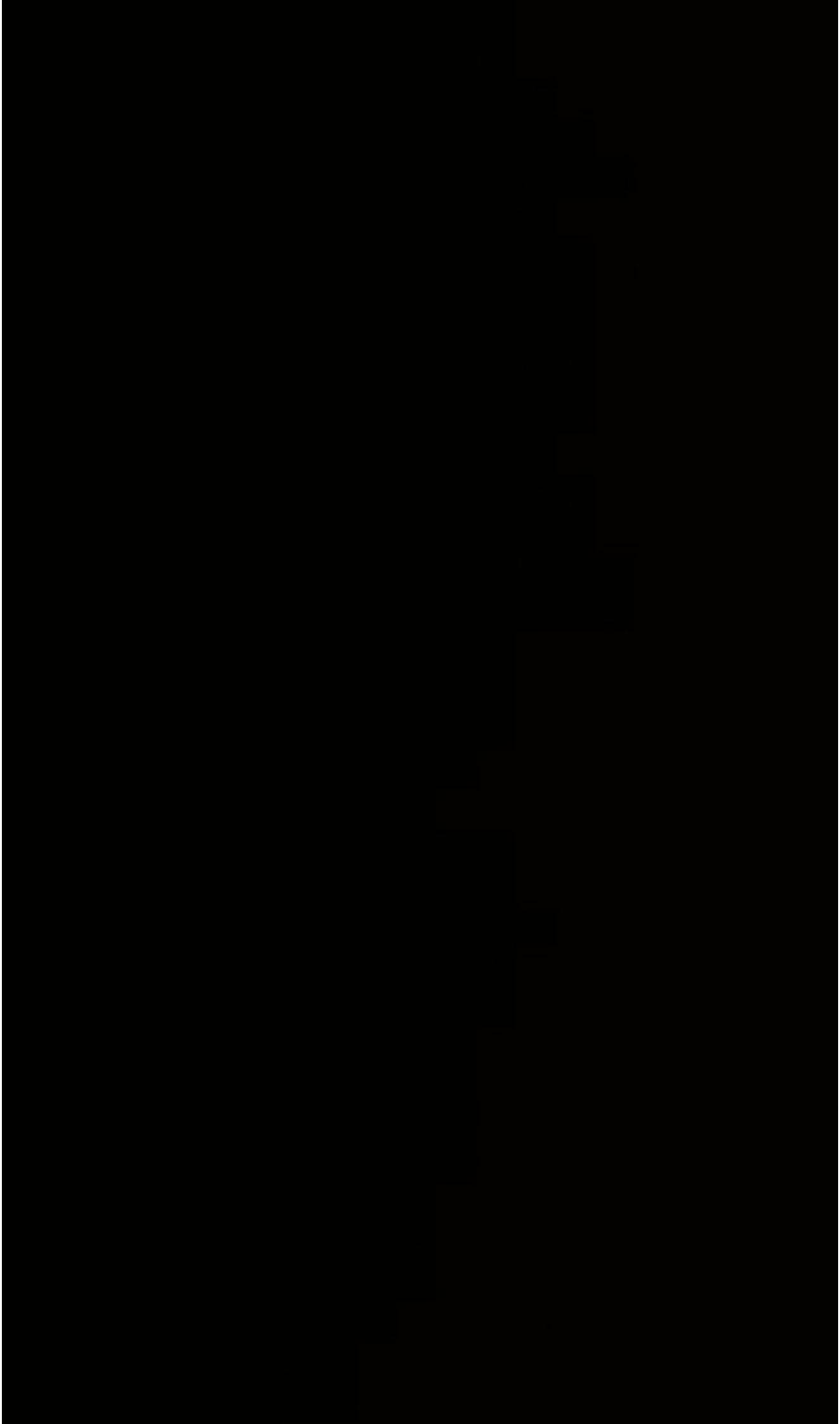
Consumption as a contagious disease : with its treatment according to the new views ; to which is prefixed a translation of Professor Cohnheim's pamphlet "Die Tuberkulose vom Standpunkte der Infections Lehre" / by Daniel Henry Cullimore.

CONSUMPTION

AS A CONTAGIOUS DISEASE

DANIEL HENRY CULLIMORE.



CONSUMPTION

AS A CONTAGIOUS DISEASE;

With its Treatment according to the New Views.

TO WHICH IS PREFIXED

A TRANSLATION OF PROFESSOR COHNHEIM'S PAMPHLET,

'DIE TUBERKULOSE VOM STANDPUNKTE
DER INFECTIONS LEHRE.'

BY

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TO

SURGEON-GENERAL SIR JOSEPH FAYRER, K.C.S.I., F.R.S., M.D., ETC.,

THIS WORK IS INSCRIBED

AS A MARK OF RESPECT FOR HIS HIGH PROFESSIONAL AND SCIENTIFIC ATTAINMENTS.

PREFACE.

THIS volume consists of two parts. The first is a translation from the German of Professor Cohnheim's pamphlet 'Die Tuberkulose vom Standpunkte der Infections Lehre.' The *British Medical Journal*, towards the conclusion of an able review, speaks of it as follows:

'The small brochure on which we have so freely drawn well merits the attention of all who are engaged in the active practice of medicine; and as this is hardly possible, so long as it remains in the original German, we would fain hope that some competent pen may translate it in its entirety.'

The second part is original matter. It takes into consideration the subject of consumption from a sanitary and pathological point of view, including its treatment according to the new views.

Special attention is devoted to the investigation of climate, with reference to the relative merits of the air of mountains and plains.

My thanks are offered to the gentlemen whose writings I

have made use of. Their names in almost every instance will be found mentioned in the text.

The whole is now placed before the public, and I trust it will prove a useful contribution to our knowledge of Tuberculosis.

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6, Connaught Street (*late* 15A, Connaught Square),
London, W.,
December, 1880.

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PART I.

CHAPTER I.

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WHOEVER may endeavour in future times to extend our knowledge of tuberculosis, must consider it extremely fortunate that a no less distinguished personage than Virchow should in the year 1860 have given us the result of his many experiments in relation to this particular disease; together with his own views of the prevailing opinion of the new doctrine which had been promulgated respecting it. For about this time a discovery was made in France, which not only stands out as an important event in the history of tuberculosis, but bids fair to change all preconceived opinions respecting it. Indeed it may be said that few discoveries have made a greater sensation than Villemin's treatise on the transmission of tuberculosis by inoculation.

Heads and hands were set to work wherever scientific investigations were carried on to prove or repeat Villemin's researches. These, however, were at first not always attended with favourable results, and it was only a few in the commencement who timidly concurred in his opinions; as time passed on dissenting views respecting it decreased more and more, and now there are in the profession few who deny that *tuberculosis is a contagious disease.*

In spite, however, of this, but few advantages have hitherto

been drawn from this knowledge in human pathology; and if I mistake not, *tuberculosis*, partly in consequence of its widespread existence and partly in consequence of its incurability, still continues to be the terror of the public and the bugbear (*Kreux*) of the doctor, a disease which we must accept as the production of our social circumstances. Such being the case, perhaps it may not prove unwelcome if a pathologist endeavour to offer the result of his investigations in the new field of inquiry as well as the limited space of this pamphlet will admit.

The substance of Virchow's teaching, and which he never tires of impressing on the student, is, that there exists a *distinct difference* between real *tubercle* and the caseous and inflammatory hyperplastic processes.

The tubercle, according to him, when it first appears is no larger than a pin's point, and always submiliary, and is formed of minute nodules lying in round lymphatic cells, and may sometimes increase to the size of a grain of millet; when, as is the case in the so-called solitary tubercle of the brain, you come across voluminous nodules, the latter always rise out of a confluence of innumerable small nodules, and instead of the *tubercle nodules* increasing in size, they undergo a change in the *centre*, resulting in the loss of water, and to which Virchow has applied the happy term Caseation (*Verkäsung*). These caseous sections sooner or later partake of the nature of tuberculization (*Nekrose*) and then ensues a softening; but when the little nodules come out superficially on the mucous membrane, they become converted into small ulcers.

So much for true tubercle.

The hyperplastic and inflammatory processes, on the contrary, of which the scrofulous lymphatic tumours and caseous pneumonia afford the best examples, have nothing to do with the *tubercular nodules*, but are true hyperplastic and real inflammatory processes, and differ from the former at a later period of their history in so far that they undergo neither *absorption* nor *further development*; the only resulting change being that of caseous metamorphosis, or degeneration.

Virchow is quite ready to acknowledge their affinity with the tubercle in this respect, in consequence of the similarity of

their terminating or least regressive stage; he, like Laennec, considers that there is an inner relationship between the two processes, and he strives for the justification of his opinion, all the more as tyrosis (*Verkäsung*) is brought about by heterogeneous products, and is not unfrequently a sequela of common exudation, of carcinoma, sarcoma, and even myoma and soft chondroma.

Caseation, according to him, is, however, characteristic only of tuberculosis and scrofula.

When we look closely into the anatomical history of the different pathological processes which are now occupying our attention, there appears, superficially viewed, but little difference among them. Our principal attention is directed to the tyrosis, and we observe therein no loss of fat or water, only that wide-spread form of tuberculization (*Nekrose*) which no one has studied more diligently than Weigert, and to which I propose to give the name of eruptive tuberculization.* The cheesy portions as a rule contain very little fat, and have the consistence of firmly coagulated white of egg. They are without induration (*Kern*) and do not assume the usual microscopic colour; in fact, they possess all the qualities which Weigert gives as the criterion of this form of tuberculosis. It is not, however, necessary for us that they should be classed as tubercle; they are tuberculoid, and the softening and ulceration are only the direct consequences of the caseation.

We have described the tubercle in Virchow's own words, but we have meanwhile become aware that in the *midst of the lymphatic cells, which form the bases of the nodule,* there are found larger epithelioid, and generally one or more giant cells, with *nodules* against their walls; with the existence of which Virchow was doubtless acquainted, but to the frequency of their appearance Langham has been the first to draw our attention.

Schuppel, in his contribution to the anatomical history of the lymphatic glands, informs us that true and distinct tubercle exists much oftener than has been commonly supposed; and Buhl's attempt to substitute desquamative pneumonia in lieu of

* In German *Nekrose* literally means an eruption; here it means an agglutinated coagulated granular formation.

Virchow's lobular hepatisation has completely fallen to the ground. It is hard to understand, that at a time when we welcome the information respecting the existence of numerous large epithelial-like cells, in the early stages of this form of pneumonia, as a rich addition to our knowledge, that Buhl should overlook their inflammatory nature.

The information which Ziegler, and particularly Seuftleben, give us in their works respecting the history of exudation-corpuscles, is to say the least also improbable, particularly when they tell us that those epithelial-like cells are in reality epithelium and not rather metamorphosed colourless blood-corpuscles; nor can I, after having seen pieces of hardened lung preserved in alcohol, followed in a short time after introduction into the body of a living rabbit by desquamative pneumonia, be led away by Buhl's doubts respecting the inflammatory origin of lobular hepatisation (*Verkäsendung*).

We have certainly to congratulate ourselves on the gain medical science has won through the improvement in the method of making experiments, as during the last few decades these alone go far to prove to us the soundness of Virchow's teaching, and yet how much diversity of opinion still exists amongst us on this subject.

It is needless for me to say that it is to experiments, and to these alone, that we owe the benefit of the discovery of the contagious tendency of tuberculosis.

If, says Villemin, who was the first to start this theory, which has now been proved on all sides, we introduce a tuberculous substance into the body of any living animal, it will become tubercular. The experiment has not proved quite successful with respect to every animal, as dogs do not appear so sensitive to the tubercular poison as rabbits and guinea-pigs.

It matters little in what manner the virus be introduced into the body of the animal experimented upon. The usual and most agreeable way is inoculation by means of a small puncture, either in the subcutaneous tissue, or into the pleural or peritoneal cavities, or in the anterior chamber of the eye.

Chaveau, and others, have succeeded in producing the disease by feeding rabbits with tubercularly impregnated food. And in experiments made lately at Munich, animals have been

rendered tubercular by the inhalation of pulverised terbercular sputa.

It matters little whether much or little tubercular substance be introduced, or whether it be used alone or mixed with other tissues, such as pieces of lung containing tubercular nodules, etc.

That which is of far greater importance is that the virus should be perfectly fresh and free from taint. The fresher it is, the less likely is the experiment to be affected by septic and other influences, and the surer the infection. When the latter takes place, it is best seen in animals when the tubercular virus has been introduced into the anterior chamber of the eye. In the latter case, if the substance introduced therein be completely fresh, the *primary* irritation will soon pass away, the small portion of infected substance will get smaller and smaller, and may even entirely disappear. For a time the eye appears quite clear and intact, when suddenly in the iris a smaller or larger number of delicate grey nodules appear, and, just as happens with the human tubercle, grow to a certain size and then caseate. Salomonsen and myself have observed the eruption of the tubercle generally twenty-one days after the inoculation has been performed; but in guinea-pigs it is, as a rule, observable a week earlier than this. I have, however, lately found the period of incubation in rabbits limited to fourteen days not only from inoculation made from human virus, but also from tubercular matter taken from animals themselves.

The chief importance of these experiments consists in the proof which is deduced from them, that tuberculosis can only be produced by tubercular matter. It is impossible to have found a more perfect criterion with respect to this particular disease. *Every symptom tuberculosis has, is manifested in animals experimented upon, those particular symptoms, and none other.* It is those alone who have studied earnestly and diligently, amidst the corpses of the phthisical, the anatomical history of tuberculosis of the lungs, can realise how much science has gained. Who is there amongst us who, at the sight of little clusters of caseous nodules in the top of a lung, has not been puzzled to know whether it was tuberculous

deposit, or merely the thickened contents of a bronchial tube? We have been mystified as to whether the peribronchial nodules were fibrous tubercles or only common inflammatory products. The time has been when every hard nodule, every chronic, as well as every constitutional thickening of the lungs, has been termed tubercular. I well remember in my student-days hearing an old Griefswald staff-surgeon say, 'We are all more or less tubercular;' a statement which was accepted at the time without hesitation. We have meanwhile learned to know the diseases of the lungs produced by the inhalation of dust, and are aware that besides pulverised coal, and the dust of certain well-characterised substances such as ultramarine, oxide of iron, sand, etc., etc., the organic and inorganic particles of road-dust penetrate with the atmospheric air into the lungs, and produce, in a more or less degree, chronic inflammatory disorders, which manifest themselves in the shape of fibrous nodules, hard ulcers, and slaty indurations, etc., etc.

But the more we study inhalation and the evil results which may eventuate therefrom, the greater must be our desire to distinguish between the aforementioned processes and the changes produced by tuberculosis, particularly as the two disorders may sometimes be found in the same person. If, however, we inoculate with the slaty indurations and peribronchial nodules, or with the thickened contents of a bronchial tube, the rabbit will not become tuberculous, a result which never fails if inoculation be performed with tubercular virus. And what are we taught from inoculating with matter taken from the human tubercle on the one side, and those caseating, inflammatory and hyperplastic processes, in short scrofulous ones, on the other? Nothing more nor less than that all these products are potent in a similar degree. If a portion of tubercular peritoneum or cerebral membrane be introduced into the peritoneal cavity of a rabbit, typical tuberculosis, commencing in the hollow of the stomach, is the result. But inoculation with a piece of lung affected with caseating pneumonia, or of a caseating testicle, produces a like effect; and nothing succeeds better in inoculation than a freshly excised *scrofulous gland cut out* of the neck. We are

consequently made aware of the close connection between these processes in spite of the difference of their anatomical genesis. Would anyone, because syphilitic caries is a different anatomical process from brain gummata and the eruption of psoriasis—would anyone separate these things one from the other, and deny their connection one with the other ?

Indeed, for all those who assert the incompleteness and unreliability of purely anatomical proof in pathology, there can be no more brilliant instance set before them than the story of tubercular doctrine. Laennec's theory, which puts forth the caseating tendency to be a criterion of tuberculosis, and therefore includes caseating pneumonia as an infiltrated or disseminated tuberculosis, has been rejected by Virchow in consequence of the caseating of many of the above-mentioned anatomical formations.

But when Virchow represents the little round nodules found in clusters in lymphatic cells to be the criterion of tuberculosis, it may be said in objection to this theory with quite as much reason, that many a syphilitic or lupous nodule, many a completely innocuous granular formation, might be classed with tuberculosis. And yet, perhaps both gentlemen are, to a certain extent, right. Neither the nodule nor the tendency to caseate must be struck out of the history of tuberculosis.

We can only look upon caseating eruptive tuberculization and the little round nodules clustered in lymphatic cells as really belonging to tuberculosis when the matter inoculated from them produces tuberculosis; that is to say, when they themselves are the production of tubercular virus.

Inoculation with caseated sarcoma, or myoma, meets with no result, nor does inoculation with the contents of a lupous nodule or a simple lymphoma ever succeed in producing tuberculosis, a result which never fails when performed with the virus taken from true tubercle on the one hand, and a scrofulous gland on the other.

It is also the same with the microscopic proofs.

Lebert, in the commencement of his pathological histology, sought in those soft dull forms, which are now called kernless accumulations (*kernlose Schollen*), for the criterion of tuberculosis, and others regarded the nodules clustered against the

walls of the giant cells as a pathogonomic characteristic of tuberculosis.

Now there are kernless *Schollen* certainly in all tuberculous and scrofulous products, as soon as caseation has set in; but similar accumulations are to be found in every possible cluster of eruptive tuberculization, and you meet the giant cells in many syphilitic and lupous nodules quite as much as in true tubercle.

This is the present state of affairs. It is not caseation alone, nor kernless accumulation (*Schollen*), not nodules or giant cells which are characteristic of tuberculosis, but *solely the caseation the result of specific causes, and the nodules which are derived from specific sources.* Let us try as we will, it won't help us; there are no anatomical definitions to be found for tubercle and tuberculosis. It must yield to the 'etiological.' I cannot help who complains of this, and I am quite ready to acknowledge that there are certain difficulties in the pathologico-anatomical diagnosis, but we won't give up the hope that the anatomical definition may some day be discovered. I cannot agree with Klebs, that the problem he puts forth in his late excellent and carefully written work respecting tubercular virus, morphologically characterised, is solved.

Those who believe that all contagious virus is parasitical in its nature will not hesitate to believe that the tubercular poison is corpuscular; and we may await with certainty that in a not very distant future these specific corpuscular elements may be demonstrated in the tubercular nodule and in the scrofulous products, which the lover of historical names may designate as the tubercular corpuscle.

CHAPTER II.

Tendency of Tubercle to Combine with Inflammatory Products—Seat of Primary Localisation—Course of the Virus in the System—Inspired Air a frequent Vehicle of Contagion—Primary Intestinal Tuberculosis—Food as a Cause of Consumption—Uro-genital Tuberculosis—Primary Meningeal Tuberculosis—Primary Osseous Tuberculosis—Circulation as a Medium of Communication—Metastatic Tubercle.

However, while waiting for the discovery of the 'tubercle corpuscle,' there is no other sure criterion of tuberculosis than its contagiousness.

In this connection the history of syphilis is highly instructive to us, in so far that its infectious properties have been found out long ago, and were well known to the profession long antecedent to the performance of any inoculation experiments.

The various analogies subsisting between tuberculosis and certain infectious disorders were also well known to the student of pathology in former times; and Virchow continually impresses upon us that when tuberculosis has once taken up its seat in a body, it acts like an infecting agent, and may pass from organ to organ until almost every part may become diseased. How far this opinion with respect to infection differs from ours, is in no instance more strikingly exemplified than where a parallel is drawn between tuberculosis and malignant ulcers which latter no one can consider contagious in the sense in which we are now speaking.

It is impossible to call a morbid product infectious which merely infects the body in which it is localised, and is perfectly inocuous to the bodies of other persons or animals. Again, although it is through Villemin's researches that the problem of the contagious properties of tuberculosis has been first made clear to us, we cannot say that the inoculation experiments have taught us any completely new anatomical truths; all we

can say is, that what we formerly conjectured is now proved. Our knowledge of the caseation of scrofulous inflammatory products and tubercles, and their subsequent softening, running into cavities in the parenchymatous organs, and into ulcers on the mucus surfaces, dates from the time of Laennec. It has also been long known that tubercles are very prone to combine with inflammatory processes, so it is very hard to determine whether the tubercle is the cause of the peritonitis, the meningitis, the orchitis, the bronchitis, or the reverse, Moreover, the union of true tubercle with scrofulous productions, such as caseating glands, caseous hepatisation with bronchial and pleural tubercles, is so little new that the frequency of these processes was one of the arguments which led Laennec to adopt his argument of infiltrated disseminated tuberculosis.

The experiments made by inoculation have only demonstrated to us that all those things are really the effect of the tuberculous virus, and may have shown us the possibility of finding a connection amongst things concerning which our information was uncertain and contradictory.

The person will best illustrate this, who will take as his starting-point the close study of the anatomical history of tuberculosis in its minutest details.

The leading principle here, as in all infectious maladies which are the cause of local changes, is that a tuberculous or scrofulous product is generated wherever the virus is introduced, and germinates, that is to say finds an opportunity for localising itself and incubating. The place where it is first introduced is the place where it is first localised; but when the virus is once in the system its further extension is influenced by the conditions of the structure of the part, and it takes the direction of the natural roads of the organism, and is transmitted by means of the blood to any near or distant organ. The course it takes is, however, very different in different cases; and it is impossible to say in which organ a tuberculous action may be set up.

The importance of the point of introduction is strikingly illustrated by inoculation experiments. When a small piece of tubercle is introduced into the peritoneal cavity, there ensues

in the first instance tuberculosis of the peritoneum, spleen, and liver. After inoculation in the anterior chamber of the eye, the iris is affected; after feeding with tuberculous matter, the intestines and mesenteric glands; and when the subcutaneous connective tissue is inoculated, the disease develops in the nearest lymphatic gland; and lastly, after the inhalation of pulverised sputa, the lungs and bronchial glands are primarily diseased.

It is impossible for us to follow the course of the virus from place to place in the human body, but there can be little doubt that it would follow the same route.

The tuberculous poison probably in most cases enters the human system with the inspired air. My observations and experience in this disease indicate to me that no organ is infected with more intensity than the lungs, and I constantly find that the lungs, bronchial tubes, and pleura are sometimes the only places affected; and in numberless other cases the history of the sick and dissecting rooms teach us that the lungs are more frequently attacked than other parts of the body.

This can only occur through the inhalation of the poison, and as an hypothesis, is further strengthened by the frequency with which the pleura and still more the bronchial and tracheal lymphatic glands are attacked in the first stage of the malady, and often in such a degree that sometimes manifest tuberculosis pleurisy, and still more frequently advanced and wide-spread caseation of the glands ensues, whilst in the lung there are found only a few nodules or only slight symptoms of caseous infiltration. This latter assertion may seem paradoxical, but it is founded on a complete analogy of what occurs in the case of inspired particles of coal-dust which reach not only the lungs but the bronchial lymphatic glands and tubes with great certainty and speed.

We are as yet uncertain under what circumstances infiltrated or disseminated tuberculosis is produced by the inhaled virus. It appears, however, that the bronchial tubes and pleuræ become diseased either after or simultaneously with the lungs; and the anatomical relations of the air-passages with each other and the digestive canal furnish the channels for further

propagation of the disease as soon as a breaking down and ulceration takes place in the tubercular deposits.

Then a quantity of infecting material must necessarily leave the lungs, and in its passage over the trachea and larynx may take root and give rise to tuberculosis of these organs, and on its way either immediately or later on induce a similar state of affairs, in pharynx, palate, tonsils, tongue, and other equally exposed parts.

A certain portion of the matter will also be swallowed, but the passage through the gullet is too rapid; and there is also no doubt that the acid secretions of the stomach are not favourable to the assimilation and further development of the tuberculous poison in the œsophagus and stomach, where tuberculosis is very rare.

