commercial travellers, especially in particular trades, business demands a certain amount of conviviality.

Tailors, printers, shoemakers, and laundresses are often found to indulge in excessive alcohol. Cab and omnibus drivers are given to hot and strong drinks "to keep out the cold."

If the temptation to drink seems in any case to be stronger than the resolution to keep within moderation, it is wisest to abstain absolutely, and perhaps wear a blue ribbon as a reminder.

Selection of Residence.—When choice of residence is possible, the natural conditions of soil and climate are to be considered in selecting a locality suitable for those predisposed to phthisis.

Soil.—There is no room for doubting that the dampness, or otherwise, of the ground has great influence on the prevalence of consumption. On porous soil, where the rain and surface water quickly drain away, and where the ground-water level is some feet below the surface, the person with a tubercular tendency lives with much less risk of increasing his predisposition than if his house were built on clay. When any impervious geological stratum lies near the surface, the ground dries but slowly after rain, and the air becomes damp and cold from the evaporation of the retained water. This is especially the case in the centre of a slight dip of the retentive layer, as in the valley of a stream or near the shores of a lake; whilst if the impervious stratum has a good slope, the water is more quickly carried away, and the ground may be dry even if clay is but a few feet below the surface. At Hampstead and Harrow, for example, the London clay rising into a hill is capped with gravel and Bagshot sand. At the summit a thick covering of the pervious stratum

ensures a dry surface; but even on the slope of the hill, where there is only a few feet of gravel over the clay, the ground easily dries.

In the reports of the Medical Officer to the Local Government Board for 1866 and 1867, an inquiry into the incidence of consumption in the counties of Surrey, Kent, and Sussex, showed how marked was the difference between the number of consumptives in various districts according to the nature of the soil.

The incidence of the disease upon the population living on retentive (or damp) soil was far greater than that on the inhabitants of districts having a pervious (or dry) soil, and phthisis was found to be more prevalent amongst those living on the *low*-lying pervious soils than amongst those on *high*-lying dry localities. Sloping impervious soils furnished a smaller proportion of consumptives among the inhabitants than the flat retentive soils.

That the dampness of the ground was to a large extent the cause of this difference is shown by the diminution of this disease in towns built on retentive soil, when drainage works had been carried out and the subsoil water thus considerably lowered. We see from this that even a damp situation can be rendered more healthy by drainage; but where selection is possible, those predisposed to consumption would do well to live on a naturally dry or pervious soil.

All houses should be built with a damp-proof course inserted in the brickwork above the ground, and where the foundations rest in the clay a layer of concrete should underlie the whole basement. Old houses are often without this safeguard. Damp houses may be found on naturally dry soils: even when a modern house is built with the statutory damp course, the slope of the ground or want of free exposure to the air may keep the cellars damp, or bring moisture to some angle of the house, and prevent a dry wholesome atmosphere indoors.

Other natural conditions, such as proximity of trees or other impediments to free movement of air and access of sunshine, have to be considered; the main object being to secure a pure air.

Purity of Air is essential, and is perhaps the one condition which is of absolute importance. If this requirement

is not fulfilled, we need not inquire further as to the climate of a place, for it is unsuitable both for the predisposed and for those who have already developed consumption, in whatever stage of the disease they may be. Purity of air includes freedom from suspended particles as well as freedom from chemical deteriorations.

This cannot be found in large towns; and healthy suburbs, or the open country generally, afford a better residence for consumptives and for the predisposed. In towns where the houses are detached and surrounded with gardens, and are not shut in by hills, the air may be kept comparatively pure. The neighbourhood of factories will generally render the air impure. The greater the movement of air, the more rapidly are impurities removed; and the greater the rarity of the air, the less can solid impurities be held in suspension. Thus at high altitudes the air is usually of exceptional purity. Pure, clear air generally ensures sunshine, which is also important.

Humidity.—The amount of moisture in the air affects evaporation from the body. When the air is saturated, evaporation is checked, and the heat regulation of the body then interfered with. Thus moist heat is more oppressive than dry heat; for in the latter, when perspiration is free, evaporation cools the surface. The effect of humidity of the air upon the body varies largely with the temperature, movement, and density of the air.

Temperature.—This includes the average temperature, the daily variations, and the differences between the temperature in the sun and in the shade.

Apart from whether the climate of a place is to be called warm or cold, we have to consider the variability of the temperature. Equability of temperature is generally an advantage for all invalids. Sudden changes, or the fear of such, prevent the patient spending as much time in the open air as may be desirable; and to keep indoors is to lose half the advantage of seeking pure air. A knowledge of the differences between the day and night temperatures, and the sun and shade temperature, helps us to warn the delicate against getting cold at night, or exposing themselves to sudden changes of temperature by abruptly leaving the sunshine. As a rule, cold dry climates are bracing

and exhilarating. If there is much wind, the cold is more acutely felt, and the climate is unsuited for invalids. With dry air, little wind, and warm sunshine, a low temperature is hardly felt; but when the sun is down, there should be a retreat to warm rooms indoors.

Hot climates are depressing and enervating, especially if the air is also moist. Cold dry climates invite active exercise out of doors; hot climates are suitable for those who are fit for nothing but basking in the warm air.

Elevation or Altitude.—The height above the sea level is of importance from the rarefaction of the air at high altitudes. Not only is the air pure on the mountains, where dwellings are sparsely scattered and factories absent, but at high altitudes breathing becomes deeper because of the rarefaction of the air. Thus the lungs get more fully expanded, and each breath takes in a full quantity of the pure air. On the other hand, the diminution of atmospheric pressure is felt in the lungs, and in some stages of consumption may tend to hæmorrhage.

The main differences between insular and sea-coast climates, and that of inland places, are due to the effect of the sea on temperature and moisture of the air.

Near the sea the climate is more equable than far inland. The yearly range of temperature may be modified by warm sea-currents tempering the winter cold, as is the case in the British Islands from the influence of the Gulf Stream. So, too, the diurnal variations are less near the sea than inland. Water heats more slowly than the solids forming the land, and also parts with its heat slowly. During the day the sun's rays warm the earth, which, giving off its heat quickly, again warms the superjacent air; whilst the sun's heat is absorbed by the sea, which does not throw out its heat as quickly as the land, and thus the air over it remains cooler. A current then becomes established from the cooler air over the sea to the warmed and more rarefied air over the land, and the cool sea-breeze during the day prevents the heat being excessive. At night, on the other hand, the breeze will be reversed, and blow from the land seawards; for during the night the heat absorbed during the daytime is slowly given off from the water, and warms the air over it, whilst the air above the land is cool.

The air of sea-side and island places is usually more moist than it is further inland, but it requires a continental distance to get quite free from sea-moisture and saline particles.

CHAPTER XIV.

Prevention of Consumption in the Family, when One Member of the Household is Consumptive.

When one member of the household has actually developed tubercular disease, there is particular need for care. In a large number of cases this occurs in a family in which there is an hereditary tendency to tuberculosis, and thus we have a source of infection in the midst of a number of susceptible persons. Occasionally, of course, it happens that the development of consumption in one member of the family is an accidental matter, *i.e.*, due to some causes operating on the individual and not common to the family. Thus a member of a family with no hereditary taint or predisposition may have become consumptive because of his occupation. Though the remainder of the family is then not so susceptible as in the former case, precautions are advisable.

In laying down the lines on which the precautionary measures should run, we may first take the hygienic measures affecting the whole household; then the rules to be observed by the patient to avoid the possible infection of others; and, finally, the precautions to be followed by the rest of the household.

I. Hygienic Management of the House—Ventilation.—The first general principle is to keep the house well ventilated. We sometimes find, under such circumstances as we are now considering, that, from a fear of harming the patient, the rooms into which he goes are kept over-heated, and, as a usual result of this, imperfectly ventilated. The fear of admitting cold air into the rooms leads to the admission only of air from the rest of the house—which has been warmed, but also has been vitiated. This is a great

mistake. Fresh air is essential to the consumptive, and frequent renewal of the air of a room will aid in removing disease-particles given off into the air, and thus also minimise the risk to others in the room who are susceptible. If it is not possible to admit warmed air from without, and the colder air causes cough or other discomfort to the patient, it is well to have two sitting-rooms which are used alternately for short periods (say an hour or two at a time), and each is thoroughly ventilated by opening wide the window whilst the patient occupies the other. It is also unwise to have too many persons in the room at a time. The number of persons should be regulated by the air-containing space of the room. In its passage through the lungs in respiration, the air is deprived of part of its oxygen, and the proportion of carbonic acid it contains is increased to 100 times its original amount, whilst the expired air contains also deleterious organic matters given off from the body. For this reason a person breathing in a closed space would soon diminish the supply of oxygen in the air, and would give out sufficient carbonic acid and organic matter to render the air unfitted to support life.

But long before the carbonic acid in the air reaches such a proportion as to cause death, the air becomes unwholesome from the organic matter exhaled. Its foulness becomes perceptible to the sense of smell, and headache and sickness are produced when it is breathed. Continued respiration of such impure air leads to lowered vitality, with pallor, lassitude, and impaired health. It is obviously impossible to keep the air within a room as pure as that outside, but we must certainly aim at keeping it sufficiently pure, that a person coming in from the fresh air can perceive no odour. This test, applied to a bed-room in the early morning, will show that ventilation is not always attended to during the night.

Observation and experiment have shown that the required degree of purity is not lost until the air has been altered by respiration to such an extent that it contains 6 parts of carbonic acid in 10,000 volumes, or half as much again as is found in ordinary pure air. Above this proportion the room feels close and stuffy, not from the carbonic acid, but from the organic matter which has been given off from

the lungs. The proportion of organic impurity in a room has been found to follow very closely the amount of carbonic acid given off by respiration. Calculation demonstrates the fact that each adult person will give off sufficient carbonic acid and organic matter to thus vitiate 3000 cubic feet of air in an hour; and ventilation, to be thoroughly adequate, should be sufficient to continually supply this quantity for every individual living in the room. In *this* climate it is found that it is only possible to change the air of a room completely three times in the hour without unduly cooling the room; and thus, with efficient ventilation, 1000 cubic feet of air-space will be sufficient in a room for each person. If, then, we wish to calculate the number of persons who can live in a certain room without danger to health, we have only to find the cubical contents of the room (by multiplying together the height, the length, and the breadth) and divide by 1000. Thus a room 15 feet long, 13 feet broad, and 10 feet high, contains 1950 cubic feet of air, and would thus be sufficient for two persons; and one, 20 feet long by 16 feet broad, and 10 feet high, contains 3200 cubic feet, and is sufficient for three persons. But as we rarely stay long together in one room, except at night, we collect, without danger, in greater numbers in our sitting-rooms, than would be advisable if we stayed in them for long together. But, as we occupy our sleeping-rooms for many hours continuously, more care is required to see that we have sufficient air-space in them. How much of the good effects of a change to the sea-side is counteracted when the family—especially the children—are packed at night in small ill-ventilated bed-rooms! For a sick person, 1000 cubic feet of air-space is quite little enough; for the healthy, 600 cubic feet may suffice. As our fires, lamps, or gas-burners also consume oxygen, we have to make allowance for these, and we may calculate that each lighted lamp or gas-burner vitiates the air as much as two persons. Thus, on winter evenings, when the gas is lighted and the curtains drawn, and we collect together in one room and make it "snug," the air is insufficient for the great demand made upon it, and the room soon becomes close. Perhaps the drowsiness which steals over the company on such occasions is really a symptom of carbonic acid poisoning. In calculat-

ing the number of persons for whom any room is suitable, we must take into account the number of hours during which the gas will be lighted, and the number of burners. Many people suffer from long hours in dark offices and work-rooms in which gas has to be constantly used, and in which often an excessive number of workers are packed. We should also make allowance for large articles of furniture, such as book-cases, beds, and wardrobes, which take up much of the space of a room. But even now our calculation supposes the changing of the air three times in an hour; and this is only possible with means for the entry of fresh air from outside and outlets for the escape of the impure air. Carbonic acid diffuses itself very quickly, and opening the window wide very soon purifies the air.

In fact, no better means of ventilation can be wanted than an open window, and when this does not chill the room it should be preferred. In the warm weather the lower part may be opened, in cooler weather opening at the top is best. The vitiated air from the lungs has been warmed inside the body, and will therefore rise, just as the vitiated and heated air from the gas goes up to the ceiling. If the fresh air enters the room near the ceiling, it at once meets the impure air there, and, besides purifying it, it cools it, and causes it to descend. Thus there is a constant circulation of vitiated air upwards, and of purified air downwards to replace it. The air which enters by the window can be directed up to the ceiling by placing a slanting board from the top of the sash; or by having windows which open with the top part falling inwards, the sides being guarded by wings. This will prevent the cooler air falling at once on entering the room, and thus causing a draught on to the heads of persons in the room.

A draught may also be prevented by stretching a piece of muslin across the opening: the incoming current of air is then broken up in passing through the meshes. The same effect is produced by a piece of fine wire gauze or a perforated plate of zinc: this explains the use of the panes of glass perforated with slits which are sometimes inserted in windows. Air can also be admitted through the window without draught by propping the lower sash open with a board which fills the opening (Hinkes Bird's method): the

air then enters the room between the two sashes, and is sent upwards by the direction of the entry. So, too, a sheet of glass fixed in the inside window-frame below prevents the direct current of air entering the room when the lower sash is opened.

To supplement the windows as a means of admitting air from outside, openings are made in the walls near the ceiling and guarded by gratings or valves (Sherringham valve), or the air enters below and is carried upwards by tubes. These Tobins' tubes should be carried up two-thirds of the height of the room, and the force of the current (which will depend upon the difference in temperature between the external air and that of the room) sends the air up towards the ceiling, where it is diffused through the room. Whatever kind of opening is used for the air to come in, the incoming current may be broken up by passing through a number of fine holes, or through a number of perforated plates the holes in which are not opposite each other. With such a diffusor free ventilation can be maintained without draught. It is well to remember that draughts mean bad ventilation: they are caused by the too rapid inrush of cold air, and the smaller the opening the more rapid the current. Conversely, the freer the aperture for admitting air, the less chance of a draught being felt. If a room is insufficiently provided with proper inlets, the air will find its way between the sashes of the windows or under the door, and as the air rushes quickly through these small chinks, draughts are felt. A draughty room may be cured by a good ventilating inlet in the wall, and the draught felt when the window is opened only an inch or two will disappear if the window is opened more widely. Whatever the means employed for ventilation, the air must be admitted from outside the house. The door is never a proper inlet, as it only admits vitiated air from the rest of the house. The air in bed-rooms is too often renewed through the door alone, although sleeping with open windows is not injurious; the night air has no peculiar pernicious properties, and the bed can be guarded from draughts by screens.

But, besides providing for the admission of fresh air, ventilation requires that the impure air should be removed. Some outlet for this is therefore necessary. In all the

means employed for carrying off the vitiated air, advantage is taken of the knowledge that hot air rises. In a room with a fire burning in an open grate there is a constant strong current of air up the chimney, and this serves the purpose of withdrawing air from the room, to fill the place of which an equal quantity of air must enter the room from outside. The fire thus, as it were, sucks air into the room through all openings by which it can enter, and thus largely aids ventilation if a sufficient inlet is provided. With small openings and a large fire, draughts must result; with larger openings free ventilation is possible without inconvenience.

As the chimney is thus the chief outlet, there will always be a current of air passing from the inlet towards the fireplace. Therefore, in a draughty room, the nearer you get to the fire the more you feel the draughts; and unless the current of incoming air is diffused as it enters, or is broken up by impact against the ceiling, a draught may be felt if you sit between the ventilator and the fireplace. The upward current of hot air in the chimney is further utilised for sucking out the impure air at the top of the room by making an opening through the wall into the chimney near the ceiling, which is guarded by a valve to prevent the smoke entering the room. As the air in a dwelling-room is usually warmer than that outside—especially in the winter—there will always be a tendency for the air to rise in the chimney, and even without a fire, an open chimney acts as an outlet for impure air. Thus open fireplaces are useful in bed-rooms even when no fire is used, and the chimney should therefore never be blocked up with sacks of straw, nor the registers completely closed. In rooms which have been unoccupied and in which the air is as cold as that outside, air may enter the room by the chimney. Then there is a down draught, which will cause the fire to smoke when first lighted. As the column of air in the chimney becomes heated it will rise, and the smoke ascends. This explains the effect of holding some burning paper up the chimney directly the fire is lighted to prevent it smoking. In the summer, when the outer air is as warm as that in the room, opening the window top and bottom will admit the air below, whilst that warmed by respiration rises and escapes above.

Free ventilation is insufficient if the room itself is not large enough. For practical purposes we may put as the limit of safety, one person for every 600 cubic feet of air-space when the room is not continuously occupied. If we take a room 18 feet long by 13 feet broad and 10 feet high, we have a capacity of 2340 cubic feet, and allowing for the space occupied by furniture, the air-containing space will be below this. If we allow one person for every 600 cubic feet of air, such a room would barely suffice for four persons. If the room is continuously occupied, we should allow only one person for 1000 cubic feet, and so the room would do for two persons for a continuous stay. This supposes good ventilation; for each person, as previously stated, requires 3000 cubic feet of air per hour that the air may be kept sweet and wholesome; and free ventilation will change the air of a room about three times in the hour.

When the lights are burning, air is required for combustion, and each light (whether gas-burner, candle, or lamp) may be calculated to require, at least, as much air as one person, and this is a low estimate—so that a room of the above size, if lighted by two gas-burners, should not contain more than two persons; though we shall probably find it then occupied by more persons than at any previous time of the day. If this be so, do not let the consumptive person be a constant member of the party, and let his stay be brief for his own sake as well as for that of the rest of the family circle.

Influence of Sunlight.—Next in importance to a sufficiency of air comes the beneficial effect of sunlight. The rooms occupied by the consumptive should be so situated and so arranged that the sunlight enters freely during some part of the day. This applies to the sleeping-room as well as to day-rooms. Every one knows the chilly, damp, and musty sensation felt on entering a room which has been long left with the shutters closed. There are still some careful but mistaken housewives who keep the best drawing-room for rare functions, and during the long intervals have the shutters closed to exclude the sun and prevent its light from fading the carpet. On entering such a room when the shutters are first thrown open one experiences

some such sensation as that felt on going into a vault. A room into which the direct rays of the sun never fall always feels less warm and less pleasant than those which have the sun on them. The inhabitants of the closely-built parts of large towns, who live in rooms into which the direct sunlight rarely or never enters, are, for the most part, pale and weakly, and often puny and stunted in their growth.

Physicists recognise chemical rays in the sun's spectrum, as well as the light-giving rays, and the health-producing property of sunshine depends on the effect of the chemical rays as well as on the influence of light and warmth.

Experiments have been made to show the influence of sunlight on the life of disease-producing micro-organisms, and it has been found that the growth of these is retarded or prevented by exposure to the sun's rays. According to Koch, sunlight, or even ordinary daylight, will kill tubercle bacilli in from a few minutes to five or six days. Common experience leads us to expect to find fungoid growths in dark cellars, but not in rooms open to the sun. The observations on the effect of sunlight on the growth of micro-organisms forces us to include sunlight amongst our list of disinfectants, and places this attribute of the sunshine above mere supposition. Thus we advocate sunny rooms for the consumptive, not only because of the beneficial effects of the sun on the patient, but also for the effect it exerts on the infective particles given off by him.

Removal of Dust.—As solid particles exhaled eventually settle, and so get into the dust, the house should be kept thoroughly clean. Especially should the sweeping and dusting of the rooms chiefly occupied by the patient be frequently and thoroughly attended to. This is one reason why two rooms are necessary for invalids, who can then occupy one while the other is being aired and cleaned. When the patient cannot be moved, a light cover for the face or a screen to the bed is needed while the window is opened and the room swept: a little bran, moistened with sanitas, can be used on the floor or carpet while sweeping. The carpet should be laid down loosely, not nailed to the floor, so that it can be easily taken up and shaken out of doors. It should not reach the wall, but a strip of boarding, stained or polished, should be left bare all round the room, which can

be easily kept free from dust, and frequently washed. If the floor is uncovered, except by loose carpet, the spaces between the boards should be carefully filled in, as crevices soon collect dust, which is with difficulty removed and probably accumulates indefinitely.

The best floor is a well-polished one, with no crevices—*e.g.*, parquet—only partially covered with loose rugs.

Curtains and hangings, which can be washed, are preferable to those of woollen material which catch the dust; and chintz covers, which can be readily cleaned, may also be provided for the furniture. Heavy curtains and hangings, sometimes needed for warmth in front of a large window space, should be frequently taken down and well shaken out of doors.

Heavy articles of furniture, which are with difficulty moved, often hide an accumulation of dust beneath; and the tops of lofty wardrobes, especially those with a cornice round the top, require to be kept clean above.*

All dusting should be done with a damp cloth, except for such furniture as would be thus injured, so that the dust may be really removed. Dry dusting merely results in stirring the dust into the air of the room, from which it again settles when the process is over.

For the same reason the old plan of sprinkling damp tea-leaves on the floor before sweeping has its advantages.

A good housewife knows where to look for dust, and pays special attention to the darker corners, the tops of picture-frames, high shelves, and the less accessible ledges. One of minor advantages of a bright and well-lighted room is that dust, being easily seen, is more frequently removed.

Warming.—Where the sun shines warm all the year round, and the temperature of the atmosphere is always high, no provision for artificial warming is needed in the dwellings. In a climate such as that of the British Isles, where the sun is so often obscured, every provision ought to be made to let the sun shine into our rooms both for light and warmth. Living-rooms on the sunny side of the house are not only more cheerful, but warmer than those

* Pasting a piece of brown paper across the top of the wardrobe cornice gives a flat surface, which is easily dusted.

cut off from the sun, either by their aspect or by overshadowing trees or buildings.

For comfort, and also for health, we want to keep the temperature of our living-rooms sufficiently warm, and for healthy men a temperature of from 55° to 60° F. should be maintained. Below this temperature the room feels cold, and is certainly too cold to sit in. For young children, old persons, and invalids the temperature of the room should be higher. But it is not only necessary to warm the sitting-rooms. If the passages are cold, there will be a constant current of cold air from the passages into the warm room through any opening between the two, and a draught under the door or through the keyhole will almost certainly result. Besides this, we risk a chill in passing from the warm room into the cold of the passage.

In providing ourselves with the required warmth, we must be careful never to sacrifice fresh air to temperature, and so we must allow for a sufficient supply of air to feed the fire as well as for our own respiration. In all our means for artificial warming, the heat, whether from a fire or other heating apparatus, is given into the room by radiation. The heat is diffused in the room so that the warming effect diminishes very considerably the further the heat has to travel. A large room will therefore require more than one centre of heat, and a long narrow room is very inadequately warmed by a single fire or stove at one end. As the heat radiates in all directions from the fire or other centre of heat, only a part of the heat given off from a fireplace in the wall enters the room, and the greatest effect would be produced by the source of heat being placed in the centre of the room. Thus the ordinary fireplace has the disadvantage that so much of its heat is lost, only a small proportion being thrown out into the room. The rest goes up the chimney and to the back of the fireplace. In the "Galton" grate this heat is utilised in warming an air-chamber round the grate and chimney; the air enters from below, and, having been warmed by the fire, comes into the room through an opening in the wall above. But the open fire has compensating advantages. It is cheerful and also healthy, for it greatly assists ventilation by means of the chimney, and the products of combustion do not enter the

room. Other means of warming the house are closed stoves, gas-stoves, and hot-water or hot-air pipes.

That attention to the surroundings and rooms occupied by a consumptive is not unimportant in considering the various means of prevention may be seen from some observations of Dr Ransome of Manchester on *Tubercular Infective Areas*,* and by the excessive incidence of this disease in the inhabitants of back-to-back houses, where through ventilation is impossible.

It is a significant fact that nearly all the cases of probable direct infection from a phthisical patient take place in small and ill-ventilated houses, and are almost unknown in the airy houses of the well-to-do.

II. Special Precautions for the Invalid.—This is not the place to insist upon the importance of hygienic management in the treatment of consumption, for we are now regarding the patient merely as a possible source of infection. It is clearly his duty to minimise those risks as far as it is in his power to do so. The great medium by which the infective particles are given off from the lungs is the expectoration.

a. **The Sputa.**—In most cases of consumption the cough is attended with expectoration, and the sputum can be shown to contain the bacilli of tuberculosis. Especially in cases of consumption where there are cavities in the lungs, and in which the phlegm is yellow or greenish, are the disease-producing particles to be found in great numbers. Unless some means be taken to destroy not only the bacilli, but also their spores, the expectorated matters remain sources of danger for a long period. The sputum, allowed to dry on a handkerchief, may come off into the air and add disease-germs to the dust; and mucus expectorated on to the ground dries and gives its contained spores to the air, to be possibly inhaled by some living being. Expectorating on the floor—a dirty habit, still far from uncommon amongst the lower classes—is for the consumptive a danger to the community, which may be compared to the careless disregard for others which is shown by those who take an infectious patient in a public vehicle.

It is best for the consumptive patient at home to have

* *Transactions of the Epidemiological Society of London*, 1886-87.

his spitting-cup near at hand, and to expectorate into this. This need not be unsightly in shape or appearance. The spittoon should contain about a wine-glassful of some liquid germicide, as, for example, carbolic acid, 10 grs. to the ounce, or a solution of bichloride of mercury (corrosive sublimate) of the strength of 1 part in 500 of water. This may be coloured so as to prevent accidents. If the sublimate solution is coloured blue—a colour almost unknown in medicines for internal use—there is little fear of it being mistaken for medicine: the bottle should be labelled "Poison," and kept in a locked cupboard. Bichloride is quickly rendered inactive by albuminous substances, and thus requires frequent renewal. The spittoon may then be emptied into the drains without danger of disseminating infection. It should never be emptied into the dust-bin or ash-heap. If no disinfectant (germicide) be placed in the spittoon the contents should be thrown on a hot fire and burned, and the spittoon itself well rinsed with boiling water. Expectoration into the chamber-vessel, unless it contain a disinfectant, or into the closet, should not be permitted. When the expectoration is scanty, or when the patient is from home, pieces of linen, which can be burned, may be used to receive the sputa; or if the handkerchief is used, it should be soaked in disinfectant, or scalded, as soon as it is done with. In the hospital to which I am attached as physician, certain short rules have been drawn up by the Medical Board, on lines proposed by myself, with a view to instructing the patients on these points. The following notice is conspicuously displayed in the wards and lavatories for the instruction of the in-patients; and on leaving the hospital a leaflet, such as is given to the out-patients (see p. 139), is handed to each patient for his guidance at home:—

North London Consumption Hospital, Mount Vernon, Hampstead.

REGULATIONS.

Patients must keep their spitting-cups with them throughout the day and spit nowhere but into them whilst in the house.

REGULATIONS—*continued.*

Out-of-doors spit into a handkerchief or piece of rag, which must be placed in a bucket provided on coming in.

NEVER SPIT ON THE FLOOR,
Either in the Rooms or Lavatories.

The spit-cup must be emptied into a porcelain vessel provided for that purpose and afterwards washed over sink in lavatory. Spit-cups must not be emptied down closets or washed in lavatory basins.

By Order of the
RESIDENT MEDICAL OFFICER.

Dr Sims Woodhead in his work on *Bacteria and their Products* says:—

"Through the work of Koch, Cornet, and others, the Germans have come to look upon perfect cleanliness in the treatment of phthisical patients as absolutely essential. Pocket handkerchiefs and bed linen used by phthisical patients are most carefully sterilised by means of bichloride of mercury, hot air, steam, or other germicidal agents; patients are strongly enjoined not to expectorate except into receptacles specially made for the purpose—receptacles that can be carried about, can be most readily cleaned, and in which expectorations can be easily disinfected."

As an example of the diminution of consumption in Germany, Dr Woodhead mentions that in the Grand Duchy of Baden the deaths from tuberculosis in 1887 were 2·80 per 1000 inhabitants as against 3·08 per 1000 in 1882, and adds:—"Were this to be equalled in the British Isles, and the patients were not carried off by other diseases, the saving to our community would be nearly 10,000 lives per annum."

b. **The Breath.**—But apart from the danger from the sputa there is a possible risk from direct infection by the breath, especially in close or ill-ventilated rooms, if close contact is allowed for any length of time between the patient and a susceptible person.

The patient should therefore sleep alone. No other person should occupy the same bed with a consumptive, for the close contact for many hours gives the risk of direct infection from the breath.

Sisters of nearly the same age often share the same bed; but if one is consumptive this should never be permitted, as the other is specially susceptible if there is any hereditary predisposition. When possible the consumptive should have a bed-room to himself. But where another member of the family occupies the same room, the room should be large and well ventilated, the beds should be far apart, or if necessarily somewhat close, a screen should be placed between them. If there is a fire in the room, the non-consumptive's bed should not be placed between the consumptive's bed and the fireplace, for the chimney is the chief outlet for the air of the room, and there will always be a current of air from the consumptive's bed towards the fireplace, which would thus pass over the other bed. In the case of a tuberculous child who requires a nurse to sleep near, the child's cot should be so placed with reference to the nurse's bed that the currents in the room carry the air from around the child away from the nurse's bed.

Disinfection.—The disinfection of a room which has been long occupied by a consumptive patient may not always be necessary, though it undoubtedly is a wise procedure to adopt. Amongst the poorer and less careful members of the community, there may be sufficient disregard of precautions to make this a desirable measure before the room is again occupied.

III. **For the Remainder of the Household,** it is necessary that they should pay due regard to their own health and avoid as far as possible all predisposing causes of consumption as mentioned elsewhere. This is specially important for those who are much with the invalid; but as all members of the household are in the presence of an infective person, all should exercise some care. In cases where there is a family tendency to consumption, the various members of the family must be regarded as specially susceptible persons. Regular out-door exercise should be taken, clothing should be adapted to the climate and weather, and food should be sufficient, meals taken at regular times and not hurriedly.

There need be no restrictions as to intercourse with the invalid, but if any member of the family has a bad cold, or

bronchitis, it is wise to limit the time spent with the patient during its continuance.

So, too, children and others recovering from measles, whooping-cough, or influenza, should not be much with the invalid. Kissing should be avoided between the patient and other members of the family. If any member of the family gets out of sorts or has a cough, it is well to seek advice early. A periodical examination by a physician of the chest in the case of each member of the family might with advantage be allowed.

CHAPTER XV.

State Hygiene tending to the Prevention or Diminution of Consumption.

The health of the individual is so dependent upon his surroundings that it is essential to consider how far the conditions of life in large civilised communities influence the prevalence of consumption, and what control may be, and to some extent already is exercised by the state on the conditions which favour the causation of this disease. Although an individual can, by attention to hygienic rules, do much to ward off consumption when rendered liable to the disease by hereditary or acquired weakness, his efforts in this direction may be counteracted or rendered less effectual if his neighbours and those amongst whom he lives disregard sanitary requirements.

This dependence upon the mode of life of our neighbours has led to the framing of laws and regulations, binding upon all members of a community, with the object of preventing any person from doing anything which would constitute a serious danger to the health of others.

The various Public Health Acts and Bye-laws which are in force throughout the kingdom, or in special localities, have been for the most part directed against disease in general, excepting those regulations which deal with the acute infectious fevers. And, although in this country there have been no laws specially applied to the prevention

or diminution of consumption, the general improvement brought about in sanitation has had its effect on the prevalence of phthisis. This is seen in the diminution of the disease as shown by the Registrar-General's Reports, from which it appears that in twenty years the number of deaths from consumption has fallen from 54,231 per million in 1870 to 48,366 per million in 1890, representing a saving of something like 30,000 lives every year. The diminution of over-crowding—both of houses on a given area, and of the inhabitants in each house,—as well as the drainage of the subsoil, have an important influence on the development of consumption. The well-known reports on the prevalence of consumption in the army issued in 1839 and 1858, and the improvement when barrack-rooms were better ventilated and less crowded, as also the diminution of phthisis amongst prisoners when the ventilation of cells was attended to, sufficiently indicate the influence of overcrowding and inadequate ventilation.