It has not, however, yet been discovered whether the gastric juice hinders the development of the poison, or whether it is really digested and destroyed. But it is often the case with consumptive patients, when large quantities of tuberculous matter have been swallowed, that the obstacle has been overcome, and catarrh of the stomach ensues. Infection will most likely ensue in the digestive tract, at points where the contents are longest delayed, such as the vicinity of the ileo-cæcal valve, the lower part of the ileum, the cæcum and descending colon. The upper and lower extremities of the tube are less exposed. It is easy to understand in what part of the intestinal wall the tubercle is likely to establish itself—viz. on those mainly where all received and absorbed substances are longest detained, such as the lymphatic apparatus of the wall of the stomach, and the agminated and solitary follicles.

They are, as is well known, the seat of caseating and tubercular ulcers of the bowels. Simultaneously with or immediately after the tubercular development in the follicles, the mesenteric glands become affected, while, on the other hand, the phthisical ulcers admit the poison into the branches of the portal veins, and the liver is endangered.

How often tuberculosis of the liver takes place is well known to those who have taken the trouble to examine this organ with sufficient care in all cases of chronic tuberculosis. Consumptive disease of the lungs and intestines so generally end

with this combination, that it represents the classical form of common lung disease; but further developments sometimes take place. The virus may pass through the stomach to the ductus communis choledochus and produce tuberculosis of the bile ducts.

But the transmission to the peritoneum from deep ulcers in the intestines is more frequent and more important. It is almost needless for me to remark that the virus inhaled from the atmospheric air may attack the larynx and trachea without infecting the lungs, a complication which has long been known to the profession as primary tuberculosis of the larynx.

Although tubercular disease of the intestines has been described as secondary to the affection of the lung, there are cases in which the poison is introduced into the system by means of the intestinal canal. I allude to those cases in which advanced tuberculosis of the bowels and mesenteric glands and peritoneum ensue without, or with only very slight, disease of the lungs; a form of tuberculosis rare in adults but common enough amongst young children.

The reason why young children are so exposed to this danger is illustrated by the experiments made by Gerlach, Klebs, Arth, and others, who have demonstrated to us the affinity between the virus of the Perlsucht of cattle, and that of human tuberculosis. And have furthermore proved that the virus of diseased cows impregnates the milk.

Whether the milk of tuberculous women has the power of transmitting the virus has, as far as I am aware, not yet been investigated; but the well-known prevalence of tuberculosis amongst cattle, and the wide-spread custom of bringing up children on cows' milk, on the other hand, offers an explanation of the frequency of primary consumptive disease of the intestines in children.

It is of no particular importance in the course of tuberculosis in the stomach whether the virus be introduced with swallowed sputa or milk. It is worth mentioning, in so far that we have observed that the mesenteric glands are highly affected, while the intestines are scarcely touched. Perhaps the influence of food in producing tuberculosis possesses even a wider extent. The question may, at least, be entertained, whether all the

so-called scrofulous inflammations of the lip, mouth, and pharynx, especially the caseated swellings of the lymphatic glands, may not have to thank the tubercular virus contained in the food, and more particularly in the infected milk, for their origin.

A subject of more remote importance, and one that, as regards its bearing with respect to syphilis, offers a particularly interesting subject for discussion is *uro-genital tuberculosis.* If the virus from tuberculosis of the uterus is ever transmitted *in coitu* to the male, such a case must be exceptional; but what is still less likely is that a man suffering from tuberculous disease of the lung, or any other organ, may transmit the virus to the mucous membrane of the woman during the act of copulation.

Such cases, I say, are of very rare occurrence, and therefore not so worthy of our consideration as the more general way in which uro-genital tuberculosis is produced. As a rule, it is a disease of excretion. The virus, from whatever source it has become impregnated with the juices of the body, like other foreign substances in the blood, is excreted by the kidneys, and most probably, like cinnabar particles, oil-drops, milk-globules, and bacteria, through the glomeruli.

It is by this means it gets access to the urinary passages, and tuberculosis may ensue, on whatever point it gets a hold. This most frequently takes place in the canaliculi of the pyramids; but the disease may break out in the pelvis of the kidney, in the ureter, in the bladder, and even in the prostatic portion of the urethra. It is only the first outbreak which requires explanation, for if this once takes place it will spread quickly through the connecting channels of these particular organs. The virus passes with the greatest ease in the direction of the urinary passages. It may pass from the kidney to the other ureter, and ascend to the other kidney; most frequently, however, it is the urethra that is attacked. In the male, the prostate will now be affected, and the virus will pass thence by the ducti ejaculatorii to the seminal vesicles, and onwards to the vas deferens, the epididymis and testicle; but it can also pass directly where the ureter and vas deferens cross. In the female, the urinary tuberculosis takes the

same course; but as regards genital tuberculosis in her case, its virus rarely attacks the vagina, while it will frequently infect the tubes and the uterine mucous membrane. The anatomical structure of her form, however, renders it highly improbable that it can pass through the urinary passages. In the greater majority of cases, the virus passes from the tubes into the peritoneum, which is scarcely ever found free from tubercle, in genital tuberculosis in the female.

Although a close analysis shows that uro-genital tuberculosis is seldom a primary outbreak, the same cannot be said of all parts where the tubercle establishes itself. In meningeal tuberculosis, for instance, we cannot deny that in cases of persons who have died of chronic consumption, in whom the final catastrophe was hastened by disease of the membranes of the brain, no deposits have been found, post mortem, either in the lungs or neighbouring glands. This is particularly observable in cases of children. Besides this, how shall we account for the presence of the virus in the pia mater, so distant as it is from the other infected organs? It appears to me most probable that the virus has been transmitted in a direct manner to the brain; and although I do not feel certain about the truth of Weigert's theory, that the poison gets access to the brain through the nostrils, and passes thence through the foramina of the ethmoid bone, I certainly think that it deserves consideration.

Cases of primary tuberculosis of the bones are still more puzzling. Naturally every acute-angled kyphosis is not of a tubercular character, any more than those thickened white exudate masses which fill the hollows of a carious bone are infectious, for a suppurating thickening and a caseating one are not the same, and we have also learned to distinguish between caseation and caseation. But there are, nevertheless, cases of unquestionable tubercular caries; and we now know, if not all, yet a good many of these fungoid inflammations of the joints are unquestionably of a tubercular character, and such diseases are often found in individuals in whom the most careful clinical and anatomical examinations have failed to discover any other localisation of tubercular deposits. Although in most cases the development of tuberculosis has been traced

to injury, yet it is not to be supposed that it can beget the tubercular poison; and as far as I can see, the only conclusion to be arrived at is that the virus is already circulating in the blood, and that the inflammation resulting from the injury attracts the poison from the bloodvessels and makes it settle in the tissues. The idea is one that is well supported by the experiments which have been made with respect to cinnabar and other particles which have been found in the blood. We shall frequently further on have to touch upon the subject of the propagation of tuberculosis in the blood through the medium of the circulation. There is no conceivable reason why, if the poison exists in the lungs, it may not circulate in the blood, and by this medium be transmitted to other parts of the organism. As a rule, transmission of the tubercular poison through the medium of the blood rarely occurs, in consequence of the small amount of poison which exists in it. It may, nevertheless, occur under peculiarly favourable conditions, and metastatic tubercle comparable to the most developed forms of metastatic inflammation is sometimes found.

Metastatic tubercles are often found in the bodies of sufferers from common phthisis. Sometimes in the brain, another time in the bones, then again in the kidney, intestines, lymphatic glands and spleen.

Direct transmission may occur through the mode of infection, from the peritoneum to the spleen, through the lymphatic of the diaphragm to the pleura, from the pleura to the pericardium, from the pia mater to the dura mater. It is, consequently, no matter of surprise that in certain exceptional cases a very great number of organs may be affected with tubercle.

CHAPTER III.

Acute Miliary Tuberculosis—Local Tuberculosis—Spontaneous Cure of Tuberculosis—Syphilis and Tuberculosis—Secondary predisposition—Absence of Primary Predisposition—Conclusion.

THERE are certain cases of tuberculosis which are strikingly distinguished in the manner alluded to in the last chapter; that is to say, the disease not only attacks numerous organs in the body, but effects this in a very short time, sometimes even in the space of a few weeks. It is commonly called acute miliary tuberculosis. Its mode of proceeding is so different from the course which tuberculosis usually takes, that pathological students have been at a loss to account for this peculiarity.

Among the various theories which have been advanced concerning this phase of the disease, none have been discussed in a more energetic manner than that of Buhl, who maintains that in addition to the different miliary tubercles there always pre-exists in the body a more ancient deposit of caseating matter, which he thinks forms the starting-point of the acute eruption.

The above formulary is, however, of no value to persons who in those times regard tuberculosis as a contagious malady, as we consider the caseating nodules a part of tuberculosis and a production of the same virus. What we now have to consider is not the infectious tendency of the nodules, but their *origin*, and why it is that the virus has the power to spread so rapidly in so short a time. The only explanation of the matter to my mind is, that the blood has become contaminated in a short time with quantities of virus; and the whole course of acute miliary tuberculosis would become perfectly comprehensible,

if we could demonstrate that the bloodvessels have become flooded with an overflow of the poison.

It is very interesting to learn, in illustration of this, that Ponfiek has observed tuberculous and caseating infiltration of the thoracic duct in cases of miliary tuberculosis. The latter, however, can only be of rare occurrence, judging from the fact that during the two years which have elapsed since Ponfiek's communication, I have only been able to report one case of disease of this duct in acute miliary tuberculosis; and in consequence of this, I think that another circumstance to which Weigert has lately drawn our attention is of more importance to the question at issue. He found mainly in many cases of this particular form of disease tuberculosis of the bloodvessels of the lung, and also a very characteristic case of that of the pulmonary veins. There was also local tuberculosis of the pleura and the bronchial glands in the mediastinum; and a large quantity of the caseating matter projected into the wall of the pulmonary vein and even into the lumen of this vessel.

Further investigations will determine as to whether in cases of acute miliary tuberculosis, *hitherto unknown localisations* of the disease play an important part. We may, however, say, with the proofs now before us of tuberculosis of the pectoral duct and particularly of the pulmonary veins, through the rapid overflowing of the bloodvessels, that acute miliary tuberculosis has lost much of its mysterious character.

In direct opposition to acute miliary tuberculosis we find those cases in which the disease is confined to one or more organs. They are by no means infrequent; and young persons perfectly healthy in every other respect, with the exception of a pair of caseating glands on either side of their necks, present the commonest study for the clinical surgeon. On the other hand, we find in the corpses of old men, such as the denizens of hospitals, who have succumbed to some affection incidental to old age, but a very small manifestation of tubercular eruption in a lung or pleura; all other organs being free from even a trace of the disease. Again, we have the fairly numerous amount of cases of fungoid tuberculosis in inflammatory articular affections, presented by persons who are otherwise perfectly healthy, and who are interesting to us at the present

moment in consequence of the illustration they afford us of *local tuberculosis.*

Notwithstanding the above examples, I am forced to agree with Volkman that this term 'local tuberculosis' has not been happily chosen. How many organs must be engaged in the disease to justify the application of the term *local?* and how many to justify that of general tuberculosis? In a locally progressive infectious disease like the one at present under consideration, it does not help the diagnosis of the case to tell us how far it can spread, but only if it is capable of spreading, that is to say if it is infectious. Either the nodules or caseating masses are, or they are not. The position or the number of the nodules cannot prove anything, but if there be any doubt on the subject we must have recourse to experiment, and the latter has long decided in favour of the contagious nature of local tuberculosis. And on this point I wish it to be understood that I do not allude merely to scrofulous glands, but also to the fungoid masses of tuberculous synovitis, the infectious character of which has been proved by many highly successful inoculation experiments, sometimes with the usual, at others with a prolonged stadium of incubation. Amongst those inoculation experiments, those of Koeing on rabbits with the virus of articular growths deserve mention.

The circumstance of tuberculosis, in spite of its eminently infectious properties, being sometimes '*local,*' that is to say confined to one particular organ, is not in my opinion inaccessible to explanation. Who can say but that the local tuberculosis of the old man has not been prevented by death from spreading further? We cannot, however, explain away by the shortness of life, the fact that persons with scrofulous glands, sometimes live years and scores of years without becoming phthisical. It must also not be forgotten that tuberculous infection may be overcome in the human organism. It is impossible at present to determine in what way this is brought about, in consequence of our ignorance at the present time of the qualities and biology of the tuberculous virus, and it is a question for general discussion as to whether the virus by some means or other has been extirpated from the system, or that it has lost its capabilities of proceeding

further. But there is no doubt that it can heal; pathological anatomy has long ago made us aware of the fact that cretification and cicatrisation may ensue after exudation, ulceration, and undoubted tuberculous processes have taken place. It is uncertain how long a time may elapse before this result takes place; meanwhile the virus with its original contagious properties remains in the system, without new tubercles or caseating nodules forming in other organs.

To those persons, however, who find it difficult to understand that the effects of infection may not pass beyond the part where it first develops itself—for example the nearest lymphatic gland—to such persons I shall say, look to facts presented in syphilis. How often under judicious treatment does it not happen that the cutaneous eruption or the sore throat takes place without further injurious development? How many cases are there not which come under our notice as specific infection, where a local ulcer will form, and swelling of the inguinal glands ensue without the rest of the organism being in the least affected? It is not my intention to enter on the discussion as to whether it be the soft chancre or the hard (with its train of consecutive constitutional effects), which belongs to the last category of disease; as if I am not mistaken the advocates and believers in the dualistic theory are fast vanishing from the scene.

The discovery of the mixed chancre has shown us on what a narrow footing the dualistic theory stands, and, as far as my knowledge extends, it never found many adherents among pathological anatomists.

The specific ulcer without any secondary disease of the body, and, as a rule, the soft, and sometimes even the hard chancre, resemble local tuberculosis, that is to say fungoid tuberculosis of the joints and scrofulous necks; while constitutional syphilis corresponds with the disease we term common tuberculosis, or which might, with quite as much reason, be called constitutional tuberculosis.

But we can adduce another circumstance which will help us to understand temporary or local tuberculosis. It has long been a well-recognised *fact that the complete disappearance of a specific affection is no guarantee for a complete cure.* For years

after, the virus which has been dormant in the system will break out anew. The reason why the poison remains so long inactive has not yet been explained; the most plausible explanation, to my mind, is that the delay is not caused by any inertness on the part of the virus, but rather by an increased resisting power in the constitution. The same thing is observable in tuberculosis. But this, be it observed, is totally different from a diminished sensitiveness to the effects of the tubercular poison *ab initio*, and refers only to the powers of the constitution of retaining in abeyance for a certain period the latent virus pre-existent in the system.

That our species is in a very high degree susceptible to it is proved by the long lists of mortality in every place, and it is difficult to say, as Volkman thinks, whether rabbits and guinea-pigs are still more so. It is interesting to observe that all individuals are not equally susceptible. But we are not going to discuss the primary susceptibility, as I have before stated, but the susceptibility of the further spreading of the virus in the body, and the resisting power of the same to the propagation of the disease.

Inoculation experiments prove that this greatly varies in the animals operated upon. When equally large portions of the same caseating lymphatic gland are inserted into the peritoneal cavity, or into the anterior chamber of the eye of a number of rabbits and guinea-pigs, the outbreak of tuberculosis takes place about the same time and in the same manner in all of them, but the further course of the process exhibits a very great diversity. One animal may succumb in about five weeks, and, on examination, tuberculous nodules and caseation are found in almost every organ—the peritoneum, liver, spleen, lymphatic glands, the lungs and vascular walls, etc., etc. A second will live over two months, and a third three months or more. In the latter the eyes and the lungs are infiltrated with masses of tubercle, and in the former the respiratory organs are entirely free, while the lower part of the body is greatly affected in every organ. In a fourth the eye is completely destroyed by caseous panophthalmitis, while the animal remains in other respects perfectly sound; there is no wasting away, its appetite is good, its action is lively and

robust, and when it is killed, after several months, there is no appearance of disease except in the eye. We can only account for the difference in behaviour of the virus, when it is once introduced and takes root, by supposing that the reason is to be found in the individual constitution of the animals and the state of their organs and tissues.

Analogical differences will also be found in human beings; that is to say, as soon as it has entered the constitution in one case it will incubate and infect every part more or less with tubercle. In another the virus will meet with resistance; some organs will escape entirely, and the poison will, for a longer or less time, remain localised. If anyone endeavour to account for this by attributing it to the difference of constitution among people, I have nothing to say against it; but *I do not wish* these particular constitutions to be distinguished by the terms *phthisical habit of body, or the reverse.*

This so-called *phthisical habit* of body has nothing to do with a facility for receiving the virus, but is a product of the disease. Persons possessing the *phthisical habit* are not more disposed than others to receive tuberculosis; they are *already tubercular.* They have either contracted the disease in early life, or, what is far more likely, have inherited it.

The fact that tubercular consumption is hereditary has been proved a *thousand* times over, hence the great dread of the disease experienced by the laity; and it is also certain that the taint may be inherited on the father's as well as on the mother's side.

Translated according to our views this means that the tubercular virus can be transmitted in the generative processes on either side, both *viâ* the semen and the ovum; but whether it can be transmitted, like the small-pox poison, by means of the placental circulation from the mother to the embryo is another question.

Syphilis and tuberculosis differ in so far that inherited syphilis manifests itself in the offspring before or soon after birth; while in the case of the tubercular poison the development takes place much later, sometimes after a period of several years; at least in its form of characteristic nodules or caseous deposits. But the virus in some form or another is

dormant in the system, and this, as I have before stated, constitutes the so-called *phthisical habit of body*.

The whole history of tuberculosis consequently turns upon these two things, viz.: the peculiar properties of the virus, and its effects. According to our ideas at the present time, every one is tuberculous in whose body the virus has taken root; and there can be no more predisposition in anyone to tubercle than there is to syphilis, although it may happen that one person exposed to the same contagion is more easily affected than another.

Neither is there any constitutional predisposition which causes hyperplastic or inflammatory products to caseate like tubercle, instead of being absorbed or changed into connective tissue. It is only those pathological products that undergo the specific change which are already the product of the tubercular virus.

Beyond this there is nothing in the existing history of tuberculosis wherein it differs materially from other local contagious diseases; the fever even is not pathognomonic. On the contrary, there are many scrofulous and tuberculous cases without fever, and it is sometimes difficult to decide the nature of the disorder until the nodules develop with their inflammatory processes. And, still further, how varied and diverse are the symptoms, even after the lungs, intestines, and cranial membranes are attacked; and do we not all know how difficult and sometimes impossible it is to diagnose the tuberculous nature of an ailment?

If I were to enter more closely into particulars concerning this disease, I should pass the limits and object of this small treatise. I shall, however, in conclusion, draw the attention of my readers to the deep analogy existing between tuberculosis and a disease which has often been mentioned during the course of this treatise, viz., *syphilis*.

The circumstance of Virchow having coupled the two together in his work on ulcers, under the name of granulation ulcers, proves that the analogy between them has long been recognised in our profession. We have to thank pathological experiments, however, for a confirmation of this morphological similarity; and what is still more important, for a knowledge

of their homogeneous etiology and homogeneous developmental processes. And the results which have been achieved are a sufficient answer to those persons who, through mistaken philanthropic kindness, object to scientific researches and investigations through experiments on the living animal. The latter have taught us more in a few years than clinical and anatomical investigations, with respect to syphilis, would have done in centuries; for up to the present day we have been compelled to refer to statistics for many syphilitic affections, although their inadequacy in furnishing pathological information has long been recognised; and it is entirely in consequence of the introduction of experiments that the numerous conflicting opinions, respecting many important affections in connection with constitutional syphilis, have been cleared up and placed on a solid basis.

For the above reason it is that I wish particularly to dwell on the analogy between syphilis and tuberculosis; and the pivot upon which this important subject turns is the question respecting the contagious properties of tuberculosis.

That direct transmission of the disease from one person to another is not only possible, but probably often takes place, is not only proved by the foregoing pages, but it is further confirmed by many treatises in medical literature on the subject, which are worthy of our consideration. But it must be left to future researches to ascertain the conditions under which the transmission takes place.

PART II.

CONSUMPTION AS A CONTAGIOUS DISEASE, WITH ITS TREATMENT.

PRELIMINARY REMARKS.

Antiquity of the Contagious Theory—Need of its Ventilation in England.

A CAREFUL perusal of the foregoing treatise cannot fail to convince every impartial member of the profession that Professor Cohnheim has been eminently successful in placing on a sound basis, and demonstrating to a certainty the contagious character of consumption.

The tardy and very limited acceptance of this view of the causation of phthisis, in the United Kingdom, together with a strong conviction founded on intimate experience in the human subject, and observation on the lower animal of the truth of contagion as a medium in the propagation of *tuberculosis*, furnish the reasons which induced me to lay before English readers the very able and important *brochure* of the illustrious Professor of Leipsic.

There is ample evidence to those who look about that this theory, and these facts in connection with contagion, require ventilation in England. Drs. Sanderson, Wilson-Fox, and others, have done much to familiarise their countrymen with the new views. Still, there can be little doubt that the doctrine of contagion, as regards tuberculosis, is one of slow growth amongst the older members of the profession in Great Britain and Ireland, in marked contrast with the views long and universally held in Italy and Southern Europe; where not only the laity, but the brightest orna-

ments of the profession, with very limited and intermittent dissent, have, since the time when Galen sent consumptive patients to Pompeii to inhale sulphurous volcanic exhalations, been orthodox believers in the infectious nature of tuberculosis.

To my mind these opposing theories are to be explained by the different climatic conditions.

In England and in higher latitudes in both hemispheres, the minds of men seem to have been heavily and traditionally weighted with the dread effects of the catarrhal causes which they saw around them; for until Sir Alexander Tulloch noticed the havoc wrought amongst our troops in the West Indies, the profession in this country were either oblivious, or in entire ignorance of the existence of consumption in tropical climates. But it may be said, *tout cela est changé!*

Great advances no doubt there have been, but those who believe that such change of opinion is at all general, I will refer to a leader in the *Lancet,* November 23rd, 1878, headed 'Experience on the contagion of Phthisis,' of which the following are the opening sentences: 'The remarkable instance now and again seen in which persons, without hereditary tendency to phthisis, become phthisical after long-continued attendance on sufferers from the disease, have suggested to many physicians the idea that phthisis is contagious. *If there be such contagion,* the mechanism has been supposed to be the inhalation with the breath of fine particles of tubercular sputa, atomised into the air by the patient's cough.'

The above sentences show that in England the question is only beginning to receive the attention it deserves, and a recent publication in the United States * attributes the causation of consumption almost exclusively to catarrhal, bronchitic, and pneumonic sources. Everyone must be aware that the older English clinical observers were in the habit of attributing the frequent occurrence of the disease amongst hospital nurses to the depressing nature of their occupation, and amongst the female members of the same family to hereditary predisposition; seemingly forgetting the fact, as regards the former, that when

* Dr. Loomis on 'Consumption.'

occupied in attending non-tubercular patients their equally depressing employment eventuated not in consumption, but some other disease, and as regards the latter that the male members often escaped because of their outdoor occupation.

Moreover if further evidence, indirect and negative though it be, were needed of the almost exclusive predominance of the catarrhal or pneumonic origin of consumption in this country, I might say that it is within my own knowledge that practitioners of fair standing recommend India as a suitable residence for poitrinaires. Than this there could hardly be a more fatal illusion. At the same time I admit that persons with weak chests and those predisposed to inflammatory lung affections and showing no symptoms of the so-called phthisical habit of body, might derive benefit from a winter sojourn in that country—a totally different thing, be it observed, from making it one's home during a number of years.

So much for the influence of England and its climate.