Barrack Accommodation.—The experience of the army is most instructive. In 1839 the average mortality throughout the army from diseases of the lungs was about eight per thousand annually, of which four-fifths were attributable to consumption; whereas the highest estimate amongst the civil population was only half as much. Amongst the troops, the highest death-rate from these causes was in the Foot Guards, where it reached 13·8 per thousand. That the men of the Guards were not more susceptible to diseases of the lung than the other troops, was shown by the fact that when they were serving in Canada they were less affected by these diseases than the infantry of the line who were in that country; on the other hand, the troops which took over the barracks in London, vacated by the Guards, showed even a greater prevalence of sickness than the usual amount amongst the Guards under similar conditions.* It was, therefore, evident that the sickness must be referred to some local causes, amongst which defective barrack accommodation was considered one of the most prominent.

* *Statistical Report on the Sickness, Mortality and Invaliding among the Troops in the United Kingdom, the Mediterranean, and British America*, 1839.

It is a curious commentary on the slowness with which matters relating to health received official attention, to find the report of a commission of inquiry into the causes of this excessive mortality * dated nearly twenty years later than the report from which the above facts are taken. But when the barrack accommodation was improved, the mortality from chest and tubercular diseases amongst the troops at home fell from 10·1 to 4·2 per thousand.

Drainage of Subsoil.—The influence of drainage of the subsoil is seen in the diminution of consumption in various towns which followed the drying of the ground by drainage works, as pointed out by Dr (now Sir George) Buchanan. The improvement in the prevalence of consumption in fifteen towns ranged from 49 per cent. in Salisbury, and 47 per cent. in Ely, to 11 per cent. at Merthyr. Following up these observations, Dr Buchanan was able to show that in a number of districts the prevalence of consumption had a marked relation to the proportion of inhabitants who lived on pervious or on retentive soil respectively. In the group of districts where phthisis was least prevalent, 909 per thousand of the population lived on pervious and only 91 per thousand on retentive soil; and in the most phthisical districts the proportion was 642 on pervious and 358 on retentive soil in every thousand inhabitants.†

Public Health Acts.—But the efforts of sanitarians for the public good are opposed by the ignorance of those whose benefit is chiefly sought in the various enactments of the Public Health Acts, and by the apathy of those by whom the laws should be enforced. Many of our most valuable acts and bye-laws are only permissive, and may be adopted or refused by the various local authorities. Thus they are inoperative in a great part of the country; and, where adopted, they are felt by many as restrictions which are severe when compared with the freedom in surrounding districts.

Amongst well-to-do families there is less difficulty in getting necessary hygienic measures attended to than amongst the poor. It is not only the want of means—in itself the cause of much over-crowding and of the absence

* *Report of the Commission to Inquire into the Excessive Mortality in the Army*, 1858.

† *Reports of the Medical Officer to the Privy Council*, 1866-1867.

of certain sanitary requisites—which makes the prevention of consumption a matter of great difficulty amongst the poor. We have, with them especially, to contend against a profound ignorance of the laws of health; and, as a consequence of that ignorance, deep-rooted prejudices exist, which are most difficult to overcome.

Sanitary legislation, to affect the prevalence of consumption, must be directed towards the diminution of the sources of tubercular infection on the one hand, and, on the other, towards increasing the resisting power of those most exposed to danger. Of the modes by which tuberculosis gains its entrance into the body there are two which stand out prominently as most frequent causes of the disease, both of which might be much restricted by sanitary supervision. These are the transmission of tuberculosis by means of food, and that by the air—and especially by the dust of dried tubercular sputa carried in the air. The marriage of tuberculous persons, however desirable it might be to restrict or prevent such persons from marrying, does not come within the scope of practical legislation.

Food derived from Tuberculous Animals.—The possibility of infection from the milk and flesh of tuberculous animals used as food has been abundantly proved, but the full importance of this as a cause of tuberculosis is perhaps still to be determined. If, as seems possible, tubercular meningitis, as well as strumous glands in the neck, may be caused by infection through the mucous membrane of the alimentary tract, this mode of infection assumes an increased importance. Tuberculous milk clinging to the tonsils and fauces may be one of the causes of tubercle bacilli reaching the cervical glands (scrofulous glands); and tuberculous food in the stomach and intestine infecting the abdominal lymphatics may be followed by tubercular infection of the chain of glands running up the front of the spine and so reaching the base of the brain. The large amount of abdominal tuberculosis amongst young children in London is possibly in some measure dependent upon feeding with milk from unhealthy cows. Although the flesh of tuberculous animals may cause tuberculosis if eaten imperfectly cooked, this would appear to be a less likely source of disease than milk.

When we come to consider how we may control the possible dissemination of tubercle through infected food, it becomes extremely difficult to suggest a limit for preventive legislation. If all cattle or other animals which are tuberculous in any degree, are liable to seizure and destruction, much loss may be incurred, and the loss must fall on the community, or on the particular owner. It can hardly be proposed to compensate owners for all animals so destroyed. Even partial compensation would entail severe loss on owners, as well as great expense to the nation. If in any case we can contemplate a compensation for such animals, it would be in the case of owners who gave early notice of any suspected animal; it might then serve as an incentive to care.

No compensation should be allowed where a tuberculous animal had been slaughtered for food or the flesh exposed for sale.

But the chief aim of legislation should be the prevention of tuberculosis in cattle, rather than the destruction of tuberculous flesh or milk. More attention to cubic space and ventilation in the sheds, and the early isolation of suspected animals, would probably produce far more important results than the most rigid inspection of meat and milk. Here thorough inspection of the sanitary circumstances of the animals by competent men is essential.

If cattle kept for food were subject to frequent inspection, and suspected animals were isolated, it would not be difficult to prevent the sale of tuberculous milk, or at least to prevent its being sold until it had been boiled. The milk from tuberculous cows should not be used, even as food for pigs, until boiling had rendered it harmless. Tuberculosis is said to be more common in cattle destined for food than in the general bovine population, and we may surely refer this to the conditions under which the cattle for food are kept.

The necessary air-space for keeping cattle in health can hardly be obtained in the midst of a large town; it is a mistake to keep cows for milking in close stalls shut in by houses.

We are still unable to control the possible *importation* of tuberculous food; for unless tubercular nodules are found in

the flesh the meat cannot be seized, and there is no ready means of knowing that the animal was free from tubercle in the absence of the viscera and membranes.

The following extracts from a leading article in the *British Medical Journal* of June 15, 1889, indicates some of the difficulties of the subject, and shows the importance attached by the medical profession to meat inspection in relation to tuberculosis:—

"In many cases the meat does not pass through the large slaughter-houses at all, and so never comes within range of the inspector. It has been stated by the *Glasgow Herald* (April 22nd) that it is a regular custom to send meat, killed in Ireland, cut up and packed in baskets, direct to parties in the habit of supplying the sausage factories. It is within the experience of many inspectors that a seizure of meat so cut up is made in a shop. On piecing together the portions and weighing up, it is found that only half of the carcass has been seized, the remainder being in the hands of the same butcher, though it may be already in the hands of the consumers, who have, therefore, been supplied with meat, part of which has been condemned as unfit for human food. All this sounds very horrible, but even this does not sum up the whole of the horrors of the case. Thousands of such cattle, suffering from marked tuberculosis, are annually 'stripped' and passed on to the meat markets, and are never inspected at all.

"In dealing with all this, it cannot be too strongly insisted on that half measures are worse than useless, and every opportunity should be taken of bringing the matter in this light before those in authority. Again, it may be assumed that not one out of every ten inspectors, be he medical or veterinary, has made up his mind on the tuberculosis question. Some of them have undoubtedly made a special study of tuberculosis, and have read all that has been written on the subject, but very few indeed have any acquaintance with it practically.

"How, then, is it to be expected that butchers—men who have all their lives been killing tuberculosed cattle, who have no knowledge of recent advances in the science of infective disease, and who are unable to see any direct relation between the 'grapes' of cattle and phthisis in the

human subject—should see the great importance of destroying the meat from tuberculosed cattle?

"The present system involves very great hardships, not only to consumers, but also to butchers and cattle-dealers. It has long been the custom to consider that beef, if good in colour and consistence, should be passed as sound, however much tuberculous disease has existed in the lungs or in the other viscera. If a cattle-breeder could bring his animal in good condition to market, both he and his customers were perfectly satisfied.

"Since the recent French Congress on tuberculosis—at which the subject was so fully brought before the public and the Government that, after the opinion 'that the disease can be transmitted to man from the lower animals, and from man to the lower animals, by one or other of the methods which we have already discussed, and especially by the ingestion of tubercular diseased meat and milk,' was given by the Congress, it was made illegal to expose for sale the meat that had been cut from an animal suffering from even a localised form of the disease—we, in this country, also have had our Commission, at which some of the most eminent practical authorities declared that the meat and milk of tuberculous cattle were dangerous to health, and a rider was added that it would be well that tuberculous stock should not be used for breeding purposes.

"In all fairness to the classes above mentioned, it would be well were clauses introduced into all Public Health or Local Government Bills to the effect that meat or milk from tuberculous cattle should on no account be offered for sale.

"The whole subject has a most important bearing on public health. It is one that must be taken in hand by sanitary legislators, and the sooner it is tackled thoroughly and on the broadest possible basis, the sooner shall we obtain a cleaner bill of health under the heading 'Tuberculosis.'"

The risk of the possible spread of tuberculosis by means of the milk of tuberculous cows may be best controlled by periodical inspection of cattle and the removal of all tuberculous animals, with occasional microscopical examination of the milk by experts. The regulations of the Copenhagen

Milk Supply Company * form a good model for dairy regulations and are most complete in their attention to detail. Boiling will destroy any cause of infection, and thus renders suspected milk safe for food.

Infection through Tainted Air.—Almost all authorities seem to agree that the most potent cause of tubercular infection, and certainly the most frequent source of consumption or pulmonary tuberculosis, is to be found in the dust derived from the dried expectoration of phthisical persons. It seems probable that such infection may cling about rooms which have been occupied by consumptive persons, and retain its virulence for a considerable time. There is evidence pointing to the existence of infected houses and infected workshops; and our knowledge of the infective power of dried sputum dust, shows how indiscriminate expectoration may be a source of danger. Amongst the more careful and more cleanly portion of the community the danger is minimised by the use of spittoons for the patient, and by the frequent removal of dust from the rooms. But there are persons who are less cleanly in their habits and in whose rooms dust is allowed to accumulate; and such persons are chiefly to be found amongst those who are constantly changing their place of residence, or who have no settled homes.

For such persons it is necessary to seize any opportunities which may present themselves to instruct them as to the danger to others of indiscriminate expectoration by consumptives, and to teach them how this danger may be avoided. With this object the North London Consumption Hospital has adopted the following regulations, based upon suggestions by the author:—

Directions to Out-Patients.

As it is now known that the phlegm coughed up in consumption contains the seeds of disease—

Do not swallow your expectorations. This habit may lead to consumption of the bowels.

Do not spit about the floor, nor into any utensil unless it contains a disinfectant.

Do not spit about the streets.

* Given in full in *Denmark, its Medical Organisation, Hygiene, and Demography*, Jul. Gjellerup, Copenhagen, 1891, p. 123, *et seq.*

DIRECTIONS TO OUT-PATIENTS—*continued.*

Indoors, use a special spitting-cup or other vessel in which is some disinfectant.

Outdoors, use a pocket handkerchief, or else use a piece of rag or paper, which must be burned as soon as you get home.

You can get some disinfectant from the dispenser for use in the spittoon or spitting-cup.

The contents of this spittoon should be mixed with some more disinfectant before being emptied.

The spittoon should be emptied into the pan of the W.C. or into a bright fire, but *never* anywhere else, not even into the dustheap.

If you spit into a pocket handkerchief, it must be boiled for five minutes as soon as it is done with.

Keep your room well aired, throw the window wide open when you leave the room, and always keep it open a little at the top all night.

If there is a fireplace in the room, do not stop up the chimney, but always keep it free for the passage of air.

Keep your room clean; do not allow dust to remain on the floor.

Consumptive patients should sleep alone.

Mothers who are consumptive should not suckle their children.

Printed copies of these regulations are given by the physicians to consumptive out-patients, and to patients who have been in the wards when they leave the Hospital. It is too much to expect that they will be implicitly followed out by all to whom they are given; but the distribution of such precautionary directions marks a step in advance towards preventive regulations in this country.

The danger from tuberculous dust might be diminished by the disinfection of rooms which have been occupied by consumptive persons. But that this can be controlled requires that cases of consumption should be brought to the notice of the sanitary authorities, and this necessity affords an argument for the notification of consumption by law.

To suggest the universal notification of all cases of phthisis would probably raise considerable opposition, yet there might be great advantage in requiring that a case of

tuberculosis should, under certain conditions, be notified to the health officer. The danger of all infection increases with the close crowding together of sick and healthy, and with deficient ventilation; want of cleanliness is often found combined with these conditions. Thus, the dangers are greatest in tenement houses, single-room dwellings, or common lodging-houses. All these being, for many reasons well known to the sanitarian, possible dangers to a community, should be under inspection and control. To existing regulations for such places it might be well to add provision for the notification of illness which keeps the patient confined to bed, or incapacitated from work beyond a certain time (say one, two, or more weeks), requiring in this, as in other cases, medical evidence as to the nature of the disease. When the illness is tubercular phthisis, it might be advisable to effect the removal of the patient, where the sick-room serves also as the living-room of several susceptible persons; or in any case to direct the disinfection of sputa, attention to free ventilation, and the efficient fumigation of the room, after removal or death of the patient. Similar precautions might be necessary in hotels and lodging-houses, especially at health resorts. The removal of phthisical patients would necessitate provision for their reception, and the present hospital accommodation is obviously insufficient for the purpose. Nor are the existing consumption hospitals intended for the reception of phthisical invalids in an advanced condition of the disease. These hospitals are mainly provided in the hope of curing or checking the disease, and so enabling the patients to resume their places amongst the workers. Homes for incurable consumptives are few, and not always utilised for their intended purpose. A sanitary district should provide a home for its own advanced consumptives, where the sufferers should be received, without thereby incurring the brand of pauperism; these invalids would thus be prevented from being unwilling dangers to others. In such homes, as in consumption hospitals, disinfection of all sputa should be strictly attended to.

At the least, a special ward, or better still two or more small wards, in the Infirmary might be set apart for the reception of advanced consumptives, where their surroundings should be made bright and comfortable.

CHAPTER XVI.

State Hygiene—*continued.*

The most promising field for preventive legislation, however, is to be found in endeavouring to combat the predisposing causes of consumption in a community. We have abundant evidence of the influence of overcrowding, of dampness of the subsoil, and of dusty occupations in determining the incidence of tubercular diseases.

Density of Population.—The prevalence of phthisis wherever large numbers of persons are congregated together, as in towns, is partly due to the increased opportunities for direct infection, as well as to the predisposing effect of the unhygienic accompaniments of town life. Dr Farr showed that the increase in deaths from consumption in cities over those in the country districts is as much as 39 per cent., and also that for every person who dies of consumption in the counties, 1·24 die in the cities.

The effect of town life is also shown by the fact that whereas the death-rate from phthisis in London for 1890 is 21 for every thousand persons living, the average rate for the extra-metropolitan portion of the counties of Middlesex, Surrey, and Kent, is only 15·75 per thousand persons living —or only about three-fourths of the London death-rate.

In large towns we have a general overcrowding of the population on a confined area, and in special parts of such towns there is a more localised and intense overcrowding of the poorer inhabitants. Consumption and other tuberculous diseases are not only more frequent in large towns than in more sparsely populated localities, but in the towns it is the densely inhabited, poorer districts, which suffer most.

This may be exemplified by the following figures from the last decennial supplement issued by the Registrar-General:—

The annual death-rate for phthisis for the whole of England and Wales during the ten years 1871 to 1880 was 2·12 per thousand; and for London it was 2·51 per thousand, the latter being, therefore, above that of the country generally.

But in London itself we find marked differences between the various districts.

In the outskirts we note a death-rate from consumption below the general London average; as, for example, 1·59 in Lewisham, 1·86 in Wandsworth, and 1·88 in Hampstead—this latter including the deaths which occur in the consumption hospital situated in the district.

As we get further into the town the death-rate from phthisis is higher; in the richer parishes of Kensington (2·3), Marylebone (2·6), and St George's, Hanover Square (2·6), we find the phthisis death-rate standing almost exactly at the average for the whole metropolis. In the more crowded central districts the deaths from consumption exceed the average, and we have the City and Holborn districts with a phthisis death-rate of 3 per thousand, and the Strand and Whitechapel each exceeding 3·6 per thousand.

Overcrowding.—There are two kinds of overcrowding: there is the aggregation of buildings upon a confined area, with insufficient air-space around and between the houses, and there is the crowding together of persons within the buildings. In both cases the danger to health is the same, namely, that the air becomes over-charged with respiratory impurities: the vitiation of the air by respiration is out of proportion to the possibility of purification. Where houses are crowded together the movement of air is impeded, and thus a great natural means of purification is interfered with and impurities are not sufficiently disseminated. Where too many persons live in one house or room, the freest ventilation is insufficient to keep the air sweet, and amongst the class in which overcrowding is unavoidable, or at least common, ventilation is never thought of.

Buildings.—The overcrowding of buildings is a matter which comes directly under the control of state medicine; and the subject divides itself into several aspects.

The bye-laws of most towns contain provisions for ensuring a proper circulation of air around and between the houses. Thus the width of streets and the proportion between this and the height of the houses is regulated; and open spaces must be left at the backs of the houses.

But so long as it is left to the discretion of local authori-

ties to make, or do without, more stringent regulations for the purpose of ensuring sufficient air-space around dwellings, so long will much overcrowding of buildings continue. In some towns back-to-back houses exist, and then no proper ventilation is possible. Narrow alleys between lofty houses must contain stagnant and unhealthy air if one end is blocked. In towns which contain a large labouring population, the necessity for the workpeople to live near their places of occupation crowds a large number of families within a restricted area; the houses are then built close together, and the want of ground space is made up for by increase in the height of the buildings.

Dr Ransome, in his investigations into the prevalence of tubercular diseases in some of the poorer districts of Manchester, found that though the deaths from these causes were scattered about throughout the district, a large proportion occurred in the narrow courts opening by passages into the streets. In one long thoroughfare—open at both ends—four deaths took place, whilst in a *cul-de-sac* leading out of this street, and only a quarter its length, seven deaths occurred during the same period.

The general overcrowding incident to all towns may be regulated and kept within the requirements of health by enactments regulating the width of streets, the height of houses, and the provision for open spaces, such as are to be found in the model bye-laws of the Local Government Board. But such enactments should be universally enforced by general legislation, and not be dependent for their adoption on the wisdom or fancies of local bodies, whose anxiety for the public weal is often modified by more personal considerations of commercial expediency.

In London, an open space is required in rear of each house, though this may be built over to the height of the ceiling of the ground floor; and even this small provision for thorough ventilation only applies to houses built upon land not occupied before 1882. Where houses are built back-to-back, through-ventilation is impossible, and the progressive phthisis death-rate, in direct ratio with an increased percentage of houses unfurnished with means of through-ventilation, is very suggestive. If back-to-back houses must be permitted at all, they should be built in

blocks of four houses, with an open space between each block and windows on all four sides.

The regulation of the width of streets is also of importance. No court or street, under a certain breadth, should be allowed to be blocked at either end: there should always be an opening at each end of a narrow street or court, one of these at least being of the full width of the court and open from the ground upwards; the height of the houses should be regulated by the width of the street or court; and the length of narrow streets should be limited. Such regulations are contained in the Local Government's Model Bye-laws; and if Section 157 of the Public Health Act of 1875 were made compulsory, instead of being merely permissive, these regulations could easily be enforced throughout the country.

Number of Inmates.—But though the local authorities may regulate the air-space round dwellings, it is more difficult to regulate the number of occupants of houses. In private houses they cannot interfere, and overcrowding in these can only be remedied by the general spread of knowledge on the importance of hygienic considerations. But in public buildings such as barracks, workhouses, and asylums, the number of inmates can and ought to be regulated in accordance with the demands of health; and in all dwellings and work-places which are under the supervision of the authorities the same care should be exercised. Tenement houses, common lodging-houses, schools, and work-rooms, are all subject to inspection, and the number of inmates should be proportioned to their size and means of ventilation.

To some extent this has been recognised, and the amount of cubic air-space to be allowed for each individual in barracks, workhouses, common lodging-houses, and board schools, is laid down by the authorities. But the space allowed is too often insufficient, and suggests a compromise between sanitary requirements and financial considerations. The minimum cubic space per head allowed in various buildings is as follows:—

Barracks, ...	600 cubic feet.
Poor law (for healthy persons), . .	300 ,,
,, (for the sick), .	850 to 1200 ,,

Common lodging-houses, . .	240 cubic feet.
Factory and Workshops Act (for each woman or young person), . .	250 „
Factory and Workshops Act (for each woman or young person working overtime, to provide extra for gas), .	400 „
London board schools, . . .	130 „
Canadian schools, . . .	240 „

Dwelling-Houses.—The injurious effects of inattention to hygienic details in dwelling-houses may depend upon faulty construction or on overcrowding. Dampness may be prevented by a concrete foundation, and by the insertion of a damp-proof course in the brickwork just above the level of the ground. But what can be said for the underground rooms in faultily-constructed houses in which whole families live in our towns? Healthiness, under such circumstances, is too much to expect. Although it may be too late to remedy essential structural defects in existing houses, precautions to exclude damp ought to be insisted upon in all newly-constructed houses. So, too, efficient means of ventilation—whether by windows or otherwise—should be insisted upon by inspectors of new buildings, before they are certified as fit for habitation. We have, fortunately, now no window-tax, which unintentionally placed a premium on light and fresh air in dwellings. The minimum area of windows to each room should be regulated by law; and some such regulations as are suggested in the Model Bye-laws of the Local Government Board should be in force for the whole country. So, too, the minimum height of rooms should be regulated according to their floor-area.

However well the construction and surroundings of the houses may have been planned, they may be rendered unhealthy by the overcrowding of the inmates. Sufficient air-space for the inhabitants is more likely to be found in the houses of the well-to-do than in the dwellings of those to whom the question of rent is of more pressing importance than the sanitary conditions of the rooms. Even if we get houses properly built and healthily situated, we cannot expect a diminution of phthisis unless the number of inmates is regulated to the size of the dwelling.

Overcrowding is still a marked characteristic of the habitations of the poor, and its evil effects are increased by

the dread of allowing air to enter their rooms direct from outside. Thus ventilation is unknown, and dirt is rampant. Some improvement could be effected by enforcing throughout the country the Bye-laws as to houses let in lodgings (Public Health Act, 1875, Sec. 90), by placing tenement houses under the regulations drawn up for common lodging-houses, or by some such measures as are in force in Glasgow for the "ticketed-houses" in that city. But only personal influence can prevent the overcrowding which is to be found in the houses of the better classes, where servants are made to sleep in rooms little better than cupboards, or in a cellar under the front door-steps.

Dwellings of the Poor.—Overcrowding in the dwellings of the poor requires most careful attention, and its remedy is not easy to find. The working-classes are restricted to certain districts in looking for homes, partly to be near their work, partly because of expense. Much might be done if we could persuade all whose occupation does not necessitate living in the heart of a city to live on the outskirts and away from the business portion of the town. The family would then get fresh air, and perhaps a little garden, which would do much to encourage the children to be in the open air, and the working-man on returning from his work would have the attraction of a bright home and bit of garden to keep him with his family. Where the home is close and dirty, from being also the family work-room, and ill-health makes the parents irritable and the children cross, the public-house is a welcome haven to which to escape. Philanthropists who turn their attention to hygiene in the homes of the poor will do a great deal to check drunkenness and brutality.

Where a house is occupied by more than one family, and the owner has a pecuniary interest in packing as many individuals into the house as it can contain, inspection is required in the interests of the lodgers.

Thus tenement houses should be licensed to contain a certain maximum number of inmates only, and similar provisions might with advantage be made for ordinary houses let in lodgings, and, perhaps, also for hotels and flats. Such regulations would entail inspection of such houses to prevent infringement of the law. The Local Government Board

already has the power to enforce some such regulations in the case of sublet houses; why should there be any longer delay in taking advantage of it? These regulations also should be general and not merely permissive. Common lodging-houses are already under regulations.

Necessity for Public Work-rooms.—Perhaps the most difficult class of cases to bring under control is that large body of persons who have to carry on their daily work in their own homes. Amongst such home-workers it is not uncommon to find a single room serving as living-room for the whole family, and work-room for the older members. In such rooms the air never gets properly changed, and all evil effects of overcrowding become aggravated.

Where a trade is carried on in the house, inspection within business hours should be provided; and no trade should be permitted to be carried on in any single-room tenement occupied by more than two persons, and then only if the room is above a certain size. To provide for the workers thus prevented from pursuing their occupation at home, public work-rooms might be provided, where space and facilities for the various occupations (*e.g.*, tailoring, bootmaking, &c.), could be obtained for a nominal payment.

Here, for a small sum, a man might take his work and find conveniences and appliances for his occupation, besides companionship. A woman's room would probably attract a large number of poor seamstresses and waistcoat-makers, especially if a *crêche* in the neighbourhood relieved them of the care of the younger children whilst the others were at school. Then there might be some pleasure in the family reunion in a fresh, well-ventilated room at home after the day's work was over, and the head of the family would have less excuse for spending the evening at the public-house.

Such public work-rooms might diminish some of the disadvantages of home work, as public wash-houses have removed the evils of periodically using the dwelling-room as laundry and drying-room.

Certain trades might be scheduled (as dangerous or offensive) which should on no account be permitted in rooms used as sleeping-rooms. And again, to be effective, any such regulations must be universal throughout the kingdom, at least in the towns.

If nothing further were done than to apply throughout the country the bye-laws and regulations which are now permissive, much benefit would result to the public health, and something would be done to diminish the prevalence of tubercular diseases. We might contemplate with less regret the present impossibility of dealing with hereditary tubercle, the marriage of tuberculous persons, and the suckling of infants by tuberculous mothers, if we could by such means as have been indicated diminish the risk of acquiring tubercular diseases; for healthy parents cannot produce tuberculous offspring, and healthy children growing up under more favourable hygienic conditions have not the same susceptibility to infection.

Where artisans' dwellings are built in the midst of towns, they should be made as far as possible attractive, and provisions for fresh air should be carefully considered. A huge barrack-like building gives little appearance of home, especially if the common staircase is narrow and dark. Plenty of light in staircases, passages, and rooms is important. Open air galleries are useful, especially to those whose rooms are so high that the journey up and down is fatiguing. A flat roof, with good railings round, would make a useful drying ground for clothes. The first step towards improving the condition of the working-classes is to make their homes healthy and cheerful. A high moral tone is impossible amongst those who live in broken-down and dirty houses, where the landlord exacts a high rent for miserable rooms as long as the building will hold together, and considers repairs and cleanliness as unnecessary items for expenditure.

Inspection of Factories.—Preventive measures against phthisis should include also an efficient inspection of factories, workshops, and mines; overcrowding should be prevented and ventilation enforced. Although the Factory Act allows of the inspection of work-rooms where numerous persons are employed,* overcrowding is probably still rather the rule than the exception. Each workshop should be licensed to hold a certain number of persons for so many hours a day, the number being determined in each case not

* See Factory Acts, 1864-67 ; Work-places Regulation Act of 1867 ; and Sec. 19 of Sanitary Act of 1867.

only by the cubical contents of the room, but by taking into consideration the means of ventilation; and some penalty should be enforced if the number of workers is exceeded.

Dr Pollock, in writing on the effects of dusty occupations in causing consumption, says:—"A perfect ventilation and extreme cleanliness are the best modes of prevention. The metallic dust in mines, the floating particles of flax, cotton, and straw are all possible to remove, rather let us say impossible to continue in the presence of a good system of ventilation."

This strikes the key-note of all regulations for the prevention of phthisis. In certain well-ventilated mines the mortality was found to be one-third less than in others less well managed; and the simple use of the fan in the workshops materially lessened the proportion of this disease amongst the steel-grinders of Sheffield.

Power is now given by law to enforce ventilation in workplaces, but the importance of the subject to the health of the community requires that such power should be far more efficiently exercised than it is at present.

Persons with advanced and active consumption should be excluded from crowded work-rooms, where they are a source of danger to their fellow-workers.

For those who work at dusty occupations protective measures have already done much, but even they would be less liable to consumption if the infectious particles were not ever present, or if the sources of infection—their consumptive neighbours—were fewer in number.

The physical training of children in the open air is already cared for in board schools, and is of vast importance. But healthy recreation for the parents, when the day's work is over, is not so easily obtained; and perhaps we must look to the efforts of philanthropists to provide inducements to the mother to leave her close room for an hour or two in the evening, and to keep the father from the public-house.

Sanitary measures directed against other diseases have an appreciable effect in lessening the amount of consumption; and philanthropists can give material assistance in diminishing the prevalence of this disease by their fight against dirt, drink, and dissipation.

It appears, then, that many of the conditions on which

phthisis depends come well within the reach of preventive medicine. The fundamental principles which must form the basis of any successful attempts to diminish the prevalence of this disease are—(1) to provide a sufficiency of fresh air in and around dwellings and work-places, and (2) to endeavour to improve the resisting power of the individual by hygienic and physical training during the period of growth and development; and, in later life, by exercise and recreation to relieve the strain of continuous application in the struggle for existence. Gymnastics and games form an important part of the details of school-life, as well as mental training; and work is better done at all times if healthy relaxation alternates with labour. Anything which provides for healthy recreation for the working-classes after their day's work is over must tend to improve their physical condition, and consequently their resisting power against disease.

We owe it to succeeding generations, as well as to those of our own day, to allow no time to be lost in commencing a systematic attack against a disease which annually destroys so many useful lives, and which is handed down in so many families as a fatal inheritance.

PART III.

THE HYGIENIC MANAGEMENT OF EARLY CONSUMPTION.

CHAPTER XVII.

The Curability of Consumption.

The previous pages treat chiefly of the measures needful to guard a predisposed individual against becoming the victim of consumption. In a large number of cases, attention to hygienic rules will ensure immunity from the disease. But some are so circumstanced that they cannot follow out the necessary precautions with the requisite completeness; and some unforeseen accident may bring about the disease in spite of previous care. The risk of becoming consumptive may, in fact, be very largely diminished; it is too much to expect that it can be universally and absolutely removed. Precautions against infection from scarlet-fever greatly lessen our chance of taking the disease, but we may be exposed to some unsuspected cause of infection, and no one can at all times be absolutely secure. The treatment of consumptive disease, therefore, will long continue to be a matter of great importance, and it is desirable to add a few words as to the possibilities and probabilities of cure when consumption has actually attacked the lung.

In the first place, the hygienic rules so important as preventive measures are equally necessary conditions in the treatment of the disease. Next comes the question, "Is consumption curable?" This query may be cautiously answered in the affirmative: for in many cases it admits of

a favourable reply. Consumption may be cured: but the chances of a cure depend so much upon the extent of the disease and upon the general health of the individual, that the statement has to be made with certain limitations, and needs closer examination.

The earlier the onset of the disease is recognised the greater is the likelihood of treatment being successful. In the early stage of the disease, when the mischief set up by the tubercle bacillus is small in area and not far advanced, absorption of the inflammatory products may occur, and the disease be cut short with little permanent damage to the lung.

The comparative frequency with which evidences of previous tubercular disease in the lung have been found in persons who have died from other causes, shows that pulmonary tuberculosis is often a curable disease. These obsolete tubercles show a previous attack of consumption from which the patient has recovered. It must be remembered, however, that in many of these cases the disease has been so slight that a definite diagnosis of consumption could hardly have been made from examination of the chest alone. They represent the numerous cases of "suspected" consumption, where the advance of the disease is averted by early precautions.

The proportion of such cases recorded in the pathological records of large general hospitals, in this and other countries, ranges from 4 to 9 per cent. of those dying from all causes other than phthisis.

Calculating that consumption is the cause of eight in every one hundred deaths that occur, and taking the average of 6·5 per cent. of the remainder (or nearly 6 per cent. of the whole) as having had tubercle in the lungs from which they have recovered, we have 14 per cent. of the persons dying having had pulmonary tuberculosis at some time or another.

Out of every fourteen, six recovered or nearly one-half (43 per cent.).

Just as Walshe first showed that not half of the cases of consumption were hereditary, so these figures seem to prove that nearly a half of those that get the disease recover from it.