In Italy, on the contrary—a country celebrated during centuries for its numerous, large, and crowded cities, and possessing a warm climate, we find, as might be supposed, the most favourable conditions under which to demonstrate the contagious nature of the disease under consideration. But that crowded cities are not essential to the maintenance of the contagious view, the example of the almost tropical Canary Islands * affords evidence, for there phthisical invalids are looked upon as little better than lepers, are kept in a species of quarantine, and subjected to many vexatious restrictions in their intercourse with the indigenous population.

Thus latitude seems to be always associated with the contagious theory. In France, with a climate approaching that of Italy and Southern Europe on the one hand and that of England on the other, mixed ideas of the etiology of tuberculosis have always prevailed.

That consumption is more fatal the nearer we approach the tropics has been proved, and will be generally admitted, and that this is in a great degree to be attributed to the small

* See letter in *Times*, January, 1880, from Don Horatio Wetherall, British Consul, cautioning invalids against those islands.

liability to confound the disease with bronchitic and pneumonic inflammatory phenomena, there can be little doubt. There is less danger, in fact, of confounding the curable with the more fatal disease from the rare occurrence of the former.

From the above remarks, it must appear evident that I agree with Professor Cohnheim in attributing to consumption a specific and probably something of parasitic origin. Such in fact, after mature consideration, is my opinion; for eliminating from the etiology of tuberculosis all pulmonic inflammatory attacks, it is not difficult to prove that every other known cause, be it predisposing or exciting, supports the contagious theory of the disease.

I have seen in England as in India certain cases of fatal consumption with most distinctive characters, both ante and post mortem, when the possibility of hereditary taint and the medium of contagion might fairly be left out of sight. But from the number of such cases being comparatively few, coupled with the insurmountable difficulty of correctly estimating the antecedents of patients, there is a strong probability that even here the bronchitis, or the pneumonia, or the pleurisy, or the hæmoptysis was the force—a potential one if you will, that called into activity the latent and hybernating pre-existent tuberculosis. The sufferers, as Cohnheim says, were already tubercular. And from the existence of such wide-spread sources of contagion, both hereditary and acquired, it is impossible, reasoning from the analogy of what appertains in other specific affections, to deny the force of this assertion, particularly when we remember the great tendency tuberculosis has to combine with inflammatory products, which may sometimes form a suitable nidus for the germination of the poison.

In this secondary and stimulating light, catarrhal affections, particularly in colder climates, are causes of consumption, but in none other; and it is as an effort to support this view that the foregoing translation and the following remarks are laid before the profession.

CHAPTER I.

Histogenesis of Giant Cells—The Introduction of the Tuberculosis Virus into the System—The Experiments of Max Schottellius and Tappinger—Tubercular-producing Power of Non-specific Agencies disproved—Minor Inoculation Discrepancies—An Illustrative Case—Food as a Medium of Contagion—Chronic Bovine Tuberculosis—Its Importance to the Infantile Population—Acute Bovoid Tuberculosis—Secondary infective Processes.

In the following pages I shall discuss, first, some of the most important questions brought forward by Professor Cohnheim, paying particular attention to such as still remain *sub judice*, and shall endeavour as far as possible to confine my remarks to theories and facts bearing on consumption as a contagious disease.

And, secondly, as all our knowledge must eventually assume a permanent or transitory character, the one or the other prevailing in so far as it enables us to prevent, alleviate, and cure disease, it may not be uninteresting or useless if an attempt be made to ascertain how far the contagious and corpuscular etiological views of tuberculosis may assist this *object*.

Thirdly. Under the latter heading, as having an immediate connection with confinement and domestic surroundings, as facilitating the spread of contagion, some attention will be devoted to winter health-resorts—including observations on the therapeutic value of mountain-air, to the antiseptic properties of which Drs. Clifford, Allbutt, and Burney Yeo have lately drawn attention.

Giant Cells.—In following seriatim the anatomical history of tuberculosis as given in the treatise by Professor Cohnheim, the first point that attracts attention is the prominence given to the appearance of *giant cells*, which, as first described by

Langham, are frequently seen with nuclei against their walls in the midst of the lymphatic cells which form the basis of the nodule.

The existence of these giant cells in connection with tuberculosis, or with attendant inflammatory processes, is a subject on which such varying views are held, that I think we may well say we are at present in possession of no definite information concerning them. A correct view of their origin and development is no doubt of great importance; but in the present state of our knowledge, which is accurately expressed by the aphorism, *Tot sententiæ tot homines*, it is necessary to postpone our opinions as to their pathological and diagnostic significance.

Cohnheim's views, as we see in the treatise, are at variance with those of Zeigler and Buhl.

Again, Virchow traces them to no special or distinct origin, but leans to the opinion that they arise mainly from connective tissue corpuscles, at the same time admitting the possibility of their proceeding from endothelium, epithelium, and muscle and nerve fibres.

Wagner agrees with Virchow in tracing their origin to connective tissue corpuscles, and thought he was able successfully to follow the transitional stages from the branched cells of the recticulum to the ramified and many-nucleated giant cells.

Schüppel, at a later date, stated his belief that they commenced in the bloodvessels from protoblasts, which, at first finely granular, now nucleated, and without well-defined outline, soon became more sharply contoured and nucleated internally.

Such protoblasts, he was of opinion, had their seat and passed through their metamorphosis in the small veins, or rarely in the capillaries, and still less frequently in the small arteries.

Schüppel's opinions were partially confirmed by Brodowski. He placed their seat in the bloodvessels, but thought they arose from proper germs which acquired an inordinate productive activity.

Klebs believed they proceeded from coagulated albuminous

* See *Lancet*, 1879.

bodies. Cacciola suggested a different view, and regarded the giant cells as only transverse sections of thrombosed blood-vessels, or lymphatics; these nuclei being wander-cells, or proliferated endothelial cells.

Köster, Hering, and Gaule attributed their origin to lymphatic vessels, or to hypertrophy of their epithelial cells. Zeigler thought the giant cells were but white corpuscles, which had escaped from the vessels and taking up other cells into their interior, the nuclei of which divided while their protoplasm was applied to the nutrition of the growing giant cells.

Laughans and Weiss were under the impression that they proceeded from the coalescence of granulation or other cells. Lubimon, from an examination of specimens in tuberculosis, maintains that giant cells found in the foci of this disease are independent formations, like other cells, and that they begin from a cell by increase of the protoplasm and multiplication of the nuclei. In tubercular peritonitis, and tubercular disease of the lymphatic glands, they arise within the lymphatics, and, indeed, from the proliferating endothelial cells, which in tuberculosis of the testis—that is to say of an organ, presenting connective tissue and gland tubes—the cells in question arise from the growth of the epithelial cells on the one hand, and from connective tissue corpuscles, on the other. Thus he concludes giant-cells may owe their origin to structures of very different nature, in which conclusion few will be found to differ from him.

From the above collection of opinions with reference to the histogenesis of giant cells, it will at once appear evident that their presence or absence is of no particular importance, as helping us on the road to the discovery of the exact character of the tubercular virus.

So far histology has given us only negative results, and Profesor Cohnheim, in opposition to the dictum of Laennec and Virchow, tells us that no single phenomenon, or collection of phenomena, clinical, pathological, or anatomical, is pathognomic of tuberculosis. The only infallible test being the power of the virus contained in the caseated nodular, scrofulous, or inflammatory debris to reproduce the disease; and it has

occurred to me that this view may be briefly and forcibly expressed by the phrase, *Omnis Tuberculosis e Tuberculose.*

The word 'infallible' I use advisedly, for, clinically speaking, we can hardly doubt, at least for all practical purposes, the fair reliability of the train of symptoms and auscultatory signs we are accustomed to associate with consumption; and as much may also be conceded to anatomical appearances.

But whether we agree with Laennec in including caseating pneumonia as an infiltrated tuberculosis, or exclude it from that category with Virchow, or deny that any local manifestations afford criteria of the disease, practically the pneumonic processes, as exciting and vivifying agents, will ever remain intimately associated with tuberculosis, and should suggest, from whatever point of view we examine them, the necessity, at an early date—and when alone it may be of inestimable value—of a prolonged sojourn in a warmer, drier, more sheltered, and sunnier land.

Test of Tuberculosis founded on the Results obtained by the Introduction of the Virus into the System.

As regards the infallibility of the test by inoculation and other channels of introduction, we shall now say a few words.

The first thing that strikes us on examining this subject is the contradictory results obtained by different experimenters. These contradictions, however, do not affect the main question of the inoculability of the virus, and the consequent production of tuberculosis, exhibiting, like syphilis, primary, secondary, and even tertiary phenomena in the body of the animal in which the poison is introduced, either by inoculation or per vias naturales.

Thus Villemin's original assertion that *tubercular matter,* if introduced into the body of a living animal, will become tubercular is still correct. But the opposing results are sufficient, at all events at present, to lessen the force of the doctrine *that tubercular virus, and it alone, will produce tuberculosis,* at least when viewed from the standpoint of the anatomist.

Cohnheim affirms, and from the great attention he has given

to this subject, combined with magnificent opportunities afforded by his position in the pathological chair at Leipsic, his affirmations are entitled to the very highest respect, that tuberculosis can only be produced by tuberculous matter, and that every symptom of tuberculosis is manifested by the animals experimented upon, and none other. And, again, he remarks, speaking of the similarity existing between the deposits induced by the inhalation of mechanical and chemical irritants, inflammatory fibrous nodules, hard ulcers, slaty indurations, etc., and processes produced by tuberculosis: 'if we inoculate a rabbit with any of the former products it will not become tubercular, a result which never fails if the inoculation be performed with the true virus.'

But we must also recollect that, according to him, all scrofulous deposits, caseating pneumonia and orchitis, as well as fungoid articulations, are tubercular and contain the virus. Thus we are led at once summarily to exclude all the diseases induced by non-specific mechanical and chemical inhalations from the category of tuberculosis, and ought, consequently, to hear no more of miners', knife-grinders', wool-carders', and other forms of so-called phthisis, which might be multiplied *ad infinitum*.

This view will, I imagine, also recommend itself to the clinical observer, who cannot but recognise a wide difference (unless where a septic element steps in) between those very chronic local affections and tuberculosis.

For the same reason, namely, their failure to produce tuberculosis when introduced into the economy, we must eliminate *caseated* sarcoma, myoma, and lupous nodules, the latter of which have, heretofore, been looked upon by many as closely allied to phthisis.

So much for Professor Cohnheim. Now let us hear Max Schottelius, who made experiments not only with the sputa of consumptive individuals, but with that of persons suffering from simple bronchitis, also with well pulverised cheese, brain, and cinnabar.

The result was that miliary tubercles were found in the lungs in all cases, and in equal quantity with both tubercular and bronchitic sputum. Cheese produced a smaller quantity,

pulverised brain less, and cinnabar least of all, merely a few whitish tubercles, with pigmented centres, with an interstitial deposit of the substance, which caused no inflammatory reaction.

Tappinger has also experimented with calves' brains in two cases, with only negative results—no change in the lung following from the introduction of the tubercular sputum.*

Professor Coleman, quoted by Professor Aitken of Netley, was of opinion that he could produce phthisis in the horse by confinement in close stables combined with bad and insufficient food; and the late Dr. Carswell, Professor of Pathology in the University of London, is said to have induced tubercles in rabbits by merely subjecting them to the influence of a vitiated atmosphere; and it is also said on good authority that most of the animals which die in the Zoological Gardens in Regent's Park exhibit tubercular ulcers in their lungs.

These discrepancies, however worthy of consideration, do not, I submit, overthrow the doctrine of Cohnheim; it is no doubt difficult to explain away the results following the bronchitic sputa in the experiments of Max Schottellius, but it is important that the record takes note only of the anatomical appearances, which as we have shown are unreliable. It is also open to say in all those cases that the animals may have been already tubercular, and that the non-tubercular sputa introduced, only acted as the exciting agent in calling into activity the latent disease; or we might reply, *though this has reference* more to the influence of impure air than to results following the introduction of non-specific germs, first, that the animals became infected by tubercular matter emanating from a diseased companion. Secondly, in the absence of such direct cause, that the specific poison—never stamped out—may simply accumulate in the air so imperfectly changed. Thirdly, as my old teacher Dr. Parkes says, it may grow in it; for though there may be an analogical argument against such a process, it has never been disproved, and is evidently not impossible. Fourthly, and lastly, the vitiated atmosphere may render the body less resisting or more predisposed to the morbific influence of the *attenuated poison*. Or possibly a concen-

* *Lancet*, November 23, 1880.

tration of all these causes may combine to produce the disease, which, in whatever way we may explain it, implies the presence either in the air or the body of a specific agency which must be looked upon as the vivifying principle, active or passive, in the life of tubercular consumption.

In going from the general to the particular, I will give one illustration which has reference to the animals in the Zoological Gardens, and which will show that the existence of the disease amongst them cannot be taken in evidence against the validity of the contagious theory, at least as regards the monkeys; for it is within my recollection that last winter there was a large monkey in those gardens suffering from phthisis in a sufficiently emaciated and advanced stage to infect, under the circumstances of his surroundings, all his companions: and if such a result is possible among one class of animals, may we not logically extend the argument and cry out *ab uno disce omnes?*

These remarks with reference to the lower animals are, I need hardly say, equally applicable to man, and especially so to our soldiers and those of other armies in whatever region they are found. The high mortality from this disease in military life is due to contagion aided by vitiated atmosphere, which appears to be inseparably connected with the barrack-room system.

Other minor causes, such as insufficient food, night duty, enforced celibacy and the evil it entails, may fairly be counterbalanced by the discipline, regular habits, drill and gymnastic exercises; the two latter of which must be held to contribute not only to the upright appearance but also in a marked degree to the chest development of the soldier.

Thus, however we look at it, we are driven to the conclusion that dirt, impure air, cramped position (as in many trades), want of exercise, bad food, crowded dwellings, and inflammatory lung and throat affections, cannot of themselves be held responsible for the production of consumption; we must be content to look upon them in the light of accessories.

For when, as Professor Aitken says, we consider how many persons there are who carry cleanliness to excess, whose diet is most studied and whose every exercise is directed to health, and who nevertheless die of phthisis, it is plain that a more secret hidden circumstance remains to be discovered to ac-

count for the existence of pulmonary consumption in this country.

Let us ask ourselves thoughtfully what is this hidden subtle agent that remains to be discovered, and our answer must be that it is a specific contagious germ capable, under suitable conditions, of reproducing its like; ever present, though in varying quantities, amongst the crowded haunts of man; exhibiting, by traits such as freshness and others which we do not well understand, considerable mutability as to its vitality and generative power; and tracing its ancestry back to a period of antiquity long antecedent to the time when the first-known germs of its analogue, the syphilitic virus, were carried to Europe in the person of a captain * of the horse, attached to the Hispaniolan army of the great Admiral Christopher Columbus.

This agent is probably of a parasitic nature, and is no doubt, reasoning from analogy (as no direct evidence is forthcoming), capable of being destroyed by heat, and many chemical and antiseptic reagents.†

Minor Discrepancies as regards the Contagious Virus.

In addition to those discrepancies bearing on the main question, there are some minor differences in connection with this subject. These differences have reference chiefly to the period of incubation, the order of parts attacked, and the degree of susceptibility displayed by the animals experimented upon.

The period of incubation, as noticed by Cohnheim and Salomenson, varied from fourteen to twenty days, after the lapse of which time, in dogs, as well as in the more susceptible guinea-pigs, the primary irritation in the anterior chamber of the

* The name of this celebrated captain is to be found in Acton's book.

† The destruction of the tubercular virus by heat seems inconsistent with the alleged prevalence of the disease amongst pathological microscopists, who often use chemicals in the preparation of their specimens. Phthisis in this class is said by some to be caused by their constrained position. This, in my opinion, can hardly be the case, as the same has been alleged as regard others, shoe-makers, for instance, amongst whom I have lately made some inquiries. Most of those whom I questioned, stated that they were unable to connect consumption in any way with their trade, and were of opinion that, as a class, they were not more subject to this disease than other persons.

eye became manifest; and in experiments made at Meran with the inhalation of tubercular sputa by dogs, Tappinger, after a period varying from twenty-five to forty-five days, observed well-developed miliary tubercles in both lungs, and in most cases tubercles were present to a smaller extent in the kidneys, and in some cases in the liver and spleen. This proves that secondary as well as primary disease can take place in the space of twenty-five days, in dogs, which are not supposed to be very susceptible, as they rarely suffer from spontaneous tuberculosis.

Some experiments were also made at Munich by feeding dogs with the same sputa as that used in the experiments by inhalation. Fifteen grammes (about one hundred and twenty-five grains) were mixed daily with the food of each dog.

In two dogs fed at Munich, miliary tubercles were found in the lungs after six weeks' feeding; but in six others, fed at Meran, all the organs were normal—a difference the explanation of which, as regards the atmosphere, the character of the food given, and the freshness of the tubercular matter, together with the previous state of health of the dogs themselves, would be of much importance.

In the experiments both of Cohnheim and Tappinger, the organ with which the virus first came in contact was the first to become tubercular, and the blood as a means of conveyance of the secondary disease seems, in consequence of the small amount of the poison which exists in it, unless in acute miliary tuberculosis, to play but a very subordinate part.

The following case, which I published in the *British Medical Journal* of the current year, is of interest in this connection. The rapid and severe course of the disease, and the symptoms exhibited, at variance with the experience of some other observers, can only be accounted for by the implication of the bloodvessels as a medium in the propagation of the virus, and the case must be set down as one of acute miliary tuberculosi. It also strongly resembles an infective form of this disease occurring in the bovine race, and which, in this severe phase, is held by some to be capable of being communicated to man.

To this form of tuberculosis I shall again allude.

Professor Cohnheim, we may recollect, describes how Ponfiek has observed tubercular infiltration of the thoracic duct, and how Weigert found disease of the bloodvessels of the lung in cases of acute miliary consumption.

A CASE OF ACUTE PHTHISIS FROM DIRECT CONTAGION IN A DOG.

Having read with great interest the remarks on Tuberculosis as a Contagious Disease in the *Journal* of May 8th, I send the following case, which contains many points bearing on the subject.

About six years ago, when I was acting as Residency Surgeon at Mandalay, a Bengalee servant, suffering from advanced pulmonary consumption, with copious expectoration, came under my notice. One of my dogs—a pariah—developing his natural talents as a scavenger, was, as I afterwards learned, in the habit of frequently visiting the house of the sick man, and lapping up the expectorated matter. How long this had been going on I cannot with certainty say; but a few days after the death of the man the dog appeared out of sorts, refused his food, rapidly emaciated, had a cough which increased quickly in severity, and was attended later on with a tenacious and glairy discharge from the mouth and nose. The stethoscope detected moist *râles* with rhonchus and sibilus over a greater part of the chest. These symptoms continued to grow worse for a week or ten days, when convulsive fits of about five minutes' duration, and occurring several times in the course of the day, made their appearance. These fits were of an epileptiform or tetanic character. The poor animal moaned a good deal and appeared in great pain, as he lay on his back reeling and kicking about. On the second day from the commencement of the fits, and about the twelfth from the beginning of the disease, there being but little hope of recovery, a large dose of prussic acid was given, which speedily proved fatal.

The *post-mortem* inspection was limited to the contents of the skull and the chest, as these were the parts supposed to be more prominently diseased, and in both were found lesions to

account for the symptoms during life, and their probable cause. Both pleuræ were adherent, the adhesions being recent; and the lungs were studded with softened patches, in varying stages of caseous degeneration, many of them containing muco-purulent matter, with which the minute and larger bronchi were also clogged. I did not notice the state of the bronchial glands. The brain did not show much signs of disease, and nothing similar to what existed in the lung. The membranes appeared thickened and congested, and on cutting them a good deal of serum exuded; there were no tubercular or cheesy deposits; the whole mass was uniform, and appeared softish, but I had no previous experience of the canine brain, and cannot speak with certainty.

Remarks.—This case shows that the lung of the dog is rapidly susceptible to the influence of the *materies morbi* of tubercular lung-disease, even when introduced into the system *viâ* the stomach, which, according to Cohnheim, is the slowest and least effectual mode of introduction; and it is the more worthy of notice, as he also states that dogs show little susceptibility, while rabbits and guinea-pigs have it in a remarkable degree. As European dogs are liable to degenerate in the tropics, and become an easy prey to disease, I may say that this dog was a native, had previously enjoyed good health, and, as the weather was not cold, I have no reason to believe that this acute affection was due to any other cause than contagion—the tubercular virus being fresh, and therefore in the state of greatest activity or supposed vitality. I regret that I failed to examine the contents of the abdominal cavity, as it would have helped to elucidate the order of organs attacked. The rapid emaciation is suggestive of mesenteric deposit and disease of the abdominal glands, and that such disease, if not of an earlier date, as the experiments of Cohnheim would lead us to believe, was at all events contemporaneous with that of the lung and pleura, and that both were long antecedent to lesion of the brain.

I am myself inclined to think that if the lungs were not the organs to suffer first, they were, judging from the extent of the disease, at all events the organs to suffer very early and most severely, which may be due to the greater facility for

arrest and exposure which the anatomical formation of their capillaries affords. Be this as it may, this case is somewhat exceptional, from the shortness of the stage of incubation, the comparative less susceptibility of the animal infected, the mode of introduction, and the rapidity of the disease set up, with the probable sequence of the parts attacked; all of which must be set down to the somewhat prolonged introduction of fresh tubercular poison from the lungs of a person in the last, and presumedly most contagious, period of phthisis. As it is open to say that the virus may also have been inhaled, I do not think this could have been so to an extent sufficient to account for the early severity of the lung-affection; for the other members of the family escaped *in toto*, and everybody knows that people are exposed to such risks every day without any immediate injurious results.

So much for the differences observed with regard to the minor points referred to. They are not greater, however, than the many phases of consumption would lead us *à priori* to expect, and only furnish additional evidence of the almost zymotic vigour of the virus, as exemplified by the rapid production of tuberculosis in its most fatal form, even when introduced into the lungs in what we may call a round-about manner.

While always remembering that there exists a strong consensus of opinion in favour of the inspired air as the most frequent carrier of the tubercular virus to the lungs and their appendices, and subsequently from these foci to other parts of the organism, we must, at the same time, from the examples which we have seen of the production of tuberculosis in dogs by feeding them with tubercular matter, not forget the weight to be attached to food as a medium of contagion in man.

This subject, in view of the prevalence of consumption in the bovine race, has lately received some attention, both in Europe and America, and is one of superior importance to the infantile population; particularly as regards the supply of milk in our large cities, where, as we shall show, the cows, from the state of confinement in which they are kept, are specially prone to suffer from this disease.

Dr. Heath, President of the American Farmers' Club, re-

cently read a paper before that society on this very subject of tuberculosis in domestic animals, and some of its effects on human health.

He says that this disease prevails extensively among such animals all over the world, and especially in populous and crowded localities. Just the conditions, in fact, which are believed to conduce to consumption in human beings, bring it about in the lower animals. Cows, for instance, which are kept shut up in close, foul air, as is the case with large numbers in and about London, are very liable to it. He says, also, that observations in Mexico led to the conclusion that thirty-four per cent. of all beasts slaughtered there showed them to be more or less affected with this disease, and he is of opinion that *fifty* per cent. of the cows kept in large towns are thus diseased. The fact that this is not more generally recognised is, of course, owing to the animals being slaughtered before the disorder has attained any very noticeable development. This, at any rate, is the opinion of Dr. Heath, as given in his own words. It is a little difficult to agree with his opinion at least in its entirety. Individual instances might occur, but that fifty per cent. of all our London dairy cattle should be tubercular and escape detection for the reason above alleged, appears to me open to this objection, namely: That as all black cattle are fattened to some extent before being slaughtered, the presence in them of tuberculosis would imply a certain capacity for putting on flesh, a capacity so rarely associated with the disease under consideration, that its very name—consumption—depends on a complete want of it.

The disease may, no doubt, exist without detection in a semi-latent or localised form, which, from what we have already said on this subject, may not be incompatible with resumption of health on the return of the suffering animal to its normal pasture, and, so much being granted, obviously not incompatible with the assumption of fat sufficient to ensure its safe reception at the shambles.

In whatever way the diseased animal puts on flesh, the above remarks are important in connection with increase of weight in the human consumptive, and his cure under suitable climatic conditions.

Again, Dr. Heath says that if cows were allowed to die from natural causes, the proportion succumbing to tuberculosis would be quite as great, and probably much greater than in the human subject. And it is the opinion of another eminent authority that there are few animals which have been kept for any length of time in the cow-sheds, and fed and milked in the usual manner, which are not more or less affected, especially if the cow-houses are bad.

The serious aspect of the matter, of course, is that it is probable that we have here one of the sources of this terrible scourge of human life—a disease which causes from a seventh to a fifth of all deaths. Not only is the milk of tuberculous cows very poor in quality, but it seems to have been sufficiently demonstrated that it is capable of imparting the disease to those who drink it uncooked. Klebs and Garlach have put the matter to the test by giving the milk of diseased cows to rabbits and guinea-pigs, with the result, as we have before shown, of developing consumption in them.

What has been done with inferior animals may, undoubtedly, be done in the case of young children, large numbers of whom contract this disorder from the milk with which they are supplied. The flesh of affected animals would be equally pernicious, but that it is cooked, and those who are compelled to use milk would do well to scald it before doing so, more especially during warm weather, when, as experience has shown, phthisis is not the only evil that may be lurking in the milk-can.

In France also this matter is occupying attention. M. Pench described before the French Academy a series of experiments he has conducted.

In one case he fed two of a litter of three rabbits on *diseased* milk; one of the three succumbed and the other was killed some time after, and both showed tubercular granulations.

Some other experiments described were hardly so conclusive. And in order to test for myself the correctness of these views, as far as observation can do so, I have lately been in the habit of making careful inquiries from amongst the numbers of children affected with primary intestinal tuberculosis, who seek advice at the North-West London Hospital, and have been

able in many cases to connect their disease with the milk drawn from cows kept in confinement.

For these reasons, and without going as far as Dr. Heath, and from the rarity of primary tuberculosis in adult life when uncooked milk is rarely used, we can no longer deny that children are in great danger of becoming infected from this source.

It is to some extent, however, satisfactory to know that grown-up people need not be seriously alarmed on this account; nor children to the extent that the uninitiated or non-medical reader might from a perusal of the foregoing remarks suppose.

For in adults, as we have said, no part of the gastro-intestinal mucous membrane has any great tendency to become tubercular, either primarily through the medium of the food, or in what we shall call an *intermediate* way by swallowed phthisical sputa, being protected by the acid secretions of the stomach, which seem to have a sort of parasiticidal power over the tubercular virus.

In cancer, on the contrary—a disease which has many points of resemblance with consumption, more particularly as regards the secondary semi-malignant infective processes of the latter, we find that amongst its favourite seats are to be reckoned the gullet, the stomach, and the lower bowel.

That this difference of location in the two diseases is not capable of explanation on grounds other than the protective influence of the gastric juice, I do not for a moment contend; but at the same time the subject is noteworthy in connection with the recognised therapeutic value of mineral acids, pepsin and quinia, in consumption particularly, as the latter is said to be an antiseptic agent of great power. But *revenons a nos moutons*.

In children, though the danger to them as regards consumption from infected milk cannot be denied, it is as well that no exaggerated notions on this point should prevail in the public mind; and it is to prevent unnecessary apprehension that I shall now say a few words.

It is calculated on good authority that the average duration of human life in this country is from thirty to thirty-three

years, and that one half of those born die before they attain the end of their fifth year.

This might at first sight seem to increase rather than quell the alarm, but on looking a little deeper into the matter we find: 1st. That tuberculosis in children, either from hereditary or acquired causes, never (as a rule) makes its appearance before the termination of the first dentition. 2nd. That Quetelet, the celebrated Belgian statistician, tells us that the deaths during the first year of infancy are one fourth greater than during the subsequent four years, and that the death-rate decreases in an inverse ratio for each successive year within this period, thus showing to a certainty that to causes other than consumption must be attributed to a great extent our enormous infantile mortality. And that these causes are intimately connected with the mal-assimilation of food from defective nursing, owing to the prevalence of the injuricus custom of bringing up children by hand, so encouraged in the lower classes by the luxurious habits of their superiors, the following statistics, taken from the records of the Manchester Children's Hospital, will fully prove.

Even the milk supplied by a wet-nurse for that of the mother is not, when it can be avoided, desirable; it is but a spurious substitute, having its own series of drawbacks, which this is not the place to describe.

TABLE No. 1.

ONE HUNDRED AND FIFTY CHILDREN REARED EXCLUSIVELY ON THE BREAST TO NINTH MONTH OR LONGER.

Well Developed.	Moderately Developed.	Badly Developed.
34, or 62 per cent.	35, or 23 per cent.	21, or 14 per cent.

TABLE No. 2.

FIFTY CHILDREN FED EXCLUSIVELY BY HAND.

Well Developed.	Moderately Developed.	Badly Developed.
5, or 10 per cent.	13, or 26 per cent.	32, or 64 per cent.

These statistics, though they give no death-rate, speak for themselves, and enable us to predict what, in ensuing years, will be the relative mortality as between the breast and the hand-fed children; and even further, how much defective nursing may influence deleteriously the second or tubercular period of infancy.

The remedy in the earlier period is the mother's milk (unless exceptional circumstances intervene), and when the time for nursing has passed, the child should have milk from pasture-fed cows, and from them only. Boiling is not sufficient: it may, and often does, destroy the virus existing in the tubercularly-tainted milk, but it cannot improve its quality, which is sure to be deficient as an agent of nutrition, if the cows from which it is drawn be anæmic and diseased.

That boiling gives no efficient protection when the animal whose milk is used is in an advanced stage of the disease, the following experiment, quoted by Mr. Fleming, F.R.C.V.S., clearly shows. But as it is the only case where a similar result followed the ingestion of boiled milk, its confirmation is desirable.

Six pigs taken from the litter of a healthy sow were experimented upon, four being fed with milk from a cow, which after death showed tuberculosis of the liver, peritoneum, ovaries, thoracic, and abdominal glands and pleura, with cheesy deposits in the lungs; two with uncooked milk, two with cooked milk, and the other two kept as control animals. After some months, the control animals were killed, and found quite healthy; those fed with cooked milk when killed, were affected with severe generalised tuberculosis; while of those fed with uncooked milk, one that died showed caseous enteritis, and the second, very unwell, was still alive. All the miliary tubercles in these had the histological characters of real tubercle, while the lymphatic glands showed the characters of these glands when tuberculous in man. The lymphatic glands of the throat had probably been infected from the pharynx, while the liver, and portal, and epigastric glands were infected from absorption of the virus from the stomach. From these experiments it would appear that in swine scrofula

is first developed from the milk, then tuberculosis—the one being only an advanced stage of the other.

Tuberculosis in the porcine species is always of the acute variety; while in the bovine species, as we have already shown, its prevailing characteristic is that of chronicity, as in the usual form in man. Goats and sheep are very rarely affected with tuberculosis, and the same may be said of the equine species—a fact worth remembering in connection with the use of ass's and mare's milk: the one as a substitute for that of the mother in infancy, and the other as a cure for consumption at a later period.

That the flesh of the tuberculous pig is more dangerous than that of the cow, from the nature of the disease in the former, there cannot be a doubt; though from its rapid course—a few weeks—it is necessarily more easily detected, and its use as food interdicted. In two feeding establishments in Bavaria, 75 per cent. of the pigs were affected with the disease, through 'in and in' breeding and the use of tuberculous milk. Five per cent. of the bovine species in this country are calculated by Mr. Fleming, from an analogy of what appertains in countries where public abattoirs exist, to be suffering from tuberculosis in one form or another. High-bred and stall-fed cattle are said to be very prone to the disease in England; yet it appears to be especially prevalent in Mexico (35 per cent. of all animals killed*), where the cattle roam at large, and are certainly not of the purest breed. These facts are somewhat difficult to reconcile. Moreover, as regards Mexico—a country possessing three different climates, depending on the altitudinal range, records to be valuable should, in this particular, be exact. For on the highlands, which form a large extent of the country, immunity from consumption exists among the population; and it is contrary to all our previous knowledge that, with this association, bovine tuberculosis should so largely prevail. Either there is some error as regards the quadruped or the bimana, or their diseases are not identical; or, what is more likely, the Mexico spoken of by Dr. Heath has

* According to Dr. Heath.

reference to the plains or prairies bordering on Texas—once a Mexican province—so celebrated as a grazing ground.

My own experience, founded on a recollection of many years' residence in a pastoral district, is that tuberculosis does not exist among cattle, at least in Ireland, to any appreciable or dangerously contagious extent. It is true this is only an opinion, but as yet there is no other description of evidence forthcoming in the United Kingdom.

This, I need hardly say, does not apply to our city dairies and cow-sheds, where the cattle are kept in confinement and where every facility for the development of tuberculosis exists. Calves, probably by reason of the phthisical milk with which they are sometimes fed, often suffer from tuberculosis. This, in connection with the production of the disease by inoculation with tainted blood, is of great importance with reference to vaccination; and could easily be investigated in Belgium, where the cattle are fed in sheds and the vaccine lymph is obtained direct from the heifer.

Thus though opinions may differ as to the degree in which tuberculosis prevails amongst the lower animals, and also as regards the identity of this disease with tuberculosis in man, of the existence of some intimately allied affection in the former there can be no doubt. Hitherto our proofs of the danger to man have been founded on the analogy of the transmission of the poison from animal to animal, or from man to the lower animal. Hence the following case, as an example of others equally well authenticated, is of the highest importance.* A surgeon in Providence, United States of America, had a cow affected with tuberculosis, the milk of which was consumed by his family, a large portion being allowed to one of his young children. The veterinary surgeon called in to attend the animal, warned the owner of the danger of giving this cow's milk as food, but the warning was unheeded. The latest intelligence is that the child which received the largest share died of tubercular meningitis. So much for those who deny the identity of the disease in man and the lower animal!

If not pathologically identical, the disease, whenever it is

* This case is taken from Mr. Fleming's pamphlet, 'Tuberculosis from a Sanitary Point of View.'

capable of being communicated from one to the other, is for all practical purposes one and the same. So the question arises, what risk do we incur through using the flesh and milk of infected animals? Mr. Fleming, whose opinions on this subject are entitled to great weight, says: 'When animals are in good condition, and the tubercles localised and the lymphatic glands are not generally involved, then the flesh may be allowed to be sold for consumption—the diseased parts being destroyed. But when there is generalised tuberculosis, or even an advanced stage of the disease in any important organs, then the flesh should not be consumed as food; more particularly should this be observed where there is emaciation. In any other chronic disease the flesh of emaciated animals is innutritious; in this it is so, and virulent as well.'

How far the process of cooking is destructive to the tubercular virus, it is difficult to say. As regards milk, and in a greater degree perhaps as regards flesh, when the virus is fresh, and the animal from which it is taken is in an advanced stage of the disease, the limited evidence at our disposal goes to show that, while lessening the strength of the poison, boiling does not impair its virulence to an extent sufficient to ensure the safety of the young pig. And as much may fairly be accepted with certainty with reference to the young of our own species. Yet when tuberculosis remains localised, or in a latent condition—thus affording proof for the time of the abeyance of its secondary infective power—there can be little doubt but that thorough cooking will enable our healthy *adult* population to use either the flesh or milk of such animals with impunity; nevertheless, since it is difficult to discriminate as to the extent and phase of the disease, the wisest and most desirable course consists in the condemnation and rejection of milk and flesh whose source is shown or even suspected of tubercular taint.

And as this can only be accomplished by the establishment of abattoirs and the appointment of competent inspectors, the sooner the proper authorities take action in the matter the sooner will alarm be allayed, the safety of the public ensured, and our information extended and placed on a more certain scientific basis.

There still remains another phase of this subject, a brief description of which is necessary to render it complete. I refer to the existence in adult man of a form of consumption, differing immensely, both in its infective power, and as regards the age of the persons and the organs primarily attacked, from the chronic disease we have just been considering, and to which our attention, in this country (as far as my reading goes), was first drawn by Dr. Creighton, in an article in the *Lancet* of the 19th June, 1880, headed 'An infective variety of tuberculosis in man, identical with bovine tuberculosis.'

The article consists of a series of cases, with a summing up, one of which I will give *in extenso,* to enable the reader to form his own conclusions, first, as to the exact character of the affection; and, second, as to whether identity of *post-mortem* appearances, taken alone, can establish the theory of contagion, a result claimed by the author of the article under consideration.

Case No. 3.—E. F., a female aged 17, was admitted on the 14th of April, with pulmonary symptoms of six months' standing. On examination, there were found physical signs of lung mischief (details were deferred), fluctuations between the morning and evening temperature: for example, 21st April, morning, 100·8° Fahr.; evening, 103° Fahr. Stupor, sordes, dry tongue, vomiting, and delirium, soon followed. Epileptic fits occurred on the 17th and 21st, and on the last day paralysis of the left arm and leg. Lividity of the face and rapid respiration preceded death on the 27th of April, just ten days from the date of admission into hospital.

Post-mortem inspection.—Body wasted, left lung adherent, especially to diaphragm; its pleural surface covered with adhesions containing healthy translucent tubercles. The upper part was of a red colour. In the lower lobe, near its posterior and upper angle, was a single well-marked wedge-shaped embolic infarct, one and a half inch long, and one and a quarter broad, of white medullary colour, into which a branch of the pulmonary artery entered; and underneath the thin end of the wedge-shaped area of white substance was found a number of round masses, the size of a pea, or larger, touching each other.

There was another mass at the base, where the lung adhered to the diaphragm. The right lung contained only a smaller kind of nodule, and the pleura was studded with a number of similar nodules. The peritoneal surface of the diaphragm on the right side was the seat of a most remarkable eruption of large, flat, confluent nodules, from the size of a split-pea downwards. The same nodules were seen on the peritoneum, covering the back of the bladder and the diaphragm; also smaller sessile ones on the broad ligaments, and the surface of the uterus. There was an embolic infarct in the anterior end of the tempero-sphenoidal lobe of right hemisphere, and yellow softening extending on either side of the middle cerebral artery, with miliary tubercles on the sylvian fissure, on both sides.

The above is a typical case, and the following, in the order given by Dr. Creighton, are the salient points of the disease:

1. The occurrence of tumour-like embolic infarcts in the lungs.
2. The implication of the bronchial mesenteric and portal lymphatic glands.
3. The character of the new growth, and wedge-shaped infarcts and round nodules of various sizes in the lungs, and its character in the lymphatic glands.
4. The character of the eruption in the serous membranes, and its frequency.
5. The element of obscurity in the cases viewed as cases of ordinary autochthonous tuberculosis.

The collection of these cases shows evidence of great care, and is the first attempt to establish, from pathological and microscopical researches, two things: 1st. The existence of an infective form of tuberculosis in man, identical with the same disease in the bovine race; 2nd. The strong probability, from the identity of necroscopic phenomena in the human subject on the one hand and in the ox on the other, that such disease was the result of contagion from the latter to the former.

The pedunculated broad-based sessile character of the serous tubercular nodules are distinguishing marks of bovine tuberculosis, and the discovery of these nodules in human tuberculosis is certainly presumptive evidence in favour of their

contagious origin. But in the absence of any history or opportunity for the spread of the contagion, such as the occurrence of the disease amongst butchers or herdsmen, it is not of itself sufficient to enable us to form a decided opinion.

Moreover, in this infective phase of consumption the lungs and their appendages seem to be primarily affected, obviously suggesting the inspired air as a medium of contagion; though it is not impossible, as the example of acute miliary tuberculosis in a dog, given some pages back, has shown us, that very rapid and very severe lesions of the pulmonary organs may take place even when the virus is introduced with the food. The essential conditions being that it be fresh, in large quantity, and taken from the animal in the late or presumedly most active stage of the poison—conditions which are of such improbable occurrence in this country, when beef is invariably cooked, that we need not on this account allow our equanimity to be disturbed.

But whether this phase of consumption be imparted to us from cattle or not, the disease itself undeniably exists, for the symptoms and *post-mortem* evidence brought forward clearly and in detail must be admitted. Such being the case, then, the question suggests itself, What is its nature? On this point opinions differ! According to the author of the German work on bovine tuberculosis, this affection as it exists in the human subject is a disease *per se*. But Buhl considers it an aggravated form of general tuberculosis; and it appears to me, looking at it in the light thrown on the subject by Professor Cohnheim, to be a metastatic form of acute miliary tuberculosis, the blood being surcharged with the poison, a large quantity of which was circulating in the system.

Supposing this disease, for the sake of argument, to be an aggravated form of acute general tuberculosis, we should expect it, according to the researches of Buhl in Germany and Klein in England, to have its origin, speaking anatomically, in a disseminated catarrhal pneumonia, differing from desquamative pneumonia only in the presence of giant cells among the germinating epethelium of the alveoli.

I mention this because it appears to me that the *post-mortem* descriptions given in the cases under consideration would not

confirm this view. But whether we regard the affection as a disease *sui generis*, allied to bovine tuberculosis, or as an aggravated form of general tuberculosis, the article describing it in the *Lancet* must be looked upon as a very useful contribution to the literature of the subject. It will repay perusal by all who take an interest in the many phases of this wide-spread and fatal disease.

Uro-genital Tuberculosis.—This variety, as well as primary meningeal and other local manifestations of consumption, are so fully treated in the foregoing translation by Professor Cohnheim, that it only remains to call attention to one point in reference to sexual and hereditary propagation of the disease, viz.:

Whether the tubercular virus, which all acknowledge can be propagated on either side, both *viâ* the semen and the ovum, is also capable of being transmitted, like the small-pox poison, by means of the placental circulation from the mother to the embryo.

On this point Professor Cohnheim expresses no opinion, but judging from the many analogies existing between syphilis and tuberculosis, we are inclined to the view that what is known to take place in one disease may also occur in the other.

Mr. Gant, in his able and standard work on surgery, speaks thus of the mode of communication in syphilis. He says that the poison is propagated—

'1st. From constitutional syphilis in the father without any apparent infection of the mother; 2nd. From constitutional syphilis in the mother without any apparent infection of the father; 3rd. From systemic infection of the mother, through a primary sore—a chancre contracted during pregnancy, the embryo being quite healthy at its conception, in other words by means of the placental circulation.'

Secondary Contagion.—Heretofore our efforts have been directed mainly to elucidate the primary contagious character of consumption, or in other words the spread of the disease from a contaminated to an uncontaminated individual, by means of the introduction, into the body of the latter, of the specific tubercular virus. This is called primary infection, and its earliest manifestation takes place, as in syphilis, after a

period of incubation at the seat of primary localisation. There appears to be no special receptivity on the part of anyone to the contagious action of the poison—all who are not already tainted, either from hereditary or acquired sources, are liable on exposure, and in a nearly equal degree, to become diseased. And further, although Cohnheim tells us that no anatomical appearances are pathognomic of phthisis, we may take it as a rule (which, like every other rule, has its exceptions) that the first distinctive manifestation produced by the irritation of the virus is caseification or caseation, by which it is distinguished from inflammatory products, and on which its property of secondary infection or further development throughout the body depends.

The susceptibility to this secondary infection, unlike what occurs on the introduction of the disease *ab initio*, varies greatly, not only in different animals, but in the same animal (using the word in its widest sense), owing, as we are told by Professor Cohnheim, to the sustaining power of the constitution keeping in abeyance, for a varying period, the latent virus existent in the system, and also perhaps, as it appears to me, by the more or less vigorous condition of individual organs resisting its encroachments.

It is thus alone that we are able to account for the many local varieties of phthisis, which not only never kill, but whose presence is compatible with a long and fairly comfortable life, and affords us valuable suggestions of the necessity of guarding the delicate lungs against non-specific causes of the disease.

This subject of secondary infection of the individual has been described by M. Charcot, with all the clearness and neatness of classification which pre-eminently characterises the writings and speeches of Frenchmen.

He says that tubercular matter arrived at the stage of caseation possesses the property just alluded to of propagating the tubercle from place to place, and for this reason should be viewed in the light of a truly malignant new growth.

These secondary lesions radiate or spread from primary centres or foci of caseification within very variable limits, depending on the medium utilised for the further propagation

of the disease. This secondary propagation takes place in a threefold manner: 1st. By direct infection, or infection by continuity or contiguity of structure. 2nd. To a greater or less distance by the medium of the lymphatics. 3rd. By generalised infection or dissemination of grey granulations throughout the whole organism by means of the blood-vessels, as in the rare cases of acute miliary and metastatic tuberculosis.

The local infection by direct contact has been well described by Professor Lepine. This is what is observed to take place. The visceral pleura in contact with a tubercular lung is studded with grey granulations which have not however excited any reactionary process in their vicinity; no false membranes are to be found at their level, and no adhesion with the subjacent parenchyma. Now, if the parietal layer over the part corresponding to the granulations be examined, columnar masses of superficial granulations will be found upon it. Their development evidently results from contact with the primary focus; there are no traces of tubercle on the parietal layer, except in cases where it corresponds to tubercle on the visceral layer. But the development of secondary granulations does not take place solely from immediate contact; it seems as if the seeds emanating from the principal focus have been sown to some extent in all parts of the pleural cavity. These secondary erratic tubercles are found especially in the neighbourhood of the tendinous leaflets of the diaphragm, around which the subpleural lymphatics are numerous, very superficial, and present stomata (Bizzozero and Klein). However this may be, there can be doubt, from the enormous collections of granulations found in the parts in immediate contact, that contiguity of structure plays an important *rôle* in the propagation of the disease. Infection by the lymphatics will also account for the propagation of the granulations in all parts of the lungs and pleuræ,* and is the only means of accounting for tracheo-bronchial adenopathy so common in tubercular children, as these glandular lesions are often consecutive to the lesions of the pulmonary parenchyma, and as the lymphatic path, hardened and nodular, can sometimes be traced from the original focus

* *Vide* 'Description of the Lymphatics of the Lungs,' by Klein.

in the lung to the secondary one in the glandular structure. Moreover, the lymphatic vessels have been found on examination to be invaded in their whole extent up to their termination in the circulatory system of bloodvessels, and the existence of tubercular granulations in the thoracic duct is associated by Ponfiek with acute miliary tuberculosis.

Thus it will appear plain that the secondary propagation throughout the system is explicable without the intervention of phlegmasia of the pulmonary tissue, and we have already shown that the inflammatory catarrhal processes play a part only accessory to the action of the contagious germs in the genesis of tuberculosis.

But as the existence of the pulmonary inflammatory lesions, particularly those of a chronic or rather subacute recurring character, afford not only the conditions favourable to the germination of the original poison on the one hand, but contribute on the other to excite and call into activity the latent phases of consumption, so also do we find, at all events in higher latitudes, that this phlegmasia continues to intervene in the phthisical processes if not to the end, at least to an advanced stage of the disease. And though consumption is a disease *sui generis*, exhibiting symptoms and pathological developments capable of explanation without the interference of the pneumonias, we can never forget while the weakest organ goes to the wall, and while the lungs (the organs *par excellence* associated with the disease) remain exposed to the fogs, damp air, and keen cutting east winds of this variable and cloudy land—we who treat the disease, I repeat, must not forget that all our remedial measures should be based on a fair recognition of the great *rôle* played by inflammation, both in the genesis and during the course of pulmonary tuberculosis, even when viewed as a contagious disease.

CHAPTER II.