It has been computed that in this country about 23 per cent. of all persons who die of diseases unconnected with tubercle, have been, at some period of their lives, affected with some form of internal tuberculosis; and one observer has placed the proportion of these cases of involuted tubercle as high as 38 per cent. These higher figures include tuberculosis of other organs besides the lungs.

It is interesting and encouraging to note that many of the instances of cured tuberculosis of the lungs are furnished by the records of hospitals in London, and occur in those who live under the unfavourable conditions common to the poorer inhabitants of a large city. This adds an element of hope to those whose circumstances seem to be most unfavourable, whilst, on the other hand, it justifies the conclusion that, with those living under more favourable surroundings, the proportion of cases in which consumption is cured may be placed at a higher estimate than that furnished by hospital statistics.

But though, in the majority of the cases in which cured tuberculous areas have been noted in the lungs, the disease, whilst active, was so slight as to be clinically unrecognisable without the aid of the microscope, cure may be brought about in more advanced stages of pulmonary tuberculosis. Even in those cases in which an isolated tuberculous patch in one lung has been detected by physical examination, the lung has cleared, and the clinical signs of the disease have disappeared.

Cases have been recorded where this cure of a tuberculous area has been noticed to occur more than once in the same person, and where, after the person's death from some quite different cause, patches of connective tissue—or scars—were found in the lung, representing the previous tubercular areas. Where the mischief is much more extensive, and even if cavities have formed, arrest of the disease is not uncommon; but it is hardly correct here to say that the patient is cured, for although the advance of the disease is checked, there are dangers consequent upon the damaged condition of the lung—such as hæmorrhage—which must not be overlooked. So, too, though the disease is arrested, it is possible, nay probable, that the cause of the disease has not been removed; that though the bacilli have been

rendered inactive they have not been entirely expelled from the body. Thus we may find, after some months or years of comparatively good health, that the lung mischief becomes lighted up afresh and extends. Even when the disease has been permanently checked, the patient recovers with a damaged lung, and has to submit to a restricted activity, or requires continued care and treatment.

A patient who recovers after extensive tuberculosis of one lobe of a lung does so in the same sense as one who recovers from a severe accident after amputation of a limb. Life has been prolonged, but the effects of the accident remain permanently. The destroyed lung tissue is never replaced, any more than an amputated limb grows again; and shortness of breath may permanently disable the patient. Thus, though we may justly hold out hope of life to persons who have consumption, we cannot always promise restored health.

In considering more closely the ways in which tubercular disease in the lungs may become cured or arrested in the various stages, and the completeness of the cure that may be anticipated under the different conditions, we may, first, emphasize again the importance of early detection of the mischief; for not only does the probability of cure diminish with the extension of the disease, but the greater the destruction of lung tissue, the less complete will be the restoration to health when arrest of the disease is effected.

The most favourable condition for cure is where, without any constitutional predisposition to consumption, a local injury to, or weakness of some portion of the lung has led to a tubercular nodule in an otherwise healthy organ. Here the inflammatory changes set up will probably not spread rapidly, but tend to the formation of fibrous tissue, which, enclosing the colony of bacilli, prevents them migrating to other parts. The fibrous overgrowth at last replaces the lung tissue in the damaged patch, and, contracting, leaves merely a scar to mark the site of the tubercular disease. Such scars have been repeatedly noticed, and the clinical history of the patient leaves no doubt as to their origin.

In cases where the sequence of events is as described above, the cure is complete and the permanent damage to the lung inconsiderable. But the fact that more than one

of such scars has been found in the same lung, dependent upon separate and distinct attacks of tubercle, and the discovery of such scars in persons who have died of a subsequent tuberculosis of the lung, indicates that an attack of pulmonary tuberculosis, even if localised and then cured, renders the lung more liable to suffer future attacks. The cure, therefore, must be completed by additional precautions to avoid a recurrence.

In such a patient as that above described, a cure may occur even when the tubercular inflammation has been more acute, and softening or disintegration of the inflammatory products has occurred in the centre of the nodule.

The caseous mass, not communicating with a large bronchial tube, is not expelled, but gradually dries, whilst fibrous tissue forms around it. The inspissated caseous material may undergo still further change, and remain in the lung as a small calcareous core in the centre of the fibrous nodule. When this drying process takes place in the contents of a cavity which opens into a bronchial tube, small calcareous masses are expelled by coughing and are found in the sputa. They always indicate a curative process in the spot from which they come, though there may be active extension in other portions of the tuberculous lung.

But, even when a lung attacked by tuberculosis offers a more favourable soil for the bacilli and the mischief spreads, whilst softening and excavation take place in the centre, the inflammatory changes may at length become less acute; fibrous tissue formation occurs instead of rapid disintegration—the disease, as it were, tires itself out and runs a slower course till arrest of the mischief occurs. For some time after the absence of fever, the increasing weight of the patient and the physical chest-signs on examination indicate that the disease is not advancing; the cough may still be tiresome, and the expectoration copious and purulent. Gradually the sputum becomes more tenacious and less in quantity, and physical examination gives cavity sounds free from the liquid bubbling heard when softening was active. The chest wall gradually falls in over the damaged and contracted portion of the lung, and the flattened portion of the chest moves little in respiration. The patient may now

feel well, and have gained both flesh and strength; except that any exertion causes shortness of breath, the cure is complete.

When the disease has extended into another lobe of the lung, or on to the opposite side, the chance of a cure is much diminished. But even in advanced cases of this kind, comparatively long periods of quiescence of the disease may occur, when cure is hardly to be expected. In chronic consumption, where fibroid overgrowth is abundant, extension of the mischief is slow, and the patient may continue in very nearly the same condition for years.

It is, however, hardly possible to consider the disease really cured, until, with quiescence, there is also absence of tubercle bacilli in the lung. This is naturally almost impossible to determine, but repeated careful examination of the sputa for bacilli should give a negative result before a case is pronounced to be cured. When the causative agents of the disease—the tubercle bacilli—remain in the lung, they may at any time escape from their protecting envelope and then set up mischief in some other portion of the lung.

As to the means employed to bring about a cure or arrest of consumption, it is impossible to discuss them here, even if the attempt were considered advisable. There is no specific for consumption, though perhaps in no disease have so many been advertised. The very number of the vaunted "specific cures" for consumption is a proof of the failure of each of them. Most of them get a spurious reputation from being used in cases where consumption only exists in name.

I have myself received credit for curing consumption from a patient whom I succeeded at last in convincing that the complaint for which she had consulted me was not phthisis, and whom I informed at the first examination that I could detect no signs of tubercle in the lungs.

If consumption is to be cured it must be, as in other acute diseases, by a careful consideration of the particular case and by adapting the treatment to the special requirements. If it is asked what is the treatment for consumption, I reply "Show me the patient:" for both examination of the chest, and a careful consideration of the circumstances of the individual, are necessary guides to treatment.

It must be remembered that not only are persons with hereditary predisposition to tuberculosis more liable to contract the disease, but also that in such cases consumption often advances rapidly and is not easily arrested.

When, therefore, we come to discuss the curability of consumption, we see that it is assuredly curable; for the proofs of cure in certain cases have been demonstrated, and clinical experience affords numerous examples of arrested and practically cured consumption in the early stages. But we see also that the hope of success depends mainly upon the early recognition of the disease, and diminishes as the disease advances. In later cases, under favourable circumstances, arrest, and not cure, may be anticipated, but with a damaged lung which partially incapacitates the individual. In almost all cases there is the possibility of prolonging life, sometimes for years. Most physicians have seen apparently hopeless cases restored to comparative health for months.

But it is the uncertainty of cure, as well as the incompleteness of the restoration of health, that makes the endeavours to *prevent* consumption of such great importance. Successful prevention means safety; the onset of the disease implies terrible risks, though it does not justify a desponding and hopeless prospect.

Early detection of the disease being all-important, it is essential that skilled examination should be obtained whenever there is any suspicion of danger. And, first, we must accept the fact that the recognition of commencing tubercle in the lung is no easy matter, only possible when the chest has been carefully and skilfully examined, and the sputa, if any, microscopically investigated.

The most skilful physician may sometimes be mistaken; a careless one has no right to offer an opinion. I should strongly recommend that, where a decided family tendency to consumption exists, a periodical and systematic examination of the chest should be made by a physician skilled in physical examination of the chest, and this more especially during the few years preceding completed development. We know that consumption is essentially a disease of young adults, and that it often comes on earlier in women than in men—we might say that the dangerous decade in men

is from twenty to thirty years of age, whilst in women it is from fifteen to twenty-five.

Such a special periodical examination of the chest is recommended for many reasons:—

1. That the disease may be detected, even if it has given rise to no definite symptoms.

2. That, when detected, it is possible to fix its duration, within a short time, by referring to the last examination.

3. That a person with an hereditary tendency to consumption may not be in constant dread that the insidious disease may already have "planted its seeds;" for each examination which shows the lungs to be healthy would prevent mental worry and anxiety.

4. That, when tuberculosis is detected, no time may be lost in commencing treatment, which is more hopeful the earlier it begins.

5. That commencing disease of the lungs may not be overlooked because apparently trivial complaints seem to be explained by other slight derangements of health.

The foregoing reasons may be made more clear by sketching the history not uncommonly given by a patient who is found to be suffering from pulmonary tuberculosis.

Let us imagine the patient to be a girl of seventeen or eighteen, in whose family there is some consumptive tendency.

At school she is sometimes noticed to be languid and occasionally depressed. At first this is supposed to indicate a commencing hysterical tendency, and she is encouraged to prevent giving way to depression. Perhaps a doctor is called in, who naturally avoids making too much fuss over a little want of energy, and with slight examination prescribes a tonic. At another time a pain in the upper part of the chest is complained of, and as, perhaps, some distinctly hysterical symptoms have been marked, a further reason is furnished for not making too much of the complaints.

At home she is noticed to be languid and wanting in energy, and the family doctor is consulted, who finds that she has symptoms of anæmia which appear to sufficiently explain the condition; and so a complete examination of the chest is postponed until it becomes obvious that there is something radically wrong. When examination of the chest now explains the cause of some of the previous symptoms, the

pulmonary disease is already advanced. This is not altogether a fancy picture, nor is it given to accuse medical men of failing in their duty by not making a thorough examination of the patient before prescribing. No such criticism is intended, nor would it be warranted under the circumstances first calling for medical attention. Even the family doctor is not expected to bare the chest of his patients unless the symptoms for which he is consulted point obviously to some lung or heart complaint. It is not the doctor's fault that he does not always detect at once the exact cause of a patient's symptoms. Apart from the inherent difficulties of medical diagnosis, the doctor does not always have a fair chance; the patients and their friends are often reticent in their statements, and not infrequently oppose a careful and sufficient examination in the early consultations, when it is most important. This tendency has to be guarded against by the consultant, or he may be told afterwards that he should have known what it was needful to do, and should have done it without considering their wishes.

When the patient is a young man, the difficulty is rather to get him to consult a doctor than to obtain a sufficient examination when he does seek advice.

It cannot be too clearly understood that, if we wish to detect early tuberculosis of the lungs, the examination should be made with the chest thoroughly bared to the waist. Slight divergences from the normal cannot be detected through clothing, and partial uncovering of a portion of the chest is insufficient, because of the sounds conducted from portions of the clothing in the neighbourhood. The rubbing of a vest on the skin, or the creaking of braces or stays, produce sounds which may mask important signs produced within the chest.

If a periodic visit is made to a physician with the special object of an examination of the chest, there will be no hesitation about making the examination satisfactorily. The state of the lungs, once accurately known, any variations, either in the right or the wrong direction, are readily ascertained on a subsequent visit, and previous advice and directions modified to accord with the progress observed. This may be called special pleading for the physician; it is special pleading, but on behalf of the patient.

The Hygienic Management of Early Cases.—Our knowledge of the causation of the disease and its mode of progression, as well as an appreciation of the causes which favour its development, are the real foundations on which all hygienic details of treatment are based. When consumption was thought to be entirely dependent upon climatic conditions, and catching cold was considered the chief danger, no wonder that those with a phthisical tendency, and those who had contracted the disease, should have been kept indoors and cooped up in over-heated rooms, or sent to places so sheltered from any breath of air, especially if from the north, that the houses were shut in like those in a city alley, and through-ventilation was impossible. But though the experience of such management helped to corroborate the idea that consumption was almost certainly fatal, it required a more exact knowledge of the nature of the disease to show that such treatment was in itself injurious. The safety of the lung depends upon its physiological soundness, which is diminished by a supply of impure air and increased by full functional activity in a pure atmosphere. Therefore, we prefer that a patient should be surrounded with fresh air, and when he cannot be out of doors the free ventilation of the room occupied by the sufferer should be perfect and complete. But whilst supplying as much fresh air as possible, we must guard against draughts or sudden changes of temperature. Each room has to be cleaned with open windows while the other is in use, and even when used a supply of fresh air should be secured with as little change of temperature, and as complete a protection from draughts and chills as possible. Climate and clothing thus require full consideration. In a variable climate, as in England, it is not always safe to let a patient be much out of doors, except during the summer, and consumptive patients are often ordered abroad in the winter, in order that not only a more equable temperature, but a greater amount of sunshine can be enjoyed.

Whatever the climate of the place selected, it is well for the invalid to wear clothing of some woollen material next the skin, for wool, being a bad conductor of heat, not only prevents loss of heat from the body in cold air, but protects against the heat of warmer regions. More than this, the

absorbent quality of wool soaks up the moisture from the skin, restores to the body some of the heat otherwise lost in evaporation, and prevents underclothing of this material from feeling cold and damp to the surface. Thus a rapid chill after exercise, or when the sun goes in on a hot day, is avoided. The sleeping-room of a consumptive, as of any invalid, should be large and bright; and though it need not be cold, it should be well ventilated. In a warm climate the patient's bed-room must at least be as large and well ventilated as is enjoined at home, and in cold places this latter point requires special arrangements to prevent undue lowering of temperature.

Besides fresh air, a full amount of rest is required. The same details of diet suitable for prevention are to be observed during the cure. A cup of milk or of chocolate or some warm nourishment before getting up prevents fatigue from dressing. In warm climates fruits may be taken with cream at breakfast, whilst in cold places extra milk and butter and other fats are needed. The food should be plentiful, but it is sometimes difficult to supply sufficient nourishment because of the diminution of appetite or from the dislike of the patient to many of the ordinary foods.

Fats are useful, but are often disliked. Bacon for breakfast, sardines in oil, bread and butter, buttered toast or tea-cakes, cream and milk, and salad mixed with oil, may be utilised to supply fatty food when patients cannot take cod-liver oil. Where only a small amount of food is taken at meals, a little soup, broth, bread and milk or biscuits may with advantage be given between meals, and a basin of hot bread and milk on going to bed will sometimes ensure a good night's rest. Exercise is required in moderation, but not pushed to fatigue. Some carefully regulated gymnastic exercises with the special object of expanding the chest are often of great value. Riding, lawn tennis, &c., judiciously indulged in, may all be useful. But as all exercises are chiefly important as causing increased depth of breathing, they should be indulged in in fresh air. And as all active exercise throws additional work on the respiratory organs, the amount and character of the exercise must be regulated by medical advice when the lungs are the seat of disease.

It is unnecessary and unwise to carry hygienic regula-

tions to excess; and turn what is intended for safety and health, into discomfort, if not danger. The following extract from a daily paper (*Echo*) of June 8, 1892, provides an example of hygiene run wild:—

"*Grand Duke George of Russia—His singular Medical Treatment.*—The Czar's second son, the Grand Duke George, who has been passing the winter in the Caucasus, is said to be undergoing a remarkable course of treatment for pulmonary disease. The walls in his apartments are bare and unpapered, the furniture is of plain wood or cane, without upholstering or stuff covering of any kind, and his bed consists only of the thinnest of mattresses. Throughout the winter only a very moderate fire has been kept up, while the windows of the Grand Duke's rooms have been continuously open. His attendants have suffered dreadfully from the cold, but his medical advisers hold that this low temperature is very beneficial to their imperial patient, as it tends to destroy the bacillus and prevent the formation of tubercle. They maintain that the progress of the disease has been arrested, and express hopes that, if the treatment which they prescribe is persevered with, the Grand Duke will in two years' time have completely recovered."