Symptoms and Etiology of Consumption—Symptoms of Acute Miliary Tuberculosis—Prognosis.

Before proceeding to the discussion of the treatment of pulmonary consumption, viewed in the light of contagious malady, to which the remainder of these pages will be mainly devoted, I shall first, with the object of aiming at a correct understanding of the subject, and after recapitulating its causes, briefly and concisely narrate the most prominent physical signs and symptoms by which its different stages may be detected, and its final termination foretold.

Causes of Consumption.—The one essential cause is the specific corpuscular contagious virus, concerning which so much has already been said; and the secondary causes, both predisposing and exciting, include on the one side everything in the surroundings of the individual that conduces to the accumulation of the poison, and on the other everything that facilitates the progress of the secondary infective processes of the disease, or that helps to call into activity its latent, local, or harmless manifestations. They are:

(*a*) The influence of occupations tending to cramp the chest and interfere with the proper expansion of the lungs and consequent decarbonisation of the blood. Under this head are included clerks, authors, watchmakers, tailors, dressmakers, curriers, pathological microscopists, shoemakers, and tight-lacing females. The effects of these causes, unless combined with impure air and overwork, are in my opinion liable to exaggeration; and they are removable by attention to ventilation and outdoor exercise.

(*b*) Vitiated air and confinement in barracks and other ill-ventilated and crowded dwellings, which act deleteriously, both by the depressing effect of carbonic acid on the system as well as by the facilities thus afforded to the accumulation and development of the specific virus.

(*c*) Trades which expose the lungs to direct irritation, as stone-cutters, knife-grinders, etc.

These mechanical irritants, as we have elsewhere shown, do not *per se* produce tuberculosis, but a non-specific chronic allied disease; but nevertheless they act as exciting agents where there is a pre-existent latent tubercular deposit.

(*d*) Inflammatory and catarrhal affections, as tonsilitis, laryngitis, bronchitis, pneumonia, and pleurisy.

These, from the great tendency tubercle has to combine with inflammatory products, act as powerful exciting causes of pulmonary phthisis, and are held by many eminent physicians sufficient of themselves to originate the disease.

(*e*) Syphilis, diphtheria, typhoid, malarial, dengue,* and eruptive fevers.

(*f*) Excessive sexual intercourse and onanism.

An ordinary case of chronic pulmonary consumption is generally divided for the purpose of description into three stages, each having its own symptoms and stethoscopic phenomena, expressive of certain destructive processes going on in the lungs.

These stages may conveniently be denominated: 1st. The prodromal, or stage of incubation; 2nd. That of primary irritation, or incipient consumption; 3rd. That of secondary infection, or fully developed disease.

The clinical and pathological nomenclature here given may not be always expressive of cotemporaneous phenomena, but, as a rule, it is my opinion that such will occur; neither does it follow that the symptoms corresponding to each stage will in every case be identical, for considerable variety must be expected, mainly depending on whether the case be one of pure tuberculosis, or associated *ab initio* with pulmonary or bronchitic inflammatory conditions.

* I have seen one case following dengue, and have heard of some authenticated cases following malarial fevers.

With these provisos, the following will be the symptoms and signs corresponding to each stage of the disease.

In the first or prodromal period the symptoms alone are important, the physical signs being still in abeyance. There is lassitude, languor, and want of vigour, followed or accompanied with a disinclination to ordinary exertion. The muscles are flaccid; the countenance loses its ruddy hue and becomes pale and sallow instead, the functions of digestion being but imperfectly performed. The eye has a pearly appearance, with an anæmic and yellow-tinted conjunctiva, and the temperature of the body, with occasional exceptions, is persistently a little above the healthy standard. There is progressive loss of weight, and in females the function of menstruation is generally disordered. The skin is dry, but the extremities clammy and cold, and the gums are pale and often exhibit a festooned appearance towards their dental margins. Fistula in ano, piles, and bilious irregularities may precede or accompany the disease, either now or at a later period; and in one case, on the hills in India, I have observed asthma as a distressing and persistent symptom.

All, or even half of the above, if accompanied with scrofulous swellings, or associated with a history of hereditary taint, or with one of recurring sub-acute local pneumonia, should invariably cause some uneasiness; for if remedial measures are any longer neglected, they will, at no distant date, be followed by a dry, hacking, morning cough, which may be said to introduce the second stage, or that of incipient consumption.

This is coincident with the irritation caused by the development of the virus and the formation and deposit of tubercle. The morning cough in a little while becomes persistent, is at first dry, but is soon attended with a glairy, whitish, and clear expectoration, passing by degrees into thickish agglutinated sputa, occasionally mixed or streaked with blood.

Should the patient have suffered from localised pulmonary inflammation, as is frequently the case, the pain, which at first was only temporary, shifting and flying, becomes for a time permanent, and is generally situated beneath the clavicles or between the scapulæ at the back of the lungs, and is variously described as gnawing, shooting, cutting, and a sensation of

soreness, etc. All these symptoms, particularly the amount of blood tinging the sputa, are aggravated by every catarrhal attack, and even by every cold in the head, which eventually ends in finding its way to the lungs.

Blood-spitting is a frequent concomitant of this period of consumption; and, as a rule, it occurs after each congestive pneumonic attack, though it often ushers in the disease, and in some very rare instances is said to be the sole cause of a hybrid variety called 'phthisis ab hæmoptæ.' Generally the blood, when in any quantity, is of a bright red colour, but it is not always so; it may even be dark, clotted, and fleshy, but is never, as in hæmorrhage from the stomach, mixed with semi-digested food. Hæmoptysis is due to two causes: first, to congestion during the earlier period of the disease; and second, to ulceration brought about by the extension of a cavity during its third or fully developed stage. This symptom is of such frequent occurrence, that Baron Louis tells us that it was never once absent in twelve hundred cases that came under his notice; still its presence need not necessarily be associated with phthisis, for it often follows injury to the chest and certain forms of heart-disease, and is sometimes merely a form of vicarious menstruation. Colliquative diarrhœa may be also present towards the close of this stage.

The other symptoms are dispnœa, and in high altitudes as a consequence of the rarifaction of the air, distressing asthma. There is also rapidity of breathing, with loss of the normal balance between the pulse and respiration. The pain is of occasional occurrence, being mainly coincident with the extension of the mischief to the pleuræ; but it is not present in all cases, and is often more a feeling of uneasiness than of pain.

At this period the dry heat of the skin becomes moist. There is hectic fever, with a chilly sensation and persistent high temperature, with evening exacerbations and copious perspiration of a characteristic odour during sleep, whether by day or night. Hoarseness and loss of voice appear early or late, according to the order of parts attacked.

Wasting is I believe always present, *ab initio*, but is often fitful; the patient temporarily increasing in weight, but to lose it again with interest. A dislike of fatty food is also

very frequently observed. In addition to the above, most of the symptoms associated with the first stage are still present, but in an aggravated form.

Physical Signs.—The respiratory sounds over the affected part are feeble and harsh. The murmur of expiration is prolonged, while that of inspiration is often jerking. There is also slight crepitation from the creaking distension of the air-cells, owing to the increasing loss of the elasticity of their walls in which the tubercle is being deposited. As the disease advances there will be flattening both above and below the clavicles, defective expansion of the chest walls, and a dulness on percussion, occasionally accompanied with sibilant sounds, but more frequently by bronchial breathing, bronchophony, and also compensatory or puerile respiration, not only over the surrounding healthy lung tissue, but over that of the opposite side. These signs, when taken in connection with the symptoms just detailed, are very characteristic of consumption; but it is the opinion of Professor Aitken of Netley, which my own experience in many cases confirms, that the dulness on percussion, the bronchial breathing, and the consonant rales in the upper part of the thorax, are probably never caused in the first instance by tubercle alone, but indicate consolidation, the remains most probably of a pneumonic process. And again he says: 'Flattening of the supra or infra-clavicular regions on one or both sides, and the lower situation of the upper edge of lung, with diminished respiratory movement, are always certain indications of a diminution in the size of the apex of the lung by induration and shrinking, and may indicate thus far a curative process, which is only apt to be compromised by a fresh pneumonic attack or a subsequent deposit of tubercle.

Symptoms of the Third Stage of Consumption..—The presence of all or more of the phenomena previously described, in an intensified degree, indicate the closing period of the disease.

The cough now becomes more continuous and harassing, extending into the hours of the night, and depriving the patient of rest. The expectoration gets thicker, and is probably purulent in character and numular in appearance, so significant of the formation of cavities. Sometimes there is a frothy mass thrown off with great effort, which not infrequently is

attended with nausea and retching, though its dislodgement may at other times be more easily effected. The microscope shows the expectorated matter to be a compound of mucus, pus, blood, broken-down tubercular substance, and the debris of bronchial and pulmonary tissue. The hæmorrhage which now occasionally takes place is of more serious import than what we have seen to occur at an earlier period. It is the hæmorrhage of an ulcerating cavity encroaching on the lumen of the vessels of the lung, and may prove suddenly fatal if the size of the vessel opened into be sufficiently large. As a rule, however, a suddenly fatal result is prevented by the beautiful provision adopted by nature to block up the vessel assailed. The hectic fever now becomes more severe and continuous; the night-sweating, the wasting, and sometimes the diarrhœa, proceed with the utmost rapidity. Constipation occasionally is present. The face has long since assumed the hectic flush; the lips are cracked and pale, or they may be covered with sordes; a clubbed appearance of the last finger-joints, with incurvation of the nails, has often been noticed. The appetite, long failing, has in all probability disappeared, and soon the scene closes; the mind hopeful, and clear to the last, unless in the somewhat rare instances when tubercular meningitis or albuminuria enshrouds the senses and coma terminates the struggle.

Physical Signs of the Third Stage.—They are more characteristic than in either of the preceding stages, and are marked flattening and depression beneath the clavicle of the affected side, with retraction of the intercostal spaces. The impulse of the heart seems higher up than in the normal state, and its sounds are heard with greater distinctness over a greater extent of chest surface, owing to the better conducting media afforded by the consolidated pulmonary tissue, forming, perhaps, the walls of a vomica. The dulness on percussion increases, unless in cases associated with emphysema, or a superficial cavity. The diagnostic signs of a cavity are at first the cracked-pot sound and gurgling. And later on, when it becomes in some degree emptied of its contents, there will be cavernous respiration, attended, if the cavity be a large

one, by pectoriloquy and amphoric resonance. Moist crepitation, either fine or large, is generally present throughout the disease.

Before leaving this part of the subject, I shall briefly allude to the period of life at which people are supposed to be more or less predisposed to tuberculosis. As no region of the earth, with one or two exceptions, can be said to be free from its ravages, so in like manner does it count its victims in every period of human life. In childhood and in early youth, as we have seen, it is especially fatal; manifesting itself in many forms, and attacking many regions of the body that enjoy comparative exemption in adult life; but between the ages of fifteen and seventy, when the lung is the organ mainly attacked, the greatest mortality is between the ages of twenty and forty-five or fifty. Within this period there is a slight excess between twenty and thirty-five, but it continues to make havoc on a very gradually diminishing scale up to fifty; after which epoch the mortality falls rapidly to sixty, when there is a still greater fall to seventy. In fact, the rate of mortality from tubercular diseases, as having reference to their period of greatest intensity, affords a fair indication, after the termination of the first dentition, of the general death-rate of the human race from all causes combined.

Among the symptoms of consumption we have omitted to mention the diminished vital capacity or volume of the lungs, as indicated by the spirometer, an instrument invented by Mr. Hutchinson, to measure the quantity of air capable of being expired after the fullest inspiration.

The vital capacity always increases *pari passu* with the height. Weight and other causes modify it so slightly that they need never be taken into account in estimating results. The following table, taken from Dr. Broadbent's Index of Diseases, will give a correct indication of the extent to which it is liable to be influenced by the morbid lesions incident to the different stages of consumption, and will consequently enable us to estimate the degree of interference with the decarbonisation and purification of the blood:

Height.	Capacity in Health.	Capacity in Phthisis Pulmonalis.		
Ft. In. Ft. In.	Cub. inches.	1st Stage, Cub. inches.	2nd Stage, Cub. inches.	3rd Stage, Cub. inches.
5 0 to 5 1	174	117	99	82
5 1 „ 5 2	182	122	102	86
5 2 „ 5 3	190	127	108	89
5 3 „ 5 4	198	133	113	93
5 4 „ 5 5	206	138	117	97
5 5 „ 5 6	214	143	122	100
5 6 „ 5 7	222	149	127	104
5 7 „ 5 8	230	154	131	108
5 8 „ 5 9	238	159	136	112
5 9 „ 5 10	246	165	140	116
5 10 „ 5 11	254	170	145	119
5 11 „ 6 0	262	176	149	123

'This table reads: A man whose height is between 5 feet 7 inches and 5 feet 8 inches should breathe in health 230 cubic inches: in the first stage of consumption this is reduced to 154; in the second, to 131; in the third, 108 cubic inches.'

In addition to the chronic common variety of pulmonary consumption, the causes and symptoms of which we have just enumerated, there are many other phases of the disease, concerning which much has been said in the foregoing pages. And there are also some allied affections which are tubercular, some only in name, and others by the complicating effects they exercise on antecedent or cotemporaneous tubercular degenerations. Of this latter class are the pneumonic, hæmoptic, fibroid, syphilitic and mechanical forms of consumption; often, no doubt, associated with tubercular disease and modifying its symptoms and course, and sometimes also existing as a non-tubercular, non-infecting, less fatal, more chronic and independent affection.

But amongst the phases of tubercular consumption, some

account of whose symptoms is important, is the acute miliary variety, whose etiology has already been referred to.

It is a rare form, commencing suddenly with successive attacks of rigors and high fever; the temperature on the third day running up to 104° or 105° Fahr., and the pulse varying from 117 to 128 per minute. It presents itself in two forms: in one, it is caused by the superaddition of miliary tubercles in large numbers to a pre-existent disseminated pneumonic infiltration or caseation. In the other, there is no antecedent pneumonia, no pneumonia in fact beyond what is suddenly set up in the lung tissue by an enormous deposit of semi-transparent grey granulations; the rapidity of their deposition being due to the circulation in the pulmonary vessels of a large quantity of the tubercular virus. It appears to be a disease of excessive primary infection, and might not inaptly be compared to certain cases of scarlatina and other zymotic affections where the poison is so concentrated and deleterious that death ensues before the leaven has time to ferment and exhibit its customary and usual phenomena.

The other symptoms are pain, cough, and dyspnœa from the beginning. Hectic fever, copious perspiration and severe diarrhœa soon appear; there may, however, as in the more chronic form, be constipation instead. Emaciation increases with fearful rapidity, and death from exhaustion occurs, sometimes before the tubercle has had time to caseate or vomicæ to form, and often with symptoms clearly expressive of intestinal bilious or meningeal tuberculosis. The duration of the disease is from twenty days to twelve weeks. And as it sometimes occurs as a sequela of the typhoid exanthematous and remittent fevers, it may not be illogical to suggest that its virulence may possibly be intensified by a species of catalytic action between the specific poisons of the double disease.

Prognosis.—Pulmonary consumption is in the vast majority of cases an eminently chronic disease, or, as Dr. Bennett describes it, a slow process of dying. It is characterised by periods of fitful advances and temporary arrest, which tend to foster the false hopes of the patient, and lead the unwary to believe in a permanent cure. The danger of recurrence, however, is always at hand, and confronts us at every turn; the

dreaded enemy is but frequently only in ambush, and though sometimes defeated and often repulsed, he is seldom either utterly routed or entirely dispersed. Still, as many cases of permanent cure do occur, and as in very many others the fatal termination is indefinitely postponed, pulmonary consumption can no longer be regarded in the light of an *opprobrium medicini*. The march of science here as elsewhere, has sufficiently advanced not only to reward our past and encourage our future exertions, but to justify the hope, that at no distant date, by the application of hygienic and scientific measures, we may be able, if not to eradicate, at all events to curtail, the ravages of this fatal malady.

CHAPTER III.

The Treatment of Consumption as a Contagious Malady—Preventive Treatment—Specific Curative Treatment—General Curative Treatment—Iceland—Climate—Arctic Regions of Immunity—The Effect of Heat—Mountain Regions of Immunity—The Influence of Altitude on Consumption—The Influence of Cold—The Evil Effects of Moisture—Summing-up.

The treatment of consumption viewed as a contagious disease may be classified under three heads: The prophylactic, the curative, and the palliative.

The prophylactic or preventive treatment takes into consideration the amelioration of the social conditions, the hygienic surroundings, and the personal habits of the people, or whatever in fact contributes to lessen the accumulation or diminish the virulence of the specific poison. It has reference only to individuals that are purely intact and not to such as may retain the germs of the disease in a latent or slumbering condition, for each individual is either tubercular or he is not, and if in the former state, no matter how slight its manifestation, the *rôle* of prevention has passed and the period for cure is at hand. Viewed in this light it becomes obvious that our preventive measures are practically limited to regulations applicable to people in their own homes and native country, and may be divided into two classes: first, those bearing on the immediate surroundings of the patient in an advanced stage of the disease; and second, those appertaining to the sufferer in its earlier and less contagious period. Under the former are included the free ventilation of the apartment, with the removal and disinfection of the sputa and other secretions, such precautions, in fact, as are constantly had recourse to in cases of typhoid, measles, or other similar diseases. Under the latter head, when the patient moves about amongst his

comrades in the workshop or the barracks, our endeavours must be directed to prevent overcrowding and prolonged confinement. Free ventilation, with outdoor exercise, should also be recommended.

Strictly speaking, and in accordance with the doctrine that there is no original predisposition to the reception of the poison, our preventive treatment should end here, but for practical purposes, we must not neglect anything that is calculated to strengthen the constitution from the earliest age, paying particular attention to the avoidance of everything liable to weaken the lungs or set up or render chronic any disease of these organs. The chief indications given in detail being warm clothing *for the whole body,* including merino or soft flannel* next the skin, sufficient exercise, pure air, a generous diet, and a fairly active life.

In addition, should the chest be weak or the patient liable to recurring colds the use of a good respirator is a *sine quâ non.* Chest protectors may also be worn with comfort and advantage, but if, in spite of these, as it sometimes happens, a person be unable to leave the house, on account either of our fogs or cutting east winds, then a change to a milder climate is the

* Professor Jaeger of Stuttgart commends the so-called normal clothing, which consists exclusively of wool, and is especially arranged to keep warm the middle line of the front of the body. The general object is to prevent the accumulation of fat and water in the system, the principle being, that the greater the specific gravity of the body, the better able is it to resist disease. To the well known properties of wool, as regards moisture and heat, Professor Jaeger makes this addition : He claims to prove that in our organism, there are certain gaseous volatile substances, *Duftstoffe* (odorous substances), which are continually being liberated in the act of breathing and perspiring, and have important relation to mental states. Two distinct groups appear, viz., *of lust and unlust stoffe* (substances of pleasure and disliking), the former are exhaled during a joyful and pleasant state of the mind, and produce this state with heightened vitality if inhaled. Of the latter the reverse is true. During joy and happiness the odour of perspiration is not disagreeable, while during anguish and great nervous excitement it is offensive. The substances of disliking have therefore a bad odour, and in an atmosphere of them the vitality is lowered, hence in a state of anguish and fear the body is more susceptible to contagious diseases. Now, Professor Jaeger contends that sheeps' wool attracts the 'substances of pleasure' (and this is distinct from its great odour-absorbing capacity in general), while clothing made of plant fibre favours the accumulation of the offensive substances with their evil consequences. A large amount of experimental evidence is adduced in support of these views, and the experience of many who have worn the normal clothing is satisfactory.

only preventive with which I am acquainted. And here, as we are not now speaking of consumption, there can be no objection to a sedative as contrasted with a bracing atmosphere.

Curative Treatment.—The curative treatment will now engage our attention. It may be divided into the *specific* and *general*, the former is necessarily local in its sphere, the latter, though mainly constitutional, is often local as well.

The specific treatment consists in the topical application by the medium of the function of respiration and by the process of inhalation of certain agents possessing a germecidal or destructive power over the virus of tuberculosis. The existence of any such agents has as yet, I believe, never been *positively* proved. But from what Professor Lister has demonstrated to the satisfaction of the majority of the profession with reference to the influence of carbolic acid and other antiseptics in the prevention and destruction of germs, and from the protection generally acknowledged to be afforded by cooking to those who use the milk or flesh of tubercular animals; and above all, from the experiments lately made in Germany, when rabbits inoculated with tubercular matter were kept free from tuberculosis by breathing an atmosphere saturated with benzoic acid, which invariably followed in cases where this acid was not used, rabbits being, as we are aware, especially prone to the disease. For these reasons, together with the probable bacterial character of the virus itself, it appears to me not illogical, but very reasonable, to contend that this virus may be annihilated in the human body during the stage of primary infection; and even when secondary degenerations have taken place, though destruction be no longer possible, still its reproductive vitality may be impaired and further extension of the disease by this means greatly restricted.

Since the perusal some years ago of an admirable book on the inhalation treatment of diseases of the lungs, by Dr. Watts, I have given considerable attention to this subject, and from the rapidly beneficial effects that I have sometimes seen to follow the administration of inhalations of carbolic acid, iodine tincture, compound tincture of benzoin (Friar's Balsam),

benzoic acid and its salts, sodium and ammonium benzoate, and in particular, acetic acid and vinegar especially useful in pneumonic attacks, it has often occurred to me that some destructive antebacterial result was produced.

But in whatever way we may be pleased to explain the extraordinary therapeutic value of suitable inhalations and fumigations, the fact remains that this method of topical application possesses many obvious advantages in the treatment of pulmonary affections that other modes of administration do not afford. But as almost every drug in the pharmacopœia can with proper care and precaution be usefully inhaled, it is not likely that I should contend that all have a specific action. The vast majority are simply sedative, astringent, expectorant, or soothing, just as when exhibited by the stomach, but that there are some few possessing this property is, I think, in the highest degree probable. And they should be sought for amongst the drugs distinguished for their antiseptic, disinfectant, and paraciticidal power, such as carbolic, benzoic, acetic, sulphuric acids, and their salts, and, above all, sulphur, found natural wherever immunity from consumption exists, and chlorine gas, which, according to Dr. Cottereau, of Paris, is a specific for every form of this affection.

In commencing this mode of treatment we cannot be too careful, as headache, exhaustion, and irritative cough are common accompaniments. These soon, however, pass away, and may be entirely prevented by a judicious combination of sedative and specific, given at first in small doses (about one half the dose administered *viâ* the stomach) in a sitting posture when the patient has retired for the night, the temperature of the water, from 120° Fahr. upwards, being regulated by the patient's sensations of greatest relief.

Dr. Wagner of Buda-Pesth, who has written on this subject, prefers sodium benzoate to ammonium benzoate, on account of its superior volatility and capability of penetrating deeper into the minuter bronchioles; it is also of easier decomposition, setting free benzoic acid, whose antibacterial effect is greater than either of its salts. Dr. Wagner allows his patients to inhale until a burning sensation is produced in the chest, when the breathing becomes less laboured, the cough easier, and the appetite increases.

In connection with the subject of electric chest protectors now coming into fashion, and assuming the corpuscular theory of tuberculosis, it may not be uninteresting to learn the effects produced by electricity on bacteria.

Professor Cohn, whose experiments we quote, adopted the method of sowing with bacteria a sterilized mineral nutritive solution, subjecting them to electrical currents, and noting the results. A Marie-Davy flask element he finds to exercise, according to strength of current, either no influence on the increase of bacteria, or merely a retarding one. On the other hand, the current from two powerful elements sterilized the nutritive solution completely at the positive pole in twenty-four hours, so that afterwards the bacteria introduced did not increase. At the negative pole the action was weaker, the liquid not being completely sterilized. At neither pole were the bacteria killed. A battery of five cells killed the bacteria, and sterilized the liquid at both poles. From these experiments it is clear that the effect is one of degree, depending on the strength of the charge; but if the quantity capable of destroying the bacteria be compatible with the comfort and well-being of the patient, then it is certain that in electricity we possess an additional weapon for our specific warfare against tubercular disease.