CHAPTER XVIII.

Climatic Treatment in Consumption.

Amongst the hygienic surroundings on which we rely to protect a predisposed person from consumption, there is none of greater importance than the plentiful supply of pure air. In the same way, where consumption has already commenced, there is nothing which is more useful in protecting the lungs from further encroachment of the disease.

A germ-laden air keeps up in the lungs injurious processes beyond the original mischief excited by the tubercle bacillus; and however free from this organism a warm, moist air may be in any chosen spot, it is always more charged with other germs than that of cold, dry, and elevated places. Not only the Alpine heights, but the continuous cold of a

Canadian winter tend to the recovery of healthy tone in the lung tissue around tubercular disease.

The hygienic treatment of the earliest stages of tuberculosis of the lungs is precisely that which we adopt as precautionary means where the tendency to consumption is pronounced. Neither those whose lungs, though possibly weak, are free from tubercle, nor those who have only very slight tubercular mischief, should seek places where invalids with advanced consumption are congregated. Not only is there danger from the close relationship with such patients, but living in a colony of phthisical persons cannot but be depressing to those who are themselves threatened with the disease. The danger of association with consumptives is much lessened, if it is not absolutely removed, in the cold of a mountain climate; and early cases are often much benefited by a winter amongst the snow in the dry pure air of the Swiss mountains.

The climatic treatment of consumption has, during the last few years, assumed the full importance due to an appreciation of the continuous influence necessarily exercised on the sufferers by the external conditions under which they live. The influence of pure dry air, an equable temperature with bright sunshine, so beneficial to those whose lungs are weak or already damaged by tubercle, cannot be obtained throughout the year in this country, and are sought abroad by those who can afford to travel. But the advantage which may be gained by sending consumptive patients away from home to seek health in some more genial climate have not always equalled expectation, or met the special needs of the patient. This has been largely due to an inexact appreciation of the extent and degree of the pulmonary lesions present, the want of precise knowledge as to the most desirable climate for the different stages of the disease; and partly because, in place of careful consideration of the requirements of individual cases, fashion has too frequently dictated the place of domicile.

Years ago Madeira was the chief health-resort of consumptives, and all sorts of cases were sent there. Next the South of France came into vogue, and crowds of consumptives flocked to the Pyrenees or to the Riviera. Then came the turn of the mountain climates and the Engadine, and the

clear air of the snowy mountains and altitudes of Switzerland dispute the claims of the dry sandy plains of Egypt and the African shores of the Mediterranean or those of its more attractive northern coasts. These places are all suitable health-resorts for consumptives, if proper selection is made of the kind of case to be sent to each.

To send one person to the Engadine or to Egypt, or whatever place may be most in repute, because another has benefited, is as little wise as to debar others because one has been worse for the change; and as bad as attempting to treat all cases of consumption alike with the same drugs, without regard to the individual, or the stage and character of the disease. In any case we must first ascertain the exact condition of the patient and the advantages we hope to derive from change of residence, and then select the climate which is most likely to produce the desired results.

Nor can we always shelter ourselves under the idea that if a certain climate does no good in a particular case, it will at least do no harm. An unsuitable climate may do harm; for example, by determining the onset of hæmorrhage.

Moreover, it is not always advisable that a consumptive person should leave home at all. To sum up these remarks, then, we must first decide whether the patient is in a fit condition to go away, and then we must carefully select the climate most likely to be beneficial, and at a distance within safe reach of the invalid. To do this we require to know the patient, and the exact state of his lungs; the kind of climate most suitable for persons in such a condition; and the places where the required climatic influences may be obtained, as also the facilities for reaching them.

The elements which constitute the climate of a locality may be classified as to their suitability to the various conditions found in diseases of the lungs, and by this we shall be enabled to determine the kind of climate most beneficial to the various stages of pulmonary phthisis.

1. Purity of the air and amount of sunshine.
2. Humidity or moisture of the air.
3. Temperature.
4. Movement of air and winds.
5. Elevation or altitude.
6. Nature of the soil.

In addition to these natural conditions we must give attention to some artificial conditions before we can recommend any health-resort.

These latter include—

1. Density of population.
2. Drainage and sanitation.
3. Accommodation and comfort.
4. Means of occupation and recreation.
5. Food and cooking.
6. Means of communication and facilities of approach.
7. Medical aid.

The essential climatic condition required for the residence of consumptives, as well as of the predisposed, is pure air, with sunshine which will allow of benefiting by this by spending much time out of doors. Slight movement of the air and a well-drained dry soil are advisable, whatever other characteristics may be required. Some of the more important details of climate have been mentioned previously in considering the selection of a locality for the residence of those with a tubercular predisposition. We may here discuss shortly the chief peculiarities of certain well marked varieties of climate and their influence on pulmonary invalids.

Warm Dry Climates.—The degree of warmth can be selected to suit the individual; but usually warmth rather than intense heat is preferable. In warm climates there is usually a considerable diurnal range of temperature, and with hot days there may be cold nights. During the heat of the day active exercise is hardly possible, and these climates are chiefly suited to those who are unable to take much exercise, and who can spend all day sitting in the open air.

With warm sun we may have a fresh breeze, and near the sea the stimulating effect of the sea air. The latter situation is more invigorating than the warm inland places, and is more suited to those who are able to take gentle exercise.

Warm Moist Climates are more enervating than the dry, and are not well fitted for long residence. They are unsuitable for those who are already considerably enervated by illness, but because of their sedative effect are useful for the temporary residence of those who are unduly excitable.

Cold Dry Climates are bracing, and are appropriate

for all who have sufficient strength to indulge in active exercise. They are, therefore, most suited to those who, though predisposed, have no tubercular disease, and to those who are suffering from consumption in its early stages or in whom the disease is quiescent. Cold dry air is to be found on the mountains, and there we have in addition the rarefaction of the air which is also so beneficial in early phthisis. We may, therefore, subdivide the cold dry climates into those of low altitude, and the mountain climates. Cold dry climates at no great elevation are to be found in many inland places; a rocky, sandy, or gravelly slope, with few trees but the fir or birch, furnishes an excellent example of this kind; and the low-backed chalk downs afford many sheltered sites well open to the south and not overshadowed by trees. A vigorous vegetation in the long days of the northern summer restores oxygen to the air, and lends a cheerful variety to the prospect, but it is not well to be too closely surrounded by vegetative growth. Even the much praised pine-woods are more useful as a screen, both from strong and moist winds, than as a near shelter. They also are useful as showing that, where they abound, the soil is sandy and presumably dry; but boggy hollows may be near, and decaying pine-needles, unless well exposed to the sun, may harbour germs as well as the fallen leaves of other trees.

Any snow-covered expanse has for the time—and in some places, as in Canada, for a long time—a comparatively germless and so a healthful air; and these, though not at any great altitude, help to supply the want that mountain climates satisfy. Catarrh is rare in these winter quarters, for the air is comparatively free from germs.

Cold Moist Air is to be avoided, because of the risk from catarrh. Not only the alluvial pastures of England, but the rocky scenery of some of our western coasts, are liable to this objection. In many places, where moderate elevation and a sand-rock subsoil would attract our favourable notice, glacial deposits often of the most retentive clay frustrate all efforts to establish a suitable refuge for pulmonary invalids.

Cold is not itself curative of phthisis, and in cold climates a warm house free from damp is essential.

In considering the climatic requirements for consumptives

in the various stages of the disease, we must, in the first place, consider the state of the individual, as well as the condition of his disease. A nervous and excitable person with early tubercular deposit in the lung will not derive the same benefit from the climate which would suit one of a different temperament in a similar stage of consumption; nor will the same conditions be equally suitable to a weak individual with narrow chest and one with good physique and active.

With this caution we may discuss the requirements of the various stages of pulmonary tuberculosis. There is, however, one variety of consumption for which climatic treatment cannot be utilised. In the rapidly extending tuberculosis which has received the appropriate name of "galloping consumption," the disease is too acute to allow of the patient going far from home, and the advance of the disease too rapid to give time for change of climate to have any effect. With high fever, such as occurs with this acute phthisis, rest at home is essential. So, too, when the disease, although more chronic in its course, has reached an advanced stage and is still active and extending, it is unwise to travel, and hardly desirable to leave home, when there is small hope of returning. In the early stages of consumption, when there is some consolidation of a portion of the lung, partly due to inflammatory exudation around a tuberculous centre, much benefit will result from full expansion of the air-cells of the lung, especially if at the same time reabsorption of inflammatory exudation can be assisted. In this condition the patient may still be comparatively vigorous, and if there be no fever active exercise can be enjoyed. For such persons the cold, dry, and rarefied air of a mountain climate is generally most beneficial, with active out-door exercise. If with the consolidation of lung tissue there is fever, and other signs of extension of the disease, exercise cannot be indulged in to any great extent, and we must seek a climate where pure air can be freely obtained with rest; where, in fact, the patient can sit or drive out of doors without fear of cold. This is possible in a tranquil, cold, dry air, but a warm climate is often more convenient; as fever subsides and strength returns, a change to a more bracing climate may be made. If active extension of the

disease be checked before softening has led to cavities, the patient may move to a high altitude.

When cavities have formed and expectoration is considerable, a warm or dry climate near the sea is best, but a somewhat moister air may be desirable if the cough be frequent or troublesome without much expectoration. When both lungs are affected to any marked extent, the warm sedative climates are most desirable, where fresh air can be obtained without exertion.

As long as the disease is quiescent, even if considerable in extent, travelling from place to place may be permitted, or a sea voyage may be beneficial.

When repeated hæmorrhages have occurred, high altitudes should be avoided, and a sea voyage is attended with risk. I have sometimes noticed in cases which have become quiescent after some months' activity, and in which connective-tissue overgrowth seemed to have occurred around small cavities, that a visit to a warm moist climate on the sea-coast has soon been attended with hæmorrhage, often severe.

I should feel inclined, on my present experience, to say that, with the exception of cases in which we hope for palliation rather than cure (advanced and still active disease), a dry atmosphere is more beneficial than a moist one. Whether we recommend a cold or warm place, the sea level or a high altitude, must depend upon the extent and progress of the disease; and therefore the choice of climate must be determined for each case by the physician.

The following tabular *resumé* of the kind of cases most likely to be benefited by the different kinds of climate may be useful:—

Warm Climates.—*Warm and dry.* Some are bracing, others relaxing. *Suitable for*

1. Older patients, and those who are weak.
2. Early cases who are unable to bear high altitudes.
3. Patients with large secreting cavities.
4. Patients with catarrhal complications.
5. Cases recovering from or with tendency to recurring attacks of pneumonia or broncho-pneumonia.
6. All chronic cases, if free from fever.

If able to take some exercise, the more bracing places may be chosen; if patients are too weak for any exertion, less invigorating

localities must be selected, where a full amount of sunshine is obtainable.

Warm and Moist.—This climate is altogether sedative. *Suitable for—*

1. Some chronic cases, quiescent, but with too little lung capacity to allow of exercise.
2. Early cases with fever, excitability, and sleeplessness, and with little expectoration.
3. Patients with much bronchitis.
4. Patients with harsh, irritable, and violent cough, especially if over 35 years of age, and with extensive disease, when it is considered advisable to try and allay the cough ; when the cough is better they may seek a drier climate.

Places with warm moist climate are not often adapted for prolonged residence for consumptives ; they are most suitable for winter and spring resorts only, for those who wish to avoid the cold of a northern winter, and to be where they can get out of doors.

Cold Climates.—*Cold* and *dry* climates are suited to phthisical patients, but only for those who are strong enough to take active exercise ; they are to be avoided by others. *Suitable for—*

1. The predisposed—to prevent.
2. Early stage of tubercular consolidation.
3. Slowly increasing mischief in younger patients who are still able to take exercise.
4. More advanced cases with limited extent of pulmonary mischief, or even with small cavities, if quiescent.

High Altitudes.—Cold dry climates with rarefaction of air. *Suitable for—*

1. Similar cases to those mentioned under cold climates.
2. Especially useful for the predisposed with narrow chests and those in whom there is slight tubercular deposit with surrounding inflammation.

Unsuitable for—

1. Those who are feeble and unfit for exercise, whether from weakness or from age.
2. Those with active fever.
3. Those with any extensive consolidation or excavation in *both* lungs.
4. Certain cases of hæmoptysis, viz., those where the hæmorrhage may be due to aneurismal dilatations of unsupported vessels in pulmonary cavities.

5. Those of the excitable or erethic constitution, *i.e.*, persons whose physiological equilibrium is easily disturbed, and with difficulty regained, so that slight injury or irritation produces effects out of proportion to the severity of the cause.

Cold moist climates are *unsuitable* for phthisical patients.

As no one climate is equally suitable for all stages of the disease or at all seasons of the year, it may be advisable for the patient to move from place to place as the circumstances may require.

For instance, a patient with early tuberculosis of the lung spends the summer in elevated localities and then comes down to the plains. Here the improvement gained at the high altitude may cease, and after a time symptoms may recur and further change be advisable. If the weather forbids a return to the high altitude, some bracing, warm, dry climate may be sought for the winter, and a return to the mountains be made in the spring. Or a more advanced and febrile patient unable to take exercise and with harassing cough, has been sent to a warm moist climate. As the cough decreases a drier, but still warm, climate may be visited, and as improvement advances and strength is gained a more bracing, but still warm, place may be chosen, where exercise is possible; with increasing strength a cold dry climate may be advantageously borne.

When improvement, or quiescence, is brought about in a certain climate, but with some return of symptoms on returning home, and permanent residence in the suitable climate is impossible, periodical visits of a few months' duration each year may hold the disease in check, and so eventually bring about a cure.

The neighbourhood of *pine forests*, where the air is filled with the aromatic exhalations from the trees, is often useful where there is much irritative cough and copious expectoration. This good result is also partly to be attributed to the shelter from some bleak winds afforded by the trees, and to the dry soil in which they flourish.

Ocean Voyages.—The advantages gained by long sea voyages are dependent upon the purity of the air in mid-ocean, and the rest both of mind and body that are to be obtained on board ship.

Short sea trips are insufficient to give the full benefits of voyages; it is necessary to take a sufficiently prolonged journey to get thoroughly accustomed to life on board ship, as well as to get over sea sickness which so often prevents any benefit from the sea air at the onset.

The characteristics of the ocean climate are purity of air, which is also rich in ozone; a more equable temperature than is to be obtained on shore; a moisture of the atmosphere, which is different from the damp of a wet subsoil or of an insanitary dwelling.

The sea air usually acts as a tonic to the digestive system, and whilst appetite is increased, digestion and nutrition are promoted. At the same time it serves as a sedative to the nervous system. A fairly equable temperature may be obtained for a prolonged period by the gradual progress north or south, according to the time of year. The disadvantages of sea voyages are mainly that sea sickness may weaken the patient, and it is impossible to turn back when the voyage has commenced; bad weather may necessitate confinement below where free ventilation cannot be obtained; exercise is limited to walking the deck, with such games as the number and energy of the passengers may suggest; want of occupation may be irksome to those of a restless disposition.

Long voyages are *suitable for*—

1. The predisposed with good chests.
2. The scrofulous.
3. Those with frequent small hæmorrhages.
4. Those with slight lung mischief, but with irritable cough.
5. The anæmic, or those with defective appetite.

Voyages are *unsuitable for*—

1. Those who are very weak.
2. Those with advanced and still active disease.
3. Those with severe hæmoptysis.
4. Those who suffer much from sea sickness.

It must always be remembered that there is no turning back in mid-ocean, and that if a patient finds the voyage does not suit him, or that he is getting worse, he must still go on. To send any one with advanced disease to sea generally condemns him to die far away from his friends.

CHAPTER XIX.

Travelling for Health.

In leaving home in search of health there are important considerations which demand attention apart from the natural peculiarities of climate in the place selected.