Other specific remedies may be found in *the very highly* heated air of the dry, or Turkish bath, and perhaps also as suggested by Drs. Clifford Albutt, and Burney Yeo, in the antiseptic qualities of mountain air, which latter was, I believed, first described in the following words by the latter gentleman. He says: 'The air, as I have already said, is clear, bright, and pure, and there is almost an entire absence of those organic particles which play such an important part in promoting putrefaction.'

That it has any specific influence, or that this description would not equally apply to air, other than that of mountain regions, I very much doubt. I have myself sojourned on mountains, on upland plains, and on the sea in various latitudes, and have a strong recollection that a similar atmosphere, in all its purity, with the addition of a grateful warmth, may be enjoyed in January on board ship all the way from Gibraltar

to Suez; and perhaps the same also may be experienced in many sheltered spots along the intervening shores.

That the Turkish bath, to which we have just now referred, exercises a beneficial effect during the earlier stages of consumption is admitted by all who have given attention to this subject, and this admission is strengthened by the immunity possessed by the bath attendants, many of whom in different parts of the country have assured me that this disease is unknown amongst them, though some have commenced their occupation with undoubted symptoms of its manifestation.

The late Dr. Leared, who in the year 1864 published some cases in which great improvement followed the use of the bath, attributed its good effects to its depurating action on the skin, relieving the lungs in their function of getting rid of effete matters, and also because of its direct action on those organs, as evidenced by the check of the cough expectoration, and *blood-spitting* that often followed its use. This explanation is no doubt, in the vast majority of cases, the correct one, and removes it at once from the sphere of specific remedies; but that it is not incompatible with an early and destructive action on the virus itself, both the analogy of cooking and the anti-putrefaction properties of dry heated air, as illustrated by the preservation of the Egyptian mummies, fully prove. The Turkish bath, like the antiseptic air of hill or sea, may, and probably does exercise a curative power in two ways, first, and in exceedingly rare instances, in the specific and summary manner we have been discussing; but much more frequently in a slower way, by rendering latent and abortive those secondary infective processes of tuberculosis, to the manifestation of which its fatal termination is due.

The general treatment has for its object the cure of tuberculosis by the application of measures calculated to prevent, arrest, render latent, and ultimately eradicate those secondary infective processes of the disease on which its virulence mainly depends. We have already seen, in the earlier pages of this work, how variable is the susceptibility to this secondary propagation, not only in different animals, but in the same individual at different times, depending not only on the resisting forces of a good constitution, but in an equal degree on the facilities

afforded to the further encroachments of the malady by the weakness of separate organs, amongst which the lungs, as the most frequent seat of the primary mischief, play so important a part.

The many examples of spontaneous cure quoted in the annals of pathological anatomy, can no longer fail to convince us of the good we can accomplish by attention to the patient's surroundings, and by removing him, particularly in a climate like ours, from all causes tending to set up inflammatory affections which, by weakening the lungs, facilitate the advances of, and call into activity latent tubercular disease.

Of the remedial agents at our disposal for effecting a cure in accordance with the views now enunciated, that of climate is the first in importance. Its mode of action is constitutional as well as local, and it is of itself often sufficient for our purpose, though sometimes its beneficial influence may with advantage be supplemented by the exhibition of drugs tending to aid digestion and improve the general health. Such are quinia, iron, pepsin, the mineral acids, and the different hypophosphites, as well as nutritive and fattening condiments like cod-liver oil, cream, kumys, grapes, and other ever-changing and vaunted pseudo-specifics, the administration of which, nevertheless, is sometimes attended with considerable improvement. Their curative influence is, however, of such secondary consideration when removal to a locality characterised by the absence of secondary and developing causes is possible, that it need not for the present occupy our attention, or prevent us proceeding at once to the discussion of *climate*, a subject which has of late sprung into prominence by reason of the somewhat antagonistic views prevailing with reference to the relative merits of mountain air, and that of the plains, in the treatment of consumption.

To begin at the beginning, let us ask ourselves what are the fundamental facts to guide us in the selection of a climate for a patient suffering from consumption or other disease?

They are firstly, the immunity from that disease enjoyed by the indigenous population of the place about to be selected; and second, the results of the experience of men on the spot as to the benefits to be derived from a sojourn in any given locality confirmed if possible by reliable statistics.

Now if it were possible to send patients to countries where consumption is unknown, the difficulties in the selection of a climate, at all events in the earlier stages of the disease, would in most cases easily be overcome. But as such favoured regions are inaccessible to the immense majority of our suffering people, either on the score of expense, or by reason of the difficulties to be encountered on the way, our first duty consists in a thorough examination of the topographical, climatic, geological, and social conditions of the dwellers in those lands; and then with the knowledge thus acquired at our disposal endeavour to discover nearer home health resorts, where the climate approximates the closest to that distant and unattainable ideal where immunity prevails.

On these lines, and without any foregone prejudices, I shall now proceed to lay before the reader the result of my investigations: first, with regard to the countries at the level or a little above the level of the sea; and second, with reference to mountain regions whose inhabitants enjoy an equal freedom from this affection. The best example of the former class is Iceland, whose immunity is testified by the late Mr. Keith Johnstone the eminent geographer; by the late Dr. Arthur Leared, who had sojourned in the country on four different occasions; by Dr. Hyaltalin the chief physician of Iceland; and, lastly, by Mr. Warnford Lock, who has lately written a valuable and exhaustive book in all that appertains to this island.* According to the independent testimony of all these gentlemen, I repeat there cannot be a shadow of doubt that consumption in Iceland is never indigenous, but is always, when it does occur, imported from abroad and but seldom extends to the second native generation.

Thus having proved satisfactorily the existence of exemption; how is it to be accounted for? Is it by reason of its geographical position, meteorology, geology, vegetation, the food, or even the habits of the people? A correct answer, more particularly to be useful for the purpose of comparison, involves a description of each which will now be given in detail.

Description of Iceland.—This island is situated between

* 'The Home of the Eddas.' S. Low, 1879.

63½° and 66½° north latitude, and between 14° and 24° west longitude. It lies just outside the Arctic or Polar zone of disease in a north-north-westerly point off the coast of Scotland, from which it is distant about 5°, or something over 300 miles. In extent of surface it is much larger than either Scotland or Ireland, and yet it maintains only a scattered population of 75,000 souls, who inhabit the fringe of coast-land and some of the river valleys. There are no towns of any size, the people being mainly engaged in pastoral and piscatorial occupations, and the life of the manhood population is described by Mr. Lock, who knows the country well and is familiar with the language, as one long exposure to the elements; while the weaker portion of the community and many of the stronger also, during night live in dwellings devoid of ventilation, and if not buried beneath the earth are built of turf and often become grass-grown. 'A very bad feature' says Mr. Lock, 'being the excessive stuffiness of the common living and sleeping-room, when owing to the absence of fires the greatest possible crowding and plugging is necessary in order to maintain a tolerable degree of warmth.' The people, as a rule, are not conspicuous for attention to health and hygienic virtues, but there are exceptions among the better class, whose houses are as comfortable and clean as those of their equals in other places.

The configuration of the country is, from the physician's point of view, of the first importance, and is the cause of several peculiarities of climate, hydrography, and habitation. The whole central plateau is one wild waste of lava and volcanic sand, attaining an altitudinal range varying from 1,500 to 2,000 feet high, culminating occasionally in volcanic peaks nowhere exceeding 6,000 feet, and covered, at all heights above 2,700 to 3,000 feet, with perpetual snow and ice, and with one exception devoid of dwellings. A high range of ice-clad hills stretching across the island serves to refrigerate the *moisture-laden winds from the south-west* and consequently produce two distinct climates; the northern described as dry, not so cold in winter, or hot in summer as the southern, which is wet and subject to great annual and diurnal variations. The whole north shore from the Horn to Langanes is shut out from

March till the second week in June by the descent of icebergs from the Polar Seas. Sometimes the east coast is similarly encompassed, and it has happened that the whole island has been surrounded on rare occasions. During the sojourn of these moving masses, ice, fog, frost, and snow-storms prevail, destroying all vegetation and preventing the people from following their fishing avocations—obviously not an inviting region for *poitrinaires* anxious to escape the fogs and cutting east winds of an English spring. Such, however, is the spring they would find in the North, or dry climate of Iceland, and in that of the South, in which Reykjavik the capital is situated, there is no improvement; for it is said to undergo extreme and sudden changes, both of temperature and moisture, though the atmosphere throughout the whole country is generally clear, exhilarating, and appetising, with a heavy balance of mist and damp in favour of the region south of the central glacial range before referred to.

The exact population and resources of Reykjavik, the most accessible place in the island, I have been unable to find out, but I may mention, for the benefit of intending invalids, that it does not afford a desirable winter or vernal residence, and that its importance and accommodation are such that Dr. Lietner of the Lahore University, who visited it, speaks of the jail as the only place in Reykjavik which seemed to him comfortable enough to be worth staying in. Yet strange to say so great are the virtues of the people that at that time it had had no occupant for the last seven years.

Geological Character.—The country is remarkable for its mountains, its volcanoes, and beds of living sulphur which are scattered at intervals over a considerable part of its surface. The sulphur beds, unlike the Sicilian mines—the deposit of past geological ages, and now lying unreproductive at great depths—are on the very surface of the earth in a state of constant sublimation, the deposit being renewed as soon as removed, and for this reason vastly more capable of exercising an influence for good or evil on the health of the people.

Vegetation.—Iceland moss is the only vegetable product with which we need trouble ourselves, on account of its well-known therapeutic value in affections of the organs of respira-

tion. If by a moss is meant a cryptogamous plant, then its name is a misnomer. Its Icelandic name may be rendered into English as 'fell grass,' the word grass signifying any herbage as opposed to trees, while the prefix fell, or mountain, has reference to the habitat of the plant. Grass gathering, Mr. Lock tell us, is a regular occupation for the less robust members of the family during the early summer months, and necessitates a *period of purely nomadic life among the hills.*

It is highly prized for its medicinal virtues by the natives, who consume it in such large quantities that none is left for exportation. It is also found in abundance in Greenland, Siberia, Spitzbergen, the Orkney Islands, and Continental Scandinavia, countries, with one exception, so celebrated for the absence of consumption, that it might with a good deal of reason be contended that this after all was the charm, the philosopher's stone, on which the tubercular invulnerability of so many countries depended.

Nor, to my mind, does the high rate of phthisical mortality, varying from 14.7 to 12.5, amongst the urban population of Norway and Sweden take away from the value of this drug, for everyone is aware that consumption is a disease, *par excellence*, of cities and crowded places, and that as regards the countries under consideration, particularly for those who accept the contagious theory of this affection, there is every reason, owing to the seafaring occupation of the inhabitants,* to believe that it is but too often imported from abroad. Moreover, in Northern Russia, where the country is flat, and therefore devoid of this mountain grass, it is significant that the mortality (rural and urban) is 16.4, a considerable excess as against the cities of Scandinavia. And this is the more remarkable that, as regards extreme and prolonged cold all these countries suffer in an equal degree, the only climatic difference—and I grant it is an important one—being that in some, as Siberia, the cold is associated with dryness, while in others, as Russia and the southern half of Iceland, there is an excess of moisture instead.

Dietary.—The diet of the Icelander consists mainly of fish, especially cod, which is literally the bread of the people, the

* The mercantile marine of Norway comes next after France.

liver and oil of which, as well as those of the shark, are frequently indulged in and are believed by many sufficient of themselves, not only for the prevention of consumption, but for arrest and eradication of venereal affections as well.

The good effects of the curdled sheep's sour and other species of milk, as well as whey, to which the attention of the profession has been directed by Dr. Jagielski, must not be forgotten. The people drink these in large quantities, particularly during the warm weather; and Mr. Lock is so satisfied of their efficacy as antiscorbutics, from a trial on his own person under unfavourable circumstances, that on his return to England he recommended them to the attention of the marine authorities and others engaged in preservation of the health of ships' crews. He was not, however, aware of their antiphthisical properties, and it is my own opinion that these may easily be exaggerated, for in Ireland not only the peasants, but also the pigs, indulge in copious draughts of various descriptions of milk, and yet consumption in that country is prevalent enough. And the same may no doubt be alleged not only as regards Ireland, but as regards every pastoral country in an equal degree.

Still to sum up, there can be no doubt that the dietary of the people is on the whole strongly conducive to freedom from consumption, and the same may be said also of the influence of the mountain moss in conjunction with the nomadic life incident to its collection. Above all, we must not forget the superficial sulphurous exhalations and volcanic character of the land, which seems to be inseparably allied with immunity from tuberculosis, and is the one connecting link that binds the semi-arctic low land plains of the Old World with the torrid mountain plateaux of the New in their resistance to the eucroachments of this dreaded disease.

Lest in objection to this it may possibly be alleged that in Sicily, so celebrated for its sulphur mines, no freedom prevails, I wish to repeat that the circumstances of sulphur production are totally different, and to state that at Solfatara, near Naples, where sulphurous fumaroli still exist, it is supposed to have considerable antitubercular virtues.

In Iceland the sulphur is a living fume constantly issuing

from cracks which stud a great part of the face of the country, while in Sicily it is present as an ore, deep in the bowels of the earth and the product of bygone ages. In the one case it is dug from the mines as coal is with us, in the other it emanates from fumaroli in a comparatively pure condition, and, mingling with the atmosphere, is in the most favourable state to bring its antiseptic properties to bear on the virus of tuberculosis.

Thus it will appear evident that the dietetic, geological, and vegetative conditions are eminently favourable to immunity from consumption; whilst the hygienic surroundings, as exemplified by the dirt and non-ventilation of the houses, must be held to weigh in the opposite scale. But, as the working portion of the community spend nearly all their time in the open air, and as the weaker members make annual nomadic sojourns to the upland sanitaria, the bad influence of the stuffy state of the dwellings can, after all, but play a very subordinate part.

Of the purely climatic conditions it is difficult to form an opinion. The air, as a rule, is clear, exhilarating, and appetising, but subject to extreme and sudden changes, both of moisture and temperature, and the difference of climate enjoyed or, as some might say, endured by the north and the south respectively is so marked as to forbid our attaching any great significance to its general effect upon consumption or deducing therefrom any reliable evidence as to the comparative value of Alpine or Mediterranean resorts nearer home. But the snow, mist, damp, and fog that are the necessary accompaniments, either of the high latitude on the one hand, or of the prevailing south-west winds, unless, perhaps, for a few summer months on the other, prove, at all events, that these conditions are not only compatible with indigenous immunity, but as the examples of the gradual eradication of the inherited taint show, are not prohibitive of the cure of tubercular disease. These facts are worth bearing in mind, and may serve to modify the views of many eminent men as to the evils to be apprehended from the occasional occurrence of similar atmospheric conditions at Davos-Platz, the well-known winter health resort, which is situated like Iceland as regards snow

and ice and, to a very limited extent, also as regards mist and fog, and resembling as to its altitudinal range, not only the torrid mountain valleys of the trans-Andean republic, but also to the upland central region of Iceland—a happy medium between which very closely approximates to its correct elevation.

But whether, with regard to Iceland Spitzbergen, the Steppes of Tartary, or Siberia, or any other of the Arctic or sub-Arctic regions, whose inhabitants are free from tuberculosis, the character of the climate is not, in my opinion, of the first importance. The *sine quâ non*, the one predominant feature common to all these countries, is that of a scanty population, not collected in towns or crowded places, but dispersed as nomades, as fishers, or husbandmen, over the face of the land, constantly exposed to elements, and breathing, except perhaps during short intervals, a pure air, and an air free from tubercular germs; the accumulation and development of which are by such conditions as we have been describing entirely prevented. Thus it will appear that the climate, which under the circumstances permits the freest ventilation and the greatest amount of outdoor exercise (unless where specific remedies exist) is for each individual the best. Such is the conclusion to which the investigation of the Arctic lowland regions of immunity has brought us, we shall now see if an examination of the similarly exempted mountain plateaux will confirm or reverse it.

Mountain Regions of Immunity.—These regions are, I believe, limited to the elevated plateaux of central and tropical America, and are described as follows, by Dr. Henry Bennett, in an essay read at the annual meeting of the British Medical Association, and published in their journal dated the 10th of July, 1880. He says: 'Within the last twenty years a considerable amount of information respecting meteorological and health conditions of high altitudes, has been brought forward by French physicians, who have resided and practised on the high plains of Central America, at Mexico; on the plains of Anahuac, at Santa Fe, Begota, Quito, Potosi, and the sides of the Cordilleras mountains generally (Drs. Yourdanet, Coindet, and Domec). They may be said to have established that phthisis

is rare amongst the natives of these elevations, although common in the neighbouring seaport towns, such as Vera Cruz and Guayaquil, and that in imported cases the progress of the disease is frequently arrested. I have lately been in correspondence with Dr. Domec, now a professor in the new university of Lille, who has recently passed four years at Quito, in Ecuador, a town of 70,000 inhabitants, and nearly 10,000 feet above the sea. He was one of the physicians to the hospital, a professor at the medical college, and engaged in active private practice; he only saw two or three cases of spontaneous phthisis among natives during that time, and in all cases of inherited phthisis from the seacoast that he met with, the progress of the disease soon appeared to be arrested. He has published an interesting memoir on the subject in the *Montpelier Medicale* of July, 1878.

Such evidence must be held conclusive of the comparative immunity in the places alluded to, and is especially interesting as regards Mexico and Quito, which are large and populous cities, while the exemption we have heretofore been discussing had reference to rural and nomadic peoples only. Then, how is it to be accounted for? An answer involves a brief description of the topographical climatic and other local conditions.

Quito, on the line with a population of 70,000 souls, is the highest inhabited region of the globe, and is situated on the western slopes of the Andes, in an elevated valley which extends from twenty to thirty miles in breadth, and has an elevation of from 9000 to 9500 feet. Sheltering this plateau on the east and west, are two stupendous mountain chains capped at intervals by numerous volcanic craters, and culminating on the western side in the peak of Pinchinca, and on the eastern in the snowy summit of Antisana, having elevations of 15,922 and 19,137 respectively. One or other of these volcanoes, owing to some subterranean connection, is always in a state of eruption, belching forth, as Humboldt tells us, not only sulphurous fumes, but obsidian lava and pitchy stone.

According to the hyetographic rule that the rainfall increases in a direct ratio the nearer we approach the tropics, and judging from the 300 inches that often fall on the west coast of

equatorial Africa, we might perhaps, at least during the season of periodic precipitation, expect a damp, misty climate, similar in many respects to that of the Nilghiris (7000 feet) in the Madras presidency, during the south west monsoon, or rainy season. But on the American continent, unlike what appertains in Africa and Europe, the western coast and declivity of the Andes, owing mainly, but not entirely, to the easterly course of the trade-winds, are so much more free from rain than the eastern slopes, that the Peruvians, in poetic language, patriotically speak of their cloudless skies and parched soil as 'la serenidad perpetua del Peru.' It is true Quito is not in Peru, yet it is near it, and is in the same position as regards the obstructive and rain-precipitating effects of the Andean mountains and thirsty Brazilian plains on the prevailing moist winds before referred to. Such are a few of the characteristics of Quito, and it is impossible to deny that they are well adapted to ensure a dry, warm, bracing, exhilarating, and sheltered atmosphere, and one that can be enjoyed by night as well as by day throughout the year.

Dr. Domec, quoted by Dr. Bennett, states that in a large room, with the door and window open day and night, he found the temperature to oscillate all the year round between 57° and 65° Fahr.; the mean of the winter was 15·4°, that of the spring 15·7°, that of the autumn 15·7°, and that of the summer 15·6°, that is from 59° to 60° Fahr. He states that during four years he watched daily the thermometer, placed in a large drawing-room of the house in which he lived, without a fire, and open to every wind day and night. He never once saw it, between 6 p.m. and 10 o'clock at night, above 63° Fahr., or below 57° Fahr. Sometimes in the night, with the winds from the mountains, the thermometer was lower, but the falling of the temperature was always of short duration, and its fall never reduced that of the room below 57°.

So much for Quito. As regards the city of Mexico, with a population of some 200,000, a somewhat similar, though modified, climate and domestic conditions prevail. It is not on the line, but still within the tropics, its latitude being about 20° north; thus as regards its temperature losing what is supplied to it by a considerably lower elevation. Like Quito, it is

situated in a volcanic plateau, sheltered by mountain ranges. In former times, if not at present, as we gather from the pages of Prescott, many of its villas and highly cultivated gardens were floated by rafts on the waters of a beautiful lake, which now, as in the days of Cortez and Montezuma, contributes so much to the salubrity and verdure of this charming city.

With these facts in our possession, we are in a better position to form a correct opinion as to the different agencies that contribute to exemption from tubercular consumption. The balance of evidence will, I apprehend, lean to the side of the dry, warm, bracing, exhilarating and equable climate of the American mountains, as against that of the cold, bracing, misty, and variable atmosphere of the Arctic plains of Europe and Asia; and what is of more consequence for us, in favour of that climate nearer home which most closely approximates to it, not as regards altitude alone, which *cæteris paribus* is but a tropical substitute for a higher latitude, but rather as regards such a combination of temperature, equability, dryness, and stillness of the air, as will enable, not the healthy individual who can take root and flourish in most places, but the delicate invalid, to enjoy the largest supply of pure air with the greatest amount of ease and comfort both of body and mind. Dr. Bennett believes that such conditions are to be found in a greater degree on the Riviera than at Davos-Platz, and such, I think, will eventually be the general opinion, at all events during winter, unless the advocates of the value of mountain air are able to show (a difficult task) that it is to altitude *per se*, or to cold *per se*, or even to both combined, that its superior efficacy is due.

That altitude alone exercises no protective influence we have positive proof in the existence of consumption amongst the inhabitants of the Swiss Alps and those of the hills of India, and equally valuable negative evidence is the immunity enjoyed by the many lowland countries we have described. As regards the mountains of Switzerland, we are clearly shown in an interesting work, published in 1876, in German, by Dr. Emil Müller, 'On the Statistics of Phthisical Mortality in Switzerland,' that our preconceived notions in favour of the antiphthisical

virtue of rarefied air are delusive. These statistics, quoted by Dr. Bennett, show that the mortality, which in Switzerland is 10·2 per cent. 1500 feet above the sea, is 9·8 at an altitude of from 3400 to 4400 for those engaged in industrial pursuits, as match and lace makers; but for those engaged in agricultural pursuits it is only about half, respectively 6 and 5 per cent. Above 5000 feet, with an exclusively agricultural population, it is still 4 per cent., not very much below that of the same class on the plains, at an elevation of 4400 feet. In London the mortality from phthisis is 12 per cent., and in the mountains of Switzerland, the mortality is nearly doubled for those who follow sedentary and mechanical occupations.

As regards India, my experience leads me to the conclusion that consumption is as prevalent on the hills, from 4500 to 7400 feet, as it is in other parts of the country, the moist, hot, and depressing sea-coast stations excepted. In support of this view I shall detail a couple of cases from those that came under my notice; and the first is particularly interesting from the fact that I was a fellow-traveller in all the patient's climatic wanderings, and can consequently speak with the force of an eye-witness.

Case No. 1.—A. B., aged 23, with a slight hereditary taint, caught cold after a wetting on the plains, which eventuated in setting up in the lung a localised subacute pneumonia; before the subsidence of the latter, removal to Ootacamund, 7940 feet high, was rendered necessary (not on account of the illness). This sanitarium is in the Nilghiris, latitude 11° 23′ 7″ north, and longitude 76° 43′ 2″ east. The peculiar characteristics of the climate during the south-west monsoon or rainy reason, when my patient sojourned there, are hot sun, cold damp nights necessitating fires, and rain almost every day. In the winter, however, the climate is dry, and ice half an inch thick is to be had in the mornings for a couple of months. During a six months' residence here the pulmonary symptoms grew worse, and in time those of phthisis became superadded, attended *ab initio* with distressing asthma. On removal to the plains, at an elevation of 2000 feet, weather dry, temperature 82° Fahr. in the house, and but slight diurnal variation, considerable improvement took place, until an attack of malarial fever rendered desirable a short sojourn on the hills,

at a height of 4500 feet, when the pulmonary symptoms again became slightly aggravated, all of which, particularly the expectoration and sweating, on removal to Madras city rapidly increased in severity, the climate at the time being characterised by excessive heat and moisture, with a balmy and depressing sea breeze. During the passage from Madras to Brindisi, all the symptoms, with the exception of the diarrhœa, gradually grew worse, the weather being fine but very hot, and the air loaded with moisture as far as Suez, and wet and stormy from Alexandria to Brindisi. Great improvement all round took place at Naples, and at some other places in Upper Italy during May, when the days were hot with a powerful sun, and the nights cool, but rather agreeably than unpleasantly so. This improvement continued, as well as could be expected, during the summer in England, which, at this time of the year, affords the best sanitaria for pulmonary disease.

Case No. 2.—This invalid, who was a fellow-passenger from England to India, gave me the following history: He was a native of Coorg, in Southern India, which is a small district about 4500 feet above the sea-level, in latitude 12° north, and having an average rainfall of 90 inches, with a maximum summer temperature 83° and mean 72°, and a minimum in December of 53° Fahr. He stated that he believed he contracted the disease in his native province, and that during the time he spent in England as a student at Oxford, it became so bad that he was recommended to go home, as his best chance, which recommendation he was carrying into execution when I met him. He arrived in his native mountain home during the wet season, and in a few months, and very much sooner than I expected, I saw his death in the newspapers. Those statistics, and these cases, are enough to convince the most sceptical that rarefied air, if separated from the other beneficial atmospheric conditions we have been describing, is powerless in the temperate or torrid zone either to prevent or cure consumption.

If immunity be not due to elevation, then may we not conclude, with the example of the Arctic regions before us, that cold exercises some special influence, if not on the disease, at least on the virulent germs that produce it?

My own opinion, which is borne out by much that has already been said, and which I will now endeavour more fully to prove, is that extreme cold, *per se*, is rather favourable than otherwise to the prevention, and possibly also in the early stage to the cure, of consumption. And the same may be said of the effect of extreme heat, as exemplified by the immunity enjoyed by the natives of Upper Egypt until a foreign immigration, cultivation, and a consequent more crowded population introduced the disease, which has since spread to some extent among the indigenous population. The immunity enjoyed by so many Arctic countries is certainly, when combined with dryness, strongly in favour of some germecidal congelation of the tubercular virus; but we must never forget that from the scanty character of the population the disease may never have been introduced, or if introduced had no opportunity of propagating itself to the natives. If we turn to Canada and New England, where the cold is intense and prolonged, as I know from personal experience of both countries, there is not only no exemption, but in the latter country it is calculated that half the entire death-rate is due to tubercular pulmonary disease. This may no doubt in a great degree be accounted for by the large urban population and greater moisture of the air, as compared with Siberia, etc.; and also, in the case of New England, by the frequent rapid changes from heat to cold, consequent on the uniform high temperature at which the interior of the houses are kept.

Again, as regards great heat, if, as we have said, it is favourable to the prevention of consumption, there is very little to show that it is at all calculated to arrest the course of the disease.

Dr. Parkes tells us that the mortality from consumption among the troops serving in India is less than in most other stations, including Canada. Yet India is a country where, my experience teaches me, cases of existing consumption do very badly indeed, and that the climate in India from which the best results, or rather least injury, may be expected to occur, is to be found in the dry central uplands, and also on the hills during the dry season. But the climate of the hills during the wet season and that of the moisture-laden depressing

sea-coast stations, is very injurious indeed. Thus it is obvious, from all we have said, that cold and heat, when associated with dryness, exercise an influence favourable as regards the prevention, and possibly also as regards the cure, of tubercular disease, and that this favourable influence is always intensified by the addition of equability and stillness of the atmosphere, and diminished in proportion as the quantity of moisture increases.

The evils that can fairly be laid at the door of excessive moisture, in the causation, primary and ultimate development of consumption, are so great that they can, in my opinion, hardly be exaggerated; for there is hardly a place, whether on the high hills, in the lowland valleys, by or on the ocean wave, in the Arctic, torrid, or temperate zones, that moisture does not play an important and destructive *rôle*. And as a correct understanding of this subject is intimately associated with some general knowledge of hyetographics, I will now briefly detail some of the rules that govern the precipitation of rain, and give some tables of the amount of rainfall of many well-known districts, both on the Continent and in the British Islands.

The quarters of the globe, hyetographically speaking, may be divided into the regions of periodic and constant precipitation, the former incident to the tropical, the latter to the temperate zone. As a rule, unless from exceptions due to topographical causes, the rainfall, owing to the intensity of evaporation, is greatest in the tropics; yet, from the force of this evaporation, and the periodicity of its fall, the region may be very far from moist. In temperate regions the same laws are also fairly applicable—that is, nearer the equator the greater the fall of rain; but as this is the zone of constant precipitation, for all practical purposes it will be sufficient to say that the number of rainy days bears an inverse proportion to the total annual amount of precipitation, which may here be casually illustrated by stating that in England the number of rainy days is nearly three times as numerous as in Italy and Spain, though the entire precipitation is about the same; and in St. Petersburg, where the latter is seventeen inches, as compared with twenty-seven in the British Islands on the plains, it rains

almost every day without exception; while in this country, we know very well, such is far from being the case.

The following table, taken from the late Mr. Keith Johnstone's great work on physical geography, will give a correct indication of the total and seasonal precipitation of the different regions of Europe, and will enable us, in accordance with the rules laid down, to approximate to the number of rainy days; and, consequently, cannot but be useful in helping us in the selection of any climate off the beaten track.

TABLE OF RAIN PRECIPITATION.

District of Country.	Yearly amount in English inches.	Percentage of Rain in Different Seasons.			
		Winter.	Spring.	Summer.	Autumn.
Madeira	29·82	48	17	4	31
South-west of Spanish Peninsula	30·97	32	29	4	25
Sicily	23·55	39	25	4	32
West side of Apennines	35·17	27	23	12	28
East side of Apennines	26·70	26	25	17	32
South declivity of North Apennines	63·96	27	23	13	37
Transpadanic Plain	25·67	26	24	16	34
Cispadanic Plain	36·25	21	23	25	31
South declivity of Alps	57	20	22	26	32
North side of Alps	35	19	20	35	26
West side of Alps	46·29	20	24	16	40
South of France	23·54	25	23	13	39
West half of France	24·64	26	21	22	31
Valley of the Rhine	25·62	19	24	31	26
British Islands (*Plains*)	27·0	23	20	27	30
British Islands (Hills)	50·0	26	19	25	30
West coast of Norway	82·12	26	18	21	35
Hungarian Plains	17·0	19	25	26	30
Netherlands	26·70	20	18	30	32

In addition to the above, I have collected from trustworthy sources the annual rainfall of the following places, noted for their immunity from consumption or the reverse.

Those noted for immunity are, Ekaterinburg and Jakust in Siberia, with thirteen and twelve inches respectively. To the opposite class may be assigned St. Petersburg and the neighbouring provinces with seventeen inches, where it rains almost every day, and snows on 171, with a relative precipitation in the shape of rain, as compared with snow, of 1000 to 340; and

Penzance, in Cornwall, with forty-three inches, of which seventeen fall in winter, the season when it is frequented by invalids. This is the wettest place on the lowlands of England, and as it has a mild sedative climate has been very much resorted to by consumptives, with what result let Dr. Forbes, editor of the *British Foreign Medical and Surgical Review*, who lived in the place, tell us. He says 'he lived here for five years, and in no case of consumption did he witness a cure, or even a temporary palliation that could fairly be attributed to the climate.' And Sir James Clark, speaking at a time when it was the fashion to send phthisical patients to such sedative places as this—Torquay and Madeira—tells us that in all cases where pulmonary tubercles are softening, or have become softened during the sojourn of a patient in a warm climate, the malady is hastened, and runs a more rapid course to a fatal termination. Such also is my own experience, as illustrated by the following, from many similar cases:

S. B., an army officer, showed symptoms of phthisis while serving in Southern India. On the expiration of his term of foreign service he returned to England, when, in consequence of the annoyance arising from damp and cold, he volunteered to go abroad, and took up his quarters in Madras, where he got rapidly worse, and soon sank to rest—hushed to sleep by the balmy breezes and damp warm air of the sea.

The bad influence of moisture, in conjunction with cold, is seen in the high rate of mortality of St. Petersburg and the Scandinavian coast towns; while the good influence of cold, in connection with dryness, may be equally seen in the place Jakust, in Siberia, where immunity prevails.

This is the chief town in Eastern Siberia, in latitude 62° 1′ north, and longitude 139° east, and distant from St. Petersburg 5551. It is said to be the coldest place in the world. The ground remains continually frozen to the depth of 200 feet, except in Midsummer, when it thaws three feet at the surface. During ten days in August the thermometer marks 85°; but from November till February it ranges from 40° to 60° below zero, and the river is solid ice for nine months of the year. The population is 5000, engaged in candle-making; and the surrounding inhabitants are nomadic graziers.

Before leaving this part of the subject, it is interesting to return for a moment to the table of rainfall just given. The points most worthy of notice are: First, the excess of rainfall associated with mountain regions as compared with the plains, both in the British Islands and abroad. Second, the heavy percentage of winter rain in Madeira and Sicily, places fast losing their reputation as sanitaria for pulmonary disease, and also the excessive rainfall along the coast of Norway, whose cities are so fatal to the consumptive. Third, the remarkable difference between the precipitation of the south of France and the declivity of the Alps, where Davos-Platz is situated (not that this militates as strongly as might *a priori* be expected against the dryness of the health-resorts, and places situated on mountain summits; for, as I have reason to know from an experience of many mountain ascents, it often happens that the rugged hillsides are bathed in cloud and mist, while in the plateau, or valley on the top, the sun shines brightly and the air is clear and bracing. And, fourthly, the gradually decreasing rainfall towards the east of Europe, as exemplified by the fall in Hungary.

But now, to sum up, let us inquire what has our survey of the regions of immunity from tubercular disease taught us?

1st. That all climatic influence is, up to a certain extent, relative, and that some few will recover in any climate.

2nd. That looking at consumption as a contagious disease, as forcibly illustrated by the high mortality of large towns, even when charmingly situated as Marseilles, on the North Mediterranean, it should be our object to select as sanitaria, whether on the mountains or the plains, places that will for each individual patient permit him to approximate closest to the conditions and habits of the agricultural population.

3rd. For the same reason, a sanitarium at one time excellent, may from excessive patronage or great increase in population become the reverse.

4th. That rarefied air, whether alone or in combination with heat or cold, possesses no specific influence on the tubercular virus, though either combination as free from dust, and other similar impurities, if associated with dryness, stillness, and equability of the atmosphere, afford the best conditions for the

cure of pulmonary disease, the balance being in favour of warmth *versus* cold, both as regards individual comfort and curative power, as shown by the examples of Mexico and Quito, which are the only instances of immunity existing among crowded city populations.*

5th. That moisture† in conjunction with cold in the earlier stages, or with heat or cold in the later stages, invariably exercises a bad influence, whether on the mountains, the plains, or on board ship.

6th. That certain favourable peculiarities in the dietary of a people, as in the southern half of Iceland, may maintain an immunity in spite of an adverse climate.

7th, and lastly. That the volcanic and sulphurous geological features of a district may exercise a specific influence on the virus of tuberculosis.

* According to Professor Dove, an isothermal line from the châlet of Antisana, 12,600 feet high, and just above Quito, would touch the general surface of the earth at Bordeaux and Montpelier in January, and in May at Archangel in North Russia, intercepting in its passage the summit of the Brocken, and in July descending to the sea-level near Spitzbergen.

This would place Quito, 9500 feet, on about the same isothermal plane as the Riviera in winter.

† During the continuous fog which occurred in London from November, 1879, to the first week of February, 1880, and which, as following an exceptionally wet summer and autumn, must be held to owe its prolonged and remarkable severity to excessive moisture, the whole death-rate—and particularly the death-rate from diseases of the respiratory organs—was immensely increased. Asthmatic patients suffered most. The deaths from asthma, according to Dr. Arthur Mitchell, showed a direct increase, depending on the greater density and persistence of the fog within the period alluded to. The deaths from whooping cough also increased. Rheumatism did not appear to be affected by it.

CHAPTER IV.

Treatment continued—Davos-Platz—The Riviera—Cannes—Biarritz—Arcachon—Malaga—Algiers—Hammam d'Ira—Egypt—Pau—Ventnor—Torquay—Bournemouth—Cove of Cork—Sea Voyages—Alkaline Hydrophosphites—Intra-venous Injection of Milk—Diet—Exercise—Palliative Treatment—Conclusion.

In accordance with the plan sketched out at the beginning of the last chapter, I shall now give a *résumé* of the climatic conditions of Davos-Platz, and some favourite health resorts on the Riviera and elsewhere, including a description of the class of cases that are found to derive benefit from a sojourn in each.

Davos-Platz, in the Grisons, which from its accessibility and sheltered position is the most favoured of our mountain health-resorts, lies at an elevation of 5108 feet above the level of the sea, in a valley ten miles long, and about half a mile broad, running N.N.W. and S.S.E., and fairly well sheltered on all sides except the S.E. It has two distinct and sharply-divided seasons—the summer and the winter; but as it is as a winter residence for consumptives that Davos is principally, though not exclusively, celebrated, I shall confine my observations mainly to this period. The winter approaches suddenly in the first half of November—the morning dawns, and continues for some time bright, serene, and clear, when momentarily the wind howls, ominous clouds gather, and snow begins to fall, covering the green of the valley with a mantle of white, which it retains till the end of March with a cloudless or a feathery cirrhoid sky, passingly interrupted only by the mild though somewhat frequent snowstorms, and by the occasional visitation of the *Föhn*, or south-west wind, which, melting the snow usually lying at a depth of from two to four feet, is a source of considerable annoyance and mischief to invalids.

The meteorological observations have been taken for four successive winter seasons, and are here given from an abstract of a paper read at the Meteorological Society, June 6th, 1880, by Dr. Theodore Williams, physician to the Hospital for Consumption at Brompton, and published in the *British Medical Journal*, July 10th, 1880:

'The barometric pressure varies from 24·62 inches to 25·02.

'The thermometric observations give a mean temperature for the winter months, based on four years, of 28·1° Fahr. The mean for each year is as follows: for 1876-77, 30·6° Fahr.; for 1877-78, 28·3° Fahr.; for 1878-79, 26·3° Fahr.; for 1879-80, 27·3° Fahr. The maxima range from 75° Fahr., registered in October, 1876, to 12·5° Fahr. in December, 1878; the mean maximum of the four years being 39° Fahr. The minima range from 43·1° Fahr. in October, 1876, down to −16·7° Fahr. in December, 1879; the mean minimum for the four years being 17·3° Fahr. The maxima only exceeded 60° Fahr. on eight days during last winter, and fell below 20° Fahr. on thirteen days. The minima fell below 0° Fahr. on seven days in 1876-7, on eleven days in each of the winters 1877-78 and 1878-79, and on fifteen days in last winter.

The black bulb *in vacuo* thermometer yielded the following extraordinary results of solar radiation in this mountain climate, giving a total mean of 114·4° Fahr. In 1876-77, the mean was 114·8° Fahr.; in 1877-78, 111·4° Fahr.; in 1878-79, 113·4° Fahr.; and in 1879-80, 118° Fahr. The maximum was 166° Fahr., in February 1879. The sun's rays are so powerful that, by placing black cloth behind the solar maximum thermometer, a temperature sufficiently high to boil water has been attained; but Dr. Frankland is of opinion that this permeability of the atmosphere to solar radiation does not increase with altitude, as the same results were obtained at the Fluela Pass, 2700 feet above Davos, the thermometer not marking higher records. Tanning and browning of the skin is a result of this radiation.

'The percentage of humidity varies from 72 to 62, the last two winters giving 63 and 62 respectively, indicating a very dry state of the atmosphere. Last January was a particularly

dry month, the percentage falling to 40° Fahr. The number of days on which rain or snow fell during the three winters varies from 43 to 57 per winter, and the rest of the days were for the most part sunshiny. Last winter numbered 110 fine days, 30 cloudy, and 43 wet or snowy. As may be concluded from the temperatures, but little moisture fell in form of rain, and nearly all as snow; and when snow falls, owing to the dryness and low temperature, it does not cling to the clothes —consequently invalids often go out in the snow with impunity. During the last winter there were few days on which outdoor exercise could not be taken, and in most seasons at least two-thirds of the days can be counted on for walks or drives. The prevalent winds are the north, north-east, and south-west; the latter, or *Föhn*, is most dreaded, on account of its melting the snow, and thus disturbing the winter conditions of equilibrium of climate. Wind, however, is very slight in force, and the general state of atmosphere is that of calm, or the low temperatures would be unendurable.

'The effects of the Davos climate appear to be due to— 1. The rarefaction of the atmosphere; 2. Its dryness; 3. The absence of wind, partly owing to the shelter of the mountains, and partly to the uniform layer of snow spread around; 4. The large amount of sun's rays transmitted through the rarefied atmosphere, as reflected on to the village from the extensive snow-plain lying to the east of it.'

The chief characteristics of the climate are, first, the intensity of the solar radiation, which is much greater than any place on the Riviera, and is as great at Davos in February as it is in July, being due to the rarefied air, cloudless sky, stillness of the atmosphere, and, above all, as evidenced by the winter and summer comparison, to the powerful reflecting medium furnished by the glistening raiment of the valley. Second, the low temperature in the shade, which at night occasionally falls below 16° Fahr., and which, taken in connection with the high sun temperature in day in which the patients are basking, infers an enormous range of diurnal variation, greatly at variance with the American regions of immunity, and which, if compatible with the cure of incipient phthisis, cannot be conducive to the comfort of a delicate invalid.

These rapid changes of temperature, together with the occasional mists and fogs, and the occurrence of the south-west wind, are the only drawbacks (all else being excellent); but as they are sufficient to interfere with free ventilation and continuous outdoor exercise, conditions essential to the cure of consumption, and are equally certain to produce catarrhal attacks and a general feeling of discomfort, it is not surprising that the advocates of Davos, as well as its opponents and those who are neutral in the matter, are beginning to discriminate as to the class of patients likely to be benefited by its climate during the winter season.

Mr. Symonds, writing to the *Lancet* from Davos, where as a patient he derived great benefit, and must gratefully be disposed to speak favourably of the place, says:

'I am not an exclusive believer in Davos, and am more inclined to caution about it than when I wrote a year ago in the *Fortnightly*. What I have been able to observe of the progress made by consumptive patients induces me to think that unless they can take daily exercise they would be better in a milder climate. Yet I have seen enough to convince me that the climate is beneficial in many critical cases.' He also gives it as his experience that it is possible to take more liberties with the open air at Davos than elsewhere.

Another correspondent to the *Lancet*, writing from the same place, thus expresses himself:

'May I take this opportunity of expressing my sense of the utter folly, nay, wickedness, of those who send consumptive patients to Davos, or to any other health-resort in the final stage of their malady.'

Dr. Theodore Williams uses the following language:

'To sum up, Davos, as well as the Engadine stations, which only differ from it being less well sheltered from the cold winds, has a winter climate of which the characteristic is a still, cold, dry, and rarefied atmosphere, easily permeable to the full effects of solar radiation, but to receive benefit from a residence here it is evident that a certain amount of constitutional strength, as well as a fair amount of unimpaired lung tissue, must exist.'

And, lastly, Dr. Clifford Allbutt, one of the earliest and most

eminent advocates of the value of mountain air, concludes a paper in the *Lancet*, July 26th, 1879, in the following words:

'Omitting the cases published last June, we have now before us notes of sixty-six cases, fifty-five of which were phthisis in one form or another—fifty-five cases of an organic disease which is the despair of the patient and the terror of the public. Of these fifty-five which presented themselves in all stages, and many in their last hope, thirty-seven did well, some recovered entirely, and others made progress, and are likely to recover in another season. Of those that died, I am enabled to say that one of those felt so much better at Davos than in England as to decline to return home, and contradict the opinion that he ought never to have been sent.

'As to the class of cases likely to derive benefit at Davos, they are, first, cases of acquired phthisis. When the patient is young and in possession of a good frame and fair physical powers, such a case sent with a cavity or a limited consolidation is tolerably sure to get cured; and if there be no great physical prostration, such cases may be sent with advantage when the local disease has advanced.

'Passing over the many intermediate cases, and turning to those with a strong hereditary tendency, with red tongues and irritable stomachs and diarrhœa at times, rapid emaciation, excited circulation, and sharp evening fevers, and perhaps with neurotic complications—of these there is less hope, even when the pulmonary signs are limited. Such cases should scarcely be sent at all when the local signs are much advanced, or the presence of abundant tubercle suspected. To send prostrate, emaciated patients of this class to breathe, as Dr. Bennett says, the air of stoves at Davos, is quite unjustifiable; and what are we to say to those who send patients with diffuse tubercle, and suffering in lung, larynx, and bowel? Let such false kindness be resisted. Let the physician learn to speak the truth to such sufferers, and tell them how little they have to hope from anything but the comforts of a home. Laryngeal phthisis, I fancy, does not do well at Davos, even when the patient is otherwise in fair condition. To pass from phthisis to other chest affections, it should be widely known that all heart diseases do better elsewhere, and that bronchial condi-

tions do badly if associated with defective cardiac action or senility.

'Asthmatic persons are so capricious that each patient has to find a home for himself. A given asthmatic may lose his asthma at Davos; on young persons only should the experiment be made, and on persons free from emphysema. Dyspeptics may, or may not do well at Davos, and one should not go thither without a previous careful diagnosis of his case. Nearly all nervous complaints do as well or better at other places. Finally, I find it necessary to impress strongly on all lay persons the folly of going to Davos for health purposes independent of medical advice. I have some difficulty in saying this, because I may seem to say it in the interest of my medical brethren; I say it, however, with a single eye to the good of the patients themselves, who are often foolish enough to risk at least the loss of time and money, if nothing more, by seeking a health-resort unsuited either to the degree or kind of their malady.'

Such and so excellent is the advice of Dr. Allbutt, and the other authorities whom I have quoted, that it only remains for me to sum up in few short words the advantages and disadvantages of Davos, and to point out in what it approximates to the ideal climates alluded to. In referring to the latter subject, it is necessary to bear in mind, particularly as regards the effect of extreme cold, or indeed as regards that of excessive heat, the vast difference between the prevention and cure of consumption, and not be led away, from the existence of immunity in the Arctic regions, to conclude that a similarly cold climate, even when associated with the important element of stillness or want of movement in the air, is the best for the cure of this disease. All the authorities I have brought forward tell that it is not, and that unless an invalid be able to take exercise, and enjoy the pure, cold, exhilarating air, he is, to say nothing of the chilly discomfort and monotony, pretty sure to suffer from a winter sojourn at Davos-Platz. But as these drawbacks are due not so much after all to the cold *per se*, but to cold intensified by the great diurnal ranges of temperature, and assisted by the occurrence of the mists and south wind, as proved by their coincidence with catarrhs, the

question arises, might not a summer sojourn be attended with great advantage to many patients, whose low vitality or too extensive local disease renders them unfit to stand the healing conditions of the winter season? My own opinion is that such advantage would accrue in an eminent degree; for in summer, as in winter, the air is rare, still, clear, and bracing. The solar radiation is at any rate as great, and if the atmosphere be not so free from germs, dust, etc., it must ever remain at this altitude remarkably pure; moreover warmth, if dry, is no disadvantage, but rather the reverse, as the example of Quito shows, to which place the summer climate of Davos, though certainly more moist, in many respects approximates. Thus it appears that either in its winter or its summer aspect the climate of Davos is one from which all judiciously selected *poitrinaires* may expect improvement in, many arrest of, and not a few the cure of, their malady. And it would undoubtedly be useful to many who pass the winter on the Riviera, etc., to make a summer sojourn at this Alpine resort. Suitable patients may expect cure in the first stage, and sometimes in the second; and when the powers of the constitution are good, though the lung may be extensively diseased, they may hope for arrest, or at least considerable improvement. There is some evidence to show that the Italians, and the races of Southern Europe, do better at Davos than the people of the north. Cases complicated with hæmorrhage do very well indeed, and contrast favourably in this respect with Nice, and the more exciting places on the Riviera; and also with the more soothing yet bracing air of San Remo and Bordighera. Hectic disappears, the patient increases in weight, the predisposition to bronchitis is overcome, asthma is perhaps less capricious than elsewhere, functional cases of heart disease do fairly well; but organic heart, brain, and spinal affections should never be sent here. The cure is the air—milk, brandy, and modified hydropathy being its palliative attendants. For a new arrival a process of acclimatisation of varying, but in general of several days' duration has to be undergone, and is attended with dyspnœa, sleeplessness, occasional asthma, and headache; during this time all exercise must be avoided, and the greatest quietness submitted to. All should be under

cover at the setting of the sun, though in summer a walk after dinner may with impunity be indulged in. The winter invalid should arrive in October, and remain not later than the end of March, when the slush and wet, incident to the great thaw, renders a longer stay both disagreeable and dangerous. Some advise a continuous stay at Davos, but such advice should never be followed.

From Bâle to Davos the distance by road, in carriage or sledge, is one or two days, according to the strength of the patient, who should on arrival put up at a good hotel with a southern aspect, unless he be acquainted with German, when he may, with considerable pecuniary advantage, take lodgings and look after his own *cuisine*.

The western Riviera is that portion of the north Mediterranean shore which extends from Nice to Genoa; it has long enjoyed a deserved reputation as a winter health-resort for consumptives, which, judging from the close analogy existing between its winter climate and the American regions of immunity, it ought not, in spite of recent competition, or the fancies of fashion, easily forfeit.

The climatic characteristics of this beautiful region during the winter months are warmth, equability, dryness, clearness, and stillness of the atmosphere, with an almost entire shelter from the north, north-east, and north-west winds, owing not to its latitudinal position, but to the local protective influence of the maritime Alps, which rise in many places from the fringe of the sea in successive terraces to a height of 7000 or 8000 feet. The principal health-resorts along the Riviera, from east to west, are San Remo, Bordighera, Monaco, Mentone, and Nice. The climate of each of which has its own secondary qualities, more or less well suited to certain stages, and certain complications or phases of phthisis, depending mainly on the degree of shelter afforded by the mountains and the more or less limited space between their bases and the shore. The former contributes more completely to shut out the cold north winds, which is always a desideratum, and the latter in many instances modifies the bracing character of the climate, giving rise to sensation of closeness due to a want of circulation in the air.

The latitude of this region is about 43° N., and is very little north of the same isothermal plain as Quito, where exemption from consumption exists, which it also resembles as regards shelter, degree of moisture, and equability of climate. The solar radiation must, however, be much less than at Quito, and the difference as regards altitude is complete. The prevailing winds are north and north-east, which, according to Dr. Hassall, to whose work on San Remo I am indebted for much of my information on this subject, are moister and less irritating than in England. During the prevalence of these winds the sky is clear and cloudless, and the sun in its unimpeded radiance fills the earth with caloric, which, together with the enormous supply of summer heat stored in the mountains is evolved during the bright starry nights, and thus contributes, with the aid of the high temperature of sea, and the equalising influence of the land and sea breezes, to that equability of climate so grateful to the invalid, and which enables him with impunity, and with ordinary precautions, to inhale a constant supply of pure, natural, warm air both day and night; for Dr. Bennett says that the night temperature at Mentone, unlike Davos, and very like the plateaux of tropical America, is seldom low. Throughout the winter it usually ranges between 40° and 50° Fahr. only, whilst the day temperature rises between 50° and 60° Fahr. Breathing pure air is not confined to few hours spent out of doors (say from three to five) with from nineteen to twenty hours passed in stove-heated breath-poisoned rooms, which, though it may not be the usual condition at Davos in winter, and we have reliable evidence that it is not, must still from the very nature of things, with a temperature occasionally down to 16·8° Fahr., be of sufficiently frequent occurrence to render the statement correct as regards all moderately advanced forms of consumption.

The other winds on the Riviera are the north-west, or mistral, sometimes felt with considerable force at Nice and Cannes, and often with intensity at Genoa—a city not adapted for consumptives—but only experienced in a modified form at San Remo, Bordighera, and Mentone. It is a cold, bracing, and dusty wind, and is the main cause of the exciting climate of Nice as against the soothing one of Bordighera or San

Remo. The south-west is a moist wind, and the south-east, or sirocco, is a moist, very irritating wind; but is felt less here than in Algiers, or most other places on the Mediterranean, owing to its passage over the sea, and the protective influence of the Corsican mountains.

The annual precipitation of rain on the Riviera averages as follows: 25 inches at Nice, with 60 rainy days during the winter season; 28·78 at San Remo, with 29·70 wet days; Mentone, 23·68 inches with 43·8 rainy days; Bordighera, 45 wet days. For the above the rainy days refer to the winter season, and the amount of rainfall to the whole year.

Other places, whose rainfall is interesting, are Malaga, 16·5 inches and 40 wet days; Madeira, 30 inches with 88 wet days; Ventnor, 34 inches with 105 wet days during the winter; Torquay, 39 inches with 200 rainy days; and Bournemouth, 156 for the year, with 28 inches. Both rainfall and number of rainy days here have reference to the entire year;* in all places, particularly in Southern Europe, more rain falls in winter than in summer, though every rainy day is by no means a barrier against outdoor exercise, as it implies only days on which much or little falls. At Davos-Platz there are about 40 days in the six winter months on which rain or snow falls.

Those who believe in the evil effects of excessive moisture, both *per se* and as a means of restricting outdoor exercise, from a consideration of the above figures cannot fail to be struck with the advantages possessed by the Riviera over the health-resorts in England. It is also noteworthy that Malaga, which is remarkably dry, has long been celebrated for the cure of phthisis.

Madeira, with 88 wet days during the year, does not at first appear more sedative than most other places; but we must remember that it is well in the region of winter rains, and bordering on the zone of periodic precipitation, so that nearly all its rain falls in winter. Besides, its dampness is increased by its insular position.

The average mean temperature for the Riviera is, according to Dr. Hassall—winter, 48° 89′; spring, 57°; summer, 72°; and winter 61° Fahr.; and the mean winter at San Remo,

* Ventnor excepted.

which is particularly well sheltered by reason of absence of gorges or dry ravines in the mountains, is 46·96° Fahr.; while the mean maximum in the shade is 56·17° Fahr., and the mean of both is 51·6° Fahr. Frost rarely occurs, and during the most severe season the temperature has only on two occasions registered 2° below the freezing-point. At Bordighera there is still greater equability, the mean winter temperature being as high as 53·23° Fahr.; the daily range is less than at all other places along the coast, though Mentone, with the mean minimum of 45·9°, and a mean maximum of 58·8°, and seldom, as Dr. Bennett tells us, going below 40° at night, must also be said to possess a very equable climate. It is more bracing and invigorating than either San Remo or Bordighera, which may be classified as dry, bracing, and soothing climates; while that of Mentone stands midway between them and the more invigorating, exciting, less equable, and more exposed climate of Nice.

The phthisical patients likely to derive benefit from a residence on the Riviera, must necessarily, from the nature of the climatic conditions we have been considering, include many phases and more advanced stages of disease than will derive advantage at Davos-Platz during winter. At the latter place they are limited by their constitutional powers to take exercise and endure the cold with impunity, while as regards the Riviera, in one or other of its resorts it may truly be said that it affords a climate better adapted than any other to suit the requirements of the largest number of patients in every stage, and in perhaps the most numerous phases of tubercular pulmonary disease. To sum up, the Riviera is admirably suited as a winter residence to the very young and to the very old, and particularly well adapted to delicate, scrofulo-bronchitic children struggling for existence in our cities at home. Returned tropicals do well here, and if not actually obliged to discriminate, and can stand occasional cold winds, would perhaps be more comfortable at Nice, from its superior size and social attractions, than elsewhere. Cases of simple debility, gout, rheumatism, renal degenerations, and atonic dyspepsia, and those who suffer from winter colds at home, do well. Pulmonary phthisis, when attended with hæmorrhage, is not

likely to be benefited by a residence here; and when there is no choice the moister and less stimulating air of San Remo or Bordighera is preferable to that of Nice. On the Riviera, as at Davos, heart, brain, and spinal diseases do badly; and pneumonia and pleurisy better elsewhere; but convalescents in general, including paralytics, when the active lesions have subsided, will derive advantage.

On the Riviera, as in all other foreign resorts, a room far removed from the basement, and with a southern aspect, should be selected. Patients should avoid sitting about, even in the sun, on cold iron or other seats, or rambling through old churches and museums; but should they do so, it is necessary to be provided with an extra wrap, both on this account, as well as to act as a protective against the somewhat sudden changes of temperature that often occur. All invalids should be in the house at sunset, both to avoid the rapid chilling of the air, and to escape the influence of malarial emanations that at this hour are of common occurrence.

The other accessible winter resorts suited to the requirements of the consumptive are as follows:

Cannes, on a small bay of the north Mediterranean, well protected from cold winds, has a more moist and sedative climate than Nice, with a hot winter sun, the mean minimum solar radiation being 101° Fahr., and the mean maximum 121° Fahr.

Biarritz is a fashionable village on the bay of Biscay, near the Spanish frontier, sixty-eight miles from Pau; its advantages as a winter station lie in the circumstance that the rainfall is slight, and the protection against the east winds complete. Situated on a cliff facing the east, it is warmed by the last rays of the sun, and the configuration of the ground and the nature of the soil ensure the rapid disappearance of moisture from the surface. When the north wind blows it is cold, and snow will sometims fall; but the prevailing winds in winter are the sea-breezes from the west and north-west. The climate is exciting, while that of Arcachon is calming. At the latter place invalids of a nervous temperament do well; but Biarritz is suited to persons of a lethargic constitution. The winter season begins in October and ends in May; but in

summer the place is much resorted to by French and Spaniards, who come to enjoy the cool sea-breezes and bathing. This is a very enjoyable place, being provided with a casino well supplied with literature and amusements. There is abundance of good music, a theatre, and every facility for riding and driving. There is no boating or yachting, as the sea is stormy, and bathing is often to be attempted only by the healthy and vigorous.

Arcachon, unlike Biarritz, which has long enjoyed a considerable reputation, has but recently begun to attract the attention of the medical profession; on this account, perhaps, it will be interesting to give a detailed notice of the place, which I cannot do better than in the following description of the roving correspondent of the *Lancet:*

'Arcachon is a sea-bathing place which has risen rather suddenly into prominence. Twenty years ago it was an unpretending little village; now it is a large and thriving town, covering a very extensive area, and having a sea-frontage rather more than four miles in length. Situated on the southern shore of a landlocked bay of more than 38,000 acres; nearly eight degrees of latitude south of London, and some forty miles south-west of Bordeaux, whence it is easily reached by rail; built upon a sandy dune of huge extent, within a few miles of the Bay of Biscay, whence come perennially refreshing breezes, and surrounded on all sides but one by a pine forest, Arcachon enjoys a climate which is in many respects unique. The large sheet of water to the north, fed by the Gulf Stream, ensures a tolerably equable temperature, warm in winter, and not too hot in summer. The prevailing winds from the sea bring with them an amount of rain which is a little in excess of the average, while the sandy nature of the soil ensures the rapid disappearance of every drop of moisture from the ground. If the rain were not abundant the cultivation of the soil would be impossible, and an arid desert would replace the verdant and blooming district of which Arcachon is the centre; for the soil is pure sand and nothing else, and this sand, it is said, extends to a depth of fifty metres below the surface of the ground. The surface is uneven, the sand having been originally blown into mounds and hillocks of moderate height; and this

fact, while it adds immensely to the beauty of the country, encourages surface-drainage and permits of a very varied choice of building sites as regards aspect, etc. The prevailing tree is the pine, of which there are many fine examples, and one of the chief industries of the district is the collection of resin from these trees. Sub-tropical plants, such as the castor-oil plant, the orange, and the arbutus, blossom readily out of doors.

'Accurate facts regarding the climate are difficult to obtain, and at present, it is to be regretted, no methodical meteorological observations are taken. In a *brochure* by Dr. G. Hameau, a physician practising in Arcachon, we find that for the six years, 1854-60, the mean winter temperature at noon at Arcachon was rather more than 50° Fahr., while at Bordeaux, during the same period, the mean temperature was 45° Fahr. For the five years, 1785-90, the mean winter temperature was stated by Guyot to be 43° Fahr., and for the nine years 1822-30 Lamothe stated the mean temperature to be also 43°. In the winter (December, January, February) of 1864-65, which was a winter of exceptional severity, the mid-day temperature was, on eight occasions, below the freezing-point, the lowest temperature registered being 26·5° Fahr. During the same winter the highest temperature registered at Arcachon was 66° Fahr. During the six years 1854-60, the thermometer was only upon six occasions below the freezing point, while in Bordeaux the freezing-point was attained no less than eighteen times.

'The absence of any high snow-clad mountains in its immediate neighbourhood seems to protect Arcachon from those extreme degrees of cold which are common in such places as Nice and Pau. The observations of Ottley, made in 1854-64, show that at Pau the temperature of 9° Fahr. was once attained, and that frosts of moderate severity were far from uncommon. During the same period the maximum winter temperature was 67·5°.

'The quantity of rain which falls at Arcachon is considerable, but there is this advantage, that it falls in large quantities at a time, and the showers are short rather than prolonged. It is the rain which gives the verdure and luxuriance to the

district, and since it cannot possibly lie for many minutes upon a soil the permeability of which is perfect, it seldom prevents the invalid from taking his daily exercise in the fresh air. During the three months included in the winter of 1864-65, rain fell upon twenty-five days, while upon forty-one days the sky was clear and cloudless.

'The prevailing winds come from the south and west, and, with the exception of the east wind, they are none of them notoriously unpleasant. Arcachon can claim as an advantage, that it is not open to the scourge of the mistral which so frequently sweeps over the towns of the Riviera.

'As for ozone, not much is known. Iodised paper is soon turned blue in a forest of pine, and the blue colour of the 'ozone papers' at Arcachon is deeper and more quickly produced than at many other places.

'The climate of Arcachon is double, *i.e.*, there is a forest climate and a seashore climate; the former having a temperature which, on an average, is three degrees higher than the latter. Thus the town is divided into a *ville d'été* and a *ville d'hiver*, and the natives enjoy the great commercial advantage of both a summer and a winter season. In the summer Arcachon is the great resort for the wealthy inhabitants of Bordeaux, who flock there in thousands to enjoy the sea-bathing and the cool breezes. During the summer months the houses on the beach are alone habitable, and visitors should be careful to obtain a room facing the north, and absolutely upon the seashore. This is not very difficult, in spite of the large demand, by reason of the great extent of the sea-front (nearly four miles). There is no stately and stiff promenade as in English watering-places, but the gardens of the houses and hotels run completely down to the sand, so that the visitors have a ready access to the shore. This allows of a very enjoyable and unceremonious toilet. Naked feet are very commonly observed, even amongst the better class of ladies; and it is no uncommon thing to find a bather taking a short promenade with nothing but his bathing-dress upon him. The sandy bottom and the entire absence of stormy seas render the bathing enjoyable and safe; and ladies and gentlemen may be seen bathing together, romping, laughing, and throwing off the trammels of society as completely as possible.

'In the winter the town of Arcachon is largely frequented by *poitrinaires*, and of late years many English have here sought relief for chest complaints of various kinds. During the winter season the beach is forsaken, and the recesses of the forest are solely in demand. The forest is, to a great extent, in the hands of a limited company. Boulevards and roads are being cut through it in every direction, and châlets and villas are springing up as fast as masons and carpenters can do the work. The châlets and villas are all isolated; each stands upon its own plot of ground, surrounded by a little garden and protective pine-trees, and most of them are remarkably picturesque. Indian bungalows, Swiss châlets, English cottages, even Chinese pagodas, and, be it added, cockney villas, meet the eye at every turn, and a walk through the forest of Arcachon is like visiting an exhibition of rural architecture. The Grand Hotel offers a solitary exception to the rural character of the architecture, and, while all around it affords the sweet deception of a forest life and Arcadian simplicity, it rears its ugly mass of utilitarian brickwork, spoiling the appearance of Arcachon from the sea, and, by intercepting the horizon, spoiling the views of the sea which are to be got from the high grounds behind the town.

'For those who cannot find enjoyment in absolute repose, sylvan beauty, and fresh air, Arcachon may seem a dull place. There is a casino, built in the Moorish style, charmingly perched upon a commanding elevation, where music, theatricals, and newspapers are to be found, and this forms the sum total of the artificial excitements of Arcachon. There is bathing in perfection. There are excellent roads for walking, and serviceable carriages, horses, and ponies for those who prefer riding or driving. The most interesting excursions for visitors are to the Oyster Parks in the basin, or to the lighthouse at Cape Ferret. The dwellers round the Arcachon basin are almost all of them occupied in the business of oyster culture, for which the situation is admirably adapted. It is said that upwards of one hundred millions of oysters are raised here annually, the money value of which, at the wholesale price, is about £200,000. The parks may be visited at low water, and the oyster, if the visitor be so inclined, may be

lifted from his bed and swallowed directly. At night, when the tide is falling, the oyster-boats may be seen making for the parks, each bearing a powerful light in the bow to guide the oystermen in their work, and few prettier sights than this can be seen. At Cape Ferret, on the shores of the Bay of Biscay, the visitor may see what Arcachon was before the French Government undertook the reclamation and cultivation of the dunes. Here is a veritable seaside Sahara—sand, and only sand, into which the pedestrian sinks ankle-deep, and which is whirled in eddies by the wind and washed in all directions by the waves. Upon this waste of sand the Bay of Biscay beats with a force which is as furious as it is unceasing, and the roar of the rollers breaking on the sandy beach is audible for many miles. The erection of a huge double dyke, and the judicious planting and manuring of the dunes behind it, seem, however, to have imposed a limit upon the encroachments of the mighty sea.'

Malaga.—This seems, at all events for consumptives, the El Dorado of cities, for there is no place in Europe that possesses a climate at once so mild, equable, or with so little variation from day to day. It is a seaport and situated on the Mediterranean, sixty-five miles north-east of Gibraltar, and may be reached from Liverpool after a voyage of about a week's duration, or by way of Marseilles. The mean annual temperature is 66° 11′ Fahr.; that of the winter being 53° 41′, the heat in January corresponding with May in London. The air is mild, and the force of the wind is lessened by a mountain range which forms a protecting background. The annual rainfall is about sixteen inches, with an average of about forty rainy days; the only drawback being the *terral,* a cold harsh wind from the north-west, which causes restlessness and oppression of the chest. A residence here is especially useful in the early stage of consumption, and it will also prove advantageous in an equal, if not in a greater, degree than most other places in the later stages of the disease. The town contains a large population, and supplies of all kinds are abundant.

Algiers lies at four days' journey from our shores, and cannot fail to be interesting to the ordinary European traveller anxious to stand on the threshold of Oriental life and see for

himself the existence of a novel and unfamiliar civilisation. The sea-passage from Marseilles is but a pleasant trip on a smooth sea, and need have no terrors in the majority of cases for the most delicate invalid.

The mean annual temperature is about 66° 50′, and the mean for each season is—Winter, 59° 91′; spring, 67° 60′; summer, 77° 73′; and autumn, 63° 80′. The rainfall is thirty-six inches, with ninety-six rainy days during the year; winter fogs are rare. Dr. Broadbent quotes Dr. Mitchell as follows: 'The climate of Algiers is firstly opposed to the generation, as well as the evolution, of tubercle in the lungs; second, it is not often observed, but is very exceptional, among the indigenous population; third, Europeans who do not bring the disease with them never become phthisical; fourth, those who do bring a predisposition, or even crude tubercle, with them are cured, but when the tubercle has softened the climate is no longer favourable, but the reverse.

Invalids intending to winter at Algiers should come early and secure a villa or lodgings in the suburb of Mustapha, or put up at the English boarding-house—the Villa Roussell—in the same quarter, as the French part is close to the shore, at the foot of the hill on which is built the crowded Arab town. The drainage of the hotels in this quarter is said not to be the best, and the accommodation and comforts very inferior to the hotels on the Riviera. Should one have no option in the matter, apartments removed from the basement and facing the sea should be selected; or if a patient prefer it, or should the stage of his malady be too far advanced to derive advantage from the heat of Algiers, he might move on by rail fifty miles to Hammam d'Irha, a health-resort 2000 feet above the sea-level, and possessing a site which for extent and scenic beauty is not excelled in Europe. The hotel here is comfortable and the weather delightful, with almost unbroken sunshine, and with a temperature of 60° Fahr. in the month of March. The hot-water springs, which rise to 114° Fahr., are mildly saline, and are used for bathing purposes; while there is in addition a cold alkaline and ferruginous spring, which is the ordinary drinking water. This is, no doubt, a charming retreat, but it is far away, and neither it nor Algiers should be visited by

those to whom pecuniary considerations are important. They would do better to remain on the Riviera, or perhaps still nearer home.

The same advice may be given with double force to phthisical invalids intending to sojourn in *Egypt*, which country should never be resorted to unless in the very earliest stage of consumption, when the patient will be equally well suited at Davos or elsewhere. The climate here, as I know from personal experience, is bright and fairly equable, the early mornings and the nights being often cold in winter, and in Lower Egypt the dews are so heavy that at Alexandria it always looked in the mornings as if heavy rain had fallen. The mean winter temperature being 58° 5′ Fahr. Grand Cairo, on the contrary, is dry and well deserving a visit, and has at least one very magnificent hotel, replete with luxuries and comforts. The even, monotonous journey of a dahabeeh, or Nile boat, under a cloudless sky and breathing a balmy, warm atmosphere, if inconvenient, may for the invalid be very advantageous, and a residence in Egypt may sometimes prevent a threatened attack of consumption. Nevertheless, the disadvantages—beggars, backsheesh, foul odours, and the plague of eye-flies—so outweigh the advantages, that it is not a country, however enjoyable it may be to the traveller, that ought to be recommended to the invalid, and never if money is to him an object of consideration.

Amongst other health-resorts where *poitrinaires* may go with advantage is *Pau*, 125 miles south of Bordeaux and forty-eight hours from London. The mean temperature for September, October, and November is 56° 4′; for December, January, and February, 42° 8′; while for March, April, and May it is 54°. The annual rainfall is forty-three inches, and the days on which rain falls, 119. The prevailing climatic characteristics are calmness, moderate cold, with very great heat of sun even in the coldest weather, and very rapid changes of temperature within moderate limits. In spring and autumn there are heavy rains, and rain often falls in winter, but it is of short duration and does not interfere with the daily walks. The evenings are chilly and the nights cold, and the place is well protected from all high winds. The climate is

mild and sedative, and is well adapted for all irritations of the bronchial or even intestinal mucous membranes