In visiting many of the health-resorts on the Continent and in Egypt, or on board ship, I have frequently heard the complaints of patients who have been ordered away from home, that they had not been more fully warned of some difficulties of travelling, some discomforts incidental to residence amongst strangers with a different mode of life to our own, or even some characteristic of the climate to which they had come and for which they had not prepared. The complaints are usually about matters which would be trivial discomforts to the strong traveller or pleasure-seeker, but which add considerably to the distress of the invalid. It seems to be commonly held that to find health in pulmonary affections it is essential to leave England and travel to some distant country. This idea adds to the hopelessness of those who become phthisical and have not the means to go abroad, or who are unwilling to go out of reach of their family and friends. We may lose sight of the many advantages of our own health-resorts in the discussion of the merits of rival fashionable sanitoria abroad, or in comparing the benefits to phthisical patients of residence at high altitudes amongst the snows and dry cold air of the mountains with those of basking in the balmy warmth by southern seas.

The prominence thus given to foreign and, perhaps, distant places, may sometimes lead to the impression that the successful treatment of consumption is only possible for the wealthy. The poorer patients, unable to afford the expense of travelling, come to believe that there is no hope of recovery in their own country, and so lose much of that hopefulness which is so valuable an adjunct to treatment; whilst their friends feel their poverty doubly hard as it deprives them of doing what they believe to be the one thing that might save the patient's life.

I do not by any means underrate the advantages of residence amongst the Alps, or of escaping an English winter by travelling south. These take their place with the necessary luxuries found in the sick-room of a wealthy patient.

I would, however, emphasize the fact that consumption may be combated with success without the luxury of foreign travel; and just as the less refined treatment of a hospital patient is often as successful as the costly nursing of the millionaire, so the less wealthy sufferer from consumption, with all his disadvantages, has still no reason to give up hope of recovery at home.

It is true that a damp and variable climate such as ours is not so well suited to invalids with lung affections as one which is drier and blessed with continuous sunshine. But there are many places in these islands where those who are unable or unwilling to travel may find fresh air, and sufficient warmth to enable them to enjoy it out of doors; and where they will also have comforts, both sanitary and domestic, which they might seek in vain abroad.

It is a sufficient trial to the spirit of an invalid to urge absence from business or from home, without adding to the miseries of illness the thought that their hopes of recovery are destroyed by their inability to leave England. There are many patients, also, who, from weakness or extent of disease, are unfit to travel far, who may nevertheless gain advantage from residence in some of our own health-resorts. The tendency to extol health-resorts abroad, and to ignore or depreciate those at home, is unwise; these latter demand attention from us, as by far the greater number of our own invalids are unable to visit foreign countries. The facilities for being rejoined by friends, the advantages of home comforts, of suitable and wholesome food, to which the invalid is accustomed, and a mode of life in which he has been brought up, are all in favour of home health-resorts; and to these we may add the benefits of good sanitary requirements and the skill of English medical men. These are not to be lightly put aside.

In all cases the possibility of cure depends upon an early recognition of the mischief, and where there are no financial reasons to prevent foreign travel or residence, there are

important considerations to be taken into account before ordering a patient away. Where the lungs are extensively diseased an injudicious mandate to go abroad may largely increase the discomforts necessarily attending illness, and the end that cannot be averted is embittered by strange surroundings and the absence of friends.

On advising a patient to go abroad it is well, if he be not used to travelling, to give him as far as possible some idea of the difficulties and discomforts of long journeys, and to prepare him for some of the differences in customs and in cooking, between what he has been accustomed to and that which he will find abroad.

In many points the matter of expense will need consideration. Advice to the very rich or the very poor is simple and is very easily given; the one can do anything, the other little or nothing. The difficulty is to suggest the best for those who can afford some things, but not all you might wish. The invalid who can travel with his nurse in a *coupé lit* takes a long journey with little fatigue; and the rich patient, who can have a villa at Cannes or Arcachon and take his family and servants with him, may live very much as he does at home; whilst the person who has to live in a boarding-house or an hotel must expect differences from his home life. An invalid misses small comforts, of which the robust traveller hardly notices the absence. There is no cheerful fire in the evening or on dull days; there is difficulty in getting beef-tea, &c.; his appetite and his digestion—so important for his recovery—are sorely tried by the differences in the manner of cooking the things he was fond of at home. Many good things can, of course, be had, but the novice orders his dinner without much idea of what it will look and taste like when served.

Some of these differences between home and foreign living will be touched upon in further remarks relative to points already referred to as the conditions which require attention in selecting a health-resort.

Foremost in the choice of a residence for the consumptive comes the great question of **density of population**.

Whatever may be the climatic advantages of any place, these are discounted by a closely packed population, and for the consumptive we should always prefer to choose a place

where the population is sparse, or, if not small, scattered over a wide extent, and nowhere collected into close streets and crowded dwellings. In this respect farms and country villages are better than towns.

In this connection it may be as well to draw attention to the bad effects of overcrowding within the house or room in which the invalid may spend much of his time; and to the crowding together of invalids at some health-resorts. Some fashionable resorts are thus spoiled by the very fact of their becoming popular, and their popularity leads to their downfall. This need not be the case where any great extent of suitable ground is available for houses of moderate size, and ample surroundings unencumbered with overgrown hotels or hospitals.

Drainage and Sanitation are of no less importance. The importance of proper drainage and sanitation in a health-resort should need no comment. In England this is recognised, and by degrees this subject is becoming more considered abroad. There are, however, foreign places to which invalids are sent notably deficient in sanitary requirements.

The newer hotels and sanitoria are usually the best as regards their drainage and sanitary arrangements; and in the more frequented health-resorts the villas are made as healthy as the knowledge of their owners permits.

Accommodation, &c.—Seeing that the main object with which we send consumptive patients away from home is that they may obtain pure air, it is important to provide that this should be obtained whilst they are indoors, as well as to choose a climate in which they can spend most of the day in the open. At least ten hours out of the twenty-four must be spent indoors, and most of that will be in a single room—the bed-room. The sleeping-room, therefore, is of the first importance. This must be sufficiently large and, if possible, lofty and cheerful. The patient should always have a bed to himself, and if there is no other person sharing the room, this latter should be large enough to contain 1500 cubic feet of air—therefore a room 15 feet long by 12 feet broad and 10 feet high may be taken as a standard, and this requires free ventilation. There is no reason why a phthisical patient should not have the window open a few inches

at the top all night; and if the nights are cold it is better to have a fire in the room than to close the window. In this case the bed must not be placed between the window and the fireplace if there be one, and a thick curtain may be hung near the opened window. If the window be a large one, such a curtain is required to stretch all across, as a large window is the great cooling surface of the room.

A screen near the bed may be used to keep off draught if necessary. If another person share the room a separate bed must be provided, and the room must then be about double the size which is sufficient for one person.

Early rising should be the rule, and consequently the patient should retire to bed early at night. On board ship where the state-room is of necessity small, no unnecessary time should be spent in it, and when possible the day should be spent on deck. It is better to put on extra wraps if it is chilly than to go below.

In any sanatorium a large, lofty, and cheerful sitting-room is necessary, and a glass-covered verandah or a winter garden is an advantage for exercise or rest on dull days.

It is one great drawback of all fashionable health-resorts that invalids form a large proportion of the visitors. A collection of invalids is always somewhat depressing, but could they forbear to discuss their own ailments with others one great objection to these establishments would be removed.

Many of the things to which the patient has been accustomed at home, and which constitute for him the comforts of life, will be missing in an hotel or lodging, especially if in a foreign country. It is therefore a good plan to take with him any small comforts which may have become almost necessaries; and if a prolonged stay is contemplated, some of the home photographs and nicknacks transferred to the new quarters will help to give a home-like appearance to his rooms.

Another important consideration for a health-resort consists in the means for occupation and amusement. It is unnecessary and harmful for an invalid to be idle and unemployed. It only leads to frequent musings on his illness, and consequently to depression of spirits. If the patient is able to take exercise it is an advantage to find

some object for a walk or ride. Where many people are together, excursions and picnics can be organised, and out-door games are easily got up.

But even in the most solitary place some interest and object for exercise may be found in such a pastime as making a collection of the flowers or mosses of the district, or by taking photographs with a hand camera. Taking a walk because it is ordered soon becomes monotonous, and part of the good of the exercise is missed. Pleasant companionship also adds to the interest and enjoyment of exercise.

In mountain resorts skating, sleighing, and tobogganing parties may be organised; even snow-balling, if all damp things are immediately changed, is better than sitting indoors. When the patient is unable to take exercise, the necessary materials for needlework, sketching, or whatever is the favourite indoor occupation, must be taken.

The question of foreign languages deserves some consideration. To a good linguist it matters little that all orders must be given in a foreign tongue, and that many of the persons with whom there is daily intercourse are unable to speak English. But to one whose command of the language of the country in which he finds himself is insufficient, the pleasure of residence is much diminished. To a strong and healthy person there is some amusement in making himself understood, and in the numerous mistakes or utter inability to describe what he wants. But to an invalid the want of fluency in the language makes speaking a trouble, and he is thus cut off from conversation, or even goes without comforts and perhaps necessaries rather than make the effort of asking for them. Foreign servants often make a show of understanding orders or requests made to them when they know nothing of what is required, and mistake or neglect what they have apparently assented to. It is, therefore, better for an invalid to select a health-resort where a language is spoken with which he is familiar, or at least to be accompanied by some one who speaks the language well. This disadvantage of a foreign place is minimised where many English visitors are to be found.

If the patient requires medical supervision—and all invalids may require this—an English resident medical

man is an advantage, for it will not do to be unable to speak freely with the doctor, or to misunderstand his directions.

Food and Cooking, when diet is important, and the invalid's appetite poor or capricious, are elements of importance. We cannot always expect to find abroad English cookery and English dishes. In those countries where much oil is used in cookery, almost every dish which comes on to the table may be unpalatable to those who are unaccustomed to its use.

The vegetables are in this way often spoiled to English tastes, and are usually served as a separate course from the meat to which they would give a relish.

To many this, and salad with the roast, would soon be liked; but it is generally possible, in a good hotel, to get things cooked in any way that may be desired. Unless this is specially ordered, the ordinary cookery of the country will naturally be followed.

Means of Communication.—The facilities for reaching the selected sanatorium must be known before a patient starts on the journey. Not only must we consider the distance to be travelled, and the time which will be necessary, but also the mode of travelling—by sea, rail, or road, and the conveniences and comforts to be procured *en route.*

One of the many advantages which may be gained by medical men themselves spending some time in travelling is that they are able better to appreciate the fatigue of a long journey, and to find out the means of diminishing this.

A long railway journey is very tiring to an invalid, and if at the end of it he has to drive several miles without having a rest he may arrive at his journey's end very much worse than when he started.

In this country railway journeys cannot be very long; but in going abroad the journey may have to be broken up to suit the strength of the invalid.

It is perhaps best for invalids to travel by day and have a night's rest in an hotel, where a good dinner and a comfortable bed may counteract the fatigue of the day's journey, and prepare them for the next stage. Night travelling for invalids should only be permitted when a berth in a sleeping-car can be procured.

Take for instance the journeys to the Riviera and Arcachon as examples. In going to the Riviera the journey from London to Marseilles direct takes from twenty-five to twenty-eight hours; about two hours further to Hyères, five hours from Marseilles to Cannes, and nine to San Remo. This journey could well be divided by staying a night at Dover or Folkestone, another at Paris, again at Lyons or Macon, and finally at Marseilles. Or shorter journeys would be possible by making rests at Dijon and at Lyons, and thus taking an extra day on the road.

Arcachon is about twenty hours from London, and stoppages could be made at Paris and at Bordeaux. For those who enjoy the sea, and in warm and fine weather, the journey to Bordeaux by sea from London or Liverpool is pleasant; but this route is to be avoided by those who are not good sailors. I have seen a consumptive patient walk on board the steamer at Liverpool, and have to be carried on board the launch at Pauillac, having spent almost all her time on board ill in her cabin. She had been recommended to go to Bordeaux by sea on her way to Arcachon, because a sea voyage might be good for consumption, forgetting that the sea trip was too short to be of service, or even to allow of getting over the sea-sickness.

Patients with advanced consumption, sent off to places at such a distance, feel quite cut off from their friends, or doubt the possibility of getting home again, should they not make favourable progress.

It is not sufficient to send patients to a sanatorium without full provision for their comforts and requirements. They require medical supervision whilst there, if only to advise them how to get the fullest benefit during their stay; and therefore a resident doctor in the neighbourhood is important, and preferably one who can speak their own language.

For those who are too weak to stand the fatigue of a long journey there are many parts of England which may be easily reached, and where they may find climatic conditions suitable to their requirements, and the comforts to which they are accustomed.

The chief disadvantage of our northern position over more southern latitudes is the shortness of the winter day,

and consequently the less amount of sunshine. Our London fogs are left in a journey of a couple of hours without fatigue into a drier and milder air, with all that can be desired as to food, lodging, and amusement. In selecting an English health-resort the patient should not be allowed to suppose it is a make-shift determined upon on account of his want of ability or means to go abroad. Let him rather be convinced that he is going to the very best place that could be selected, and he will then start with hope, and will benefit by every favourable change observable during his sojourn. In this way not only is the most trying and perhaps critical time got over with safety, but with arrest of the mischief the progress towards health is often continuous and ultimately complete.

CHAPTER XX.

The Symptoms of Consumption.

The changes produced within the lungs by the tubercular process interfere with the functional activity of these organs, and cause symptoms indicative of the progress of the mischief, and which help us to measure the advance or diminution of the disease.

A knowledge of the significance of these symptoms, essential to the physician, may be useful to the patient or his friends ; for, on the one hand, hope will be encouraged by favourable indications, and on the other the necessity for increased precautions may be early recognised.

It may, therefore, be well to mention the more prominent symptoms associated with consumption, and to indicate some of the deductions which may be drawn from their presence or their fluctuations.

Wasting indicates an excess of waste over supply in the body economy. This may be caused by deficient assimilation or by increased expenditure. In consumption both these causes often co-exist. The appetite is poor, and therefore the amount of food is small ; whilst the fever which

accompanies active phthisis causes increased tissue change, and therefore excessive waste.

The increased expenditure of the body produced by fever is chiefly due to the burning up of fat, and can be best met by all the means that can be used to reduce fever, and by an increased supply of starchy and fatty foods. With continuous or daily recurrent high temperature no weight can be gained; but by regulating the diet and aiding the appetite it is possible to have an increase of weight in spite of a certain degree of slight or interrupted fever.

The persistence of fever, with a steady decline of weight in consumption, usually indicates extension or at least continued activity of the disease; whereas increase of weight shows subsidence of fever, and is generally a sign of good import.

Cough results from irritation of the air passages and air cells, due either to a morbid condition of their lining membrane, *e.g.*, congestion, catarrh, ulceration, &c., or to the presence of some irritating body which the patient tries to remove by expulsive efforts.

It is important, when possible, to discover the cause of the cough, for in the first place we try to allay the irritation and so prevent cough; in the second we endeavour to aid the natural efforts, to remove the offending substance, and to make the cough effectual. The cough in the first case is generally "dry," in the latter it is attended with more or less expectoration.

The irritative "throat" cough which attends tubercle of the larynx may often be allayed by sedatives. The cough attended with free expectoration when the lungs are breaking down cannot safely be checked; here we rather endeavour to loosen the phlegm and aid its expulsion.

Night Sweats are caused either (1) by a diminution of vascular tone, or (2) by the physiological attempt to regulate the body temperature by evaporation from the surface.

In the first case the sweating, independent of body temperature, is most marked at the periods of greatest exhaustion, and may be expected to occur in the small hours of the morning when vital processes are at the lowest.

In the latter case the perspirations, mostly the result of

hectic or evening fever, will follow the rise of the body temperature to its highest point, and will most frequently occur early in the night.

Patients often dread the perspiration from the belief that it causes or adds to their weakness; whereas the sweating is a sign of prostration rather than its cause. Nevertheless we endeavour to control the fever, and to check excessive night sweating, if only because of the discomfort to the patient.

Fever.—Alterations in the body temperature are generally met with in consumption. In the acute and active phthisical condition the temperature is almost always raised during some part of the day. It may be always high, never touching the normal for weeks together, or it may be high in the evening and below normal in the morning. In advanced cases we get the irregular temperature chart of suppurative diseases. The temperature curve of any case is of great interest, and often gives a good indication of the progress of the disease.

Continuous high fever—103° and upwards—is always a sign of danger, and even when the temperature rises above 100° in the evenings we conclude that there is still active tuberculosis. The subnormal temperature often seen in the morning indicates exhaustion. The extent of the daily range of temperature is important to note: large diurnal variations show an unfavourable condition.

Speaking generally, we may say that high fever indicates fresh tubercular deposits or pneumonia around tubercular patches, and thus continued high temperature often means rapid extension of tuberculosis. A wide daily range—great difference between morning and evening temperature—indicates softening or breaking down of tubercular nodules; the high evening temperature showing that the disease is still extending.

The smaller the daily variations in temperature from the normal the less active the disease.

A constant subnormal temperature indicates exhaustion, often the result of extensive disease, which has led to much destruction of lung tissue but is not extending.

The daily variations are often irregular, but the temperature is usually lowest in the morning, and higher in the

evening. The chart on p. 185 shows the variations of temperature taken every hour.

If taken twice a day the most suitable times are 9, or 10 A.M. and 6 P.M.

Dyspnœa or Shortness of Breath may be expected whenever much of the lung is affected, and often marks cardiac weakness produced by the extra tax on the heart, from obstructed pulmonary circulation as well as by impaired nutrition of the heart. It is a most extreme symptom in advanced cases, and the breathing is then laboured even when the patient remains quiet in bed.

In less advanced cases breathing is quiet so long as the patient remains at rest, but is disturbed on movement.

Even when the disease is quiescent the breath may be short on any active movement or exertion.

Sleep is disturbed during the progress of consumption, sometimes by the excessive perspiration, occasionally by pain, and frequently by cough. Dyspnœa is sometimes distressing when the patient lies down, and sleep is then more easy when the patient is propped up by pillows or with a bed-rest.

With much exhaustion we sometimes find a patient wakeful apart from pain or cough.

It is doubtful whether narcotics are advisable in advanced phthisis; they are certainly harmful if given in sufficient quantities to completely allay cough.

Digestive Functions.—Appetite is often lessened, and, as it is important to give sufficient nourishment, care is required in selecting the diet.

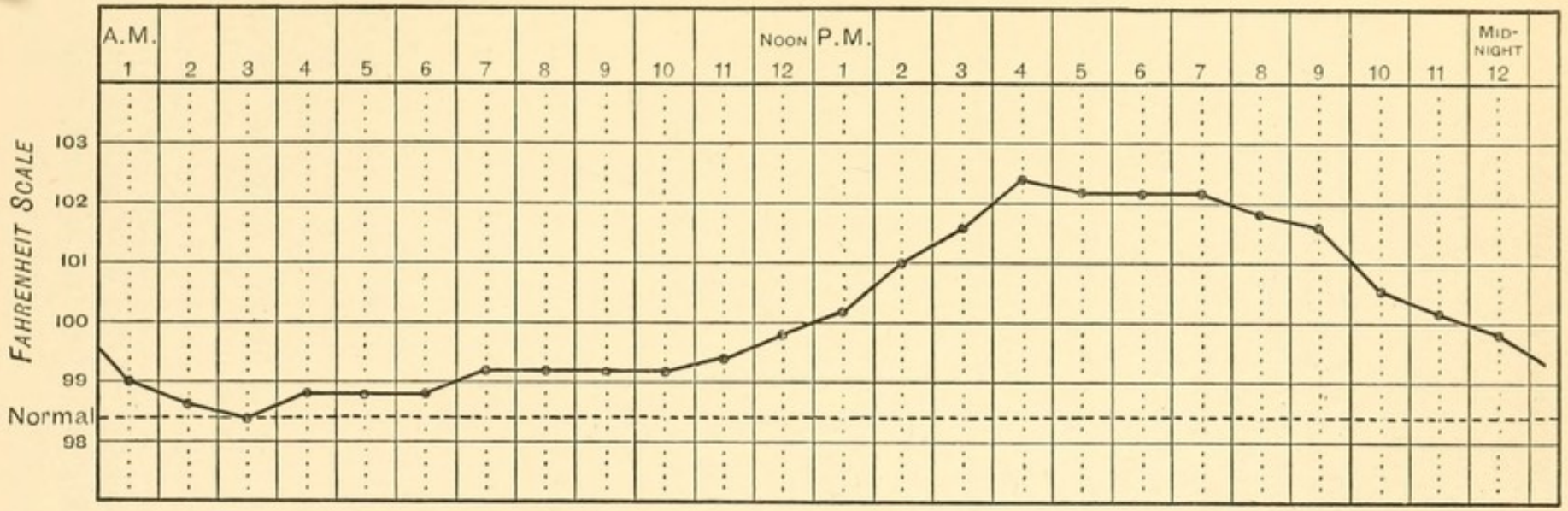
Digestion also is often impaired.

Vomiting with severe cough is sometimes a distressing symptom, especially in the morning on first waking or on getting up.

Diarrhœa is not infrequent, and if coming on late in the illness may be due to tubercular deposit or ulcers in the intestine, or it may also come on from albuminoid disease.

The habit that some patients acquire of swallowing phlegm dislodged from the air passages, instead of expectorating it, is most harmful, and must always be discouraged. These matters, teaming with bacilli, may possibly convey tubercular infection direct to the coats of the intestines.

TEMPERATURE CURVE OF ACUTE PHTHISIS.



The above Chart shows the *average* temperature for each hour in the day and night, from hourly observations extending over a continuous period of 18 days, in a case of active pulmonary tuberculosis.

Highest temperature during this period, 105·4° F. (5 P.M.); lowest, 96° F. (1 A.M.).
Greatest range in the 24 hours, 8·6° F.; greatest range in 1 hour, 4·2° F.

The patient subsequently left the hospital convalescent.

Albuminoid degeneration of internal organs—liver, kidneys, &c.—may be induced by any long-continued suppurative disease; and, though by no means characteristic of phthisis, often add to the patient's discomforts at the close of this illness.

Hæmorrhage—(Hæmoptysis).—Hæmoptysis, or spitting of blood, is sometimes the first sign that leads a person to seek advice: it may come on even before there are any recognisable signs of mischief in the chest. It is then probably the result of general oozing from the capillaries of the inflamed portion of the lung; and though the amount of blood brought up may be quite sufficient to alarm the patient, the hæmorrhage is rarely dangerous *per se* in this early stage of the disease.

But hæmorrhage is a more common occurrence in the later stages of consumption, when cavities have formed, and especially where much fibrosis exists in the excavated lung. Thus it is said to be a characteristic of chronic rather than of acute phthisis, though acute cases are not exempt.

The hæmorrhage, in a late stage of phthisis, is often considerable, and may be sufficient to cause death. When a patient actually dies during the attack of hæmoptysis, the cause of death is usually suffocation—the air passages being blocked with the blood. In these severe hæmorrhages the blood may come from a ruptured blood-vessel of considerable size—a branch of the pulmonary artery which has been left stretching across a cavity, or which has an aneurysmal dilatation.

It is important to remember that blood may be brought up and expelled by the mouth from parts other than the lung, and that blood may come from the lungs in other conditions besides phthisis. Thus, spitting of blood is not necessarily a sign of consumption, and not always a matter for anxiety.

The blood may come from the nose or mouth, and, having been swallowed, is later on brought up. It is then usually small in quantity, and altered in character.

It may come from the mucous membrane of the mouth, pharynx, larynx, trachea (or the œsophagus), and is then brought up unaltered, but small in amount, and unmixed with air.

Blood may come from the stomach in large quantities and be mistaken for pulmonary hæmorrhage, as in ulcer of the stomach. But the blood, though it may be bright in colour, is unmixed with air, and is not frothy.

When the blood has been retained in the stomach for a time it becomes dark in colour and clotted; later it is broken up, and is expelled as a dark liquid, like coffee grounds. Blood from the lung, when it has oozed from over-loaded vessels, comes up frothy from its intimate mixing with air in the air cells, and bright scarlet in colour: it is often mixed with much frothy mucus. In this form of hæmoptysis the amount of blood expelled at a time is rarely great, but the spitting of blood continues for some days. When the amount of blood exuded is considerable, some of it may come up almost unmixed with air; and if retained for a time in the lungs or bronchial tubes, some clots of bright colour may be coughed up.

This oozing of blood in the lung occurs in any condition which causes congestion of these organs, and is not uncommon in affections of the heart in which the pulmonary circulation is obstructed, as in mitral regurgitation.

When hæmorrhage occurs from an arterial branch within a pulmonary cavity, a large amount of unaltered bright coloured blood may be suddenly expelled, to be followed for some time by the expectoration of blood-stained mucus, and occasional blood clots.

It must be remembered that the continuance of sanguineous expectoration for a few days does not necessarily mean continued hæmorrhage, but indicates that the blood poured into the lung when the hæmorrhage occurred is not all expelled at once.

Severe and perhaps fatal hæmorrhage may occur from the bursting of an aneurysm of the aorta, or one of its branches within the chest, without any pulmonary disease.

Hæmorrhage from the air passages, or from the stomach, may result in some of the blood regurgitating into the lung, where the retained blood may, before it can be absorbed, serve as a nidus for bacilli, and thus be the starting-point of phthisis. Similarly, exuded blood within the lungs, from congestion, heart disease, &c., may start consumption. Still hæmoptysis is not infrequently an early sign of phthisis.

Such hæmorrhage may afford the patient the first indication that his lungs are affected, and on careful examination of the chest the most skilful physician may be unable to detect any physical signs of the mischief. Such a hæmorrhage is rarely very considerable, though it is naturally alarming to the patient.

Severe hæmorrhage from the lungs is most to be feared in chronic cases where comparatively large vessels may be left crossing a cavity and thus deprived of their support.

Whenever hæmorrhage comes on, rest in the recumbent position in a cool room must be insisted upon, and ice may be freely sucked. When severe in later stages of the disease, cold wet cloths, or ice, may be placed on the chest over the affected portion of the lung. All food and drink should be taken cold or cool, and rest should be maintained for some days.

Heart Disease and Phthisis.—It has been stated that phthisis is very uncommonly found in conjunction with valvular disease of the heart. If it is intended to imply that persons suffering from heart disease are not liable to consumption, my experience would be against this contention, for I frequently see the two conditions present in the same patient. There is nothing in heart disease protective against phthisis.

APPENDIX.

A pure culture of the bacillus is obtained as follows :—All the knives, scissors, forceps, or other instruments which may be required, are heated in a flame sufficiently to free them from any bacteria.

A test-tube is partly filled with some blood serum, or specially prepared gelatinous broth, which has been heated sufficiently to destroy any bacteria which might have been present in the materials; and the tube having been similarly freed from contamination is closed by a piece of cotton-wool also sterilised. The tube is then rested at an angle so that the contents on becoming solid present a large and sloping surface. A small portion of material from a tuberculous nodule of a freshly killed animal is removed with precautions to prevent contamination

from instruments or the air, and rubbed on the surface of the solidified serum or broth within the tube by means of a platinum wire fused into a glass rod, which immediately before use has been heated and allowed to cool. The cotton-wool plug is inserted into the mouth of the tube, which is kept at a suitable temperature until, after ten or fifteen days, the surface of the material in the tube is seen to be covered with what appears to be loosely adherent dry scales, later forming a very thin greyish-white, lustreless covering. These scales consist of colonies of tubercle bacilli. A portion of these scales may now be transferred by means of a sterilised platinum wire to a fresh tube of serum prepared as in the first case; and when colonies have appeared on the serum a new tube may be inoculated from this second growth. This process may be repeated through many successive inoculations, each inoculation producing a fresh generation, or new colonies of the bacillus. But after passing through even as many as seventy cultivations the last one is as virulent in producing tuberculosis as the first.

The following table, taken from a life insurance standard, forms a good guide to the weight for different heights for men :—

TABLE OF HEIGHTS AND WEIGHTS FOR MEN.

Height.	Average Weight.	Minimum Weight for Health.
5 ft.	120 lbs. = (8 st. 8 lbs.)	100 lbs. = (7 st.)
5 „ 1 in.	124 „ = (8 „ 12 „)	104 „ = (7 „ 6 lbs.)
5 „ 2 „	128 „ = (9 „ 2 „)	108 „ = (7 „ 10 „)
5 „ 3 „	132 „ = (9 „ 6 „)	110 „ = (7 „ 12 „)
5 „ 4 „	136 „ = (9 „ 10 „)	115 „ = (8 „ 3 „)
5 „ 5 „	140 „ = (10 „)	118 „ = (8 „ 6 „)
5 „ 6 „	144 „ = (10 „ 4 „)	122 „ = (8 „ 10 „)
5 „ 7 „	150 „ = (10 „ 10 „)	126 „ = (9 „)
5 „ 8 „	156 „ = (11 „ 2 „)	130 „ = (9 „ 4 „)
5 „ 9 „	162 „ = (11 „ 8 „)	135 „ = (9 „ 9 „)
5 „ 10 „	168 „ = (12 „)	140 „ = (10 „)
5 „ 11 „	174 „ = (12 „ 6 „)	145 „ = (10 „ 5 „)
6 „ 0 „	180 „ = (12 „ 12 „)	150 „ = (10 „ 10 „)

TABLE OF CHILDREN'S HEIGHTS AND WEIGHTS.*

(For both sexes: add to height half an inch for shoes, and to weight 5, 7, *or* 10 *lbs., according to age, for clothes.)*

Age.	Average Height.	Average Weight.	Range more and less.	
			in inches.	in lbs.
At birth.	19 inches	7 lbs.	3	+5–2
1 year.	28 ,,	21 ,,	4	4–3
2 ,,	32 ,,	28 ,,	4	3
3 ,,	35 ,,	31 ,,	4	3
4 ,,	38 ,,	35 ,,	4	5
5 ,,	41 ,,	40 ,,	$4\frac{1}{2}$	5–3
6 ,,	43 ,,	44 ,,	5	6
7 ,,	45 ,,	48 ,,	$4\frac{1}{2}$	8
8 ,,	47 ,,	52 ,,	4	10
9 ,,	49 ,,	56 ,,	4	10
10 ,,	51 ,,	60 ,,	4	10
11 ,,	54 ,,	67 ,,	5	12
12 ,,	56 ,,	72 ,,	6	14
13 ,,	58 ,,	80 ,,	7	19+
14 ,,	60 ,,	90 ,,	8	20+
15 ,,	62 ,,	100 ,,	8	25+

* From collected essays by William Squire, M.D., F.R.C.P. (J. & A. Churchill).

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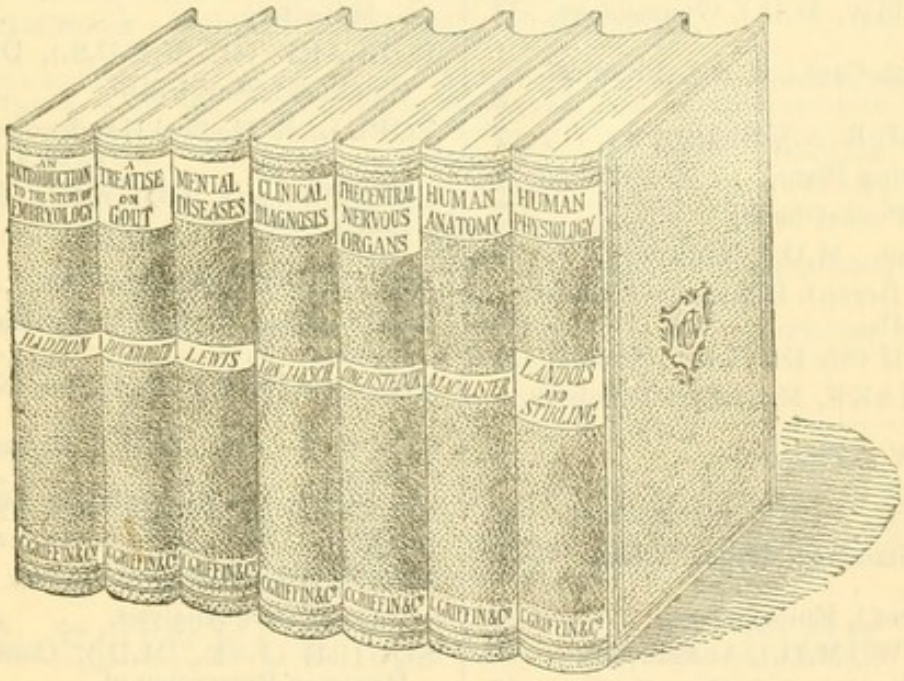

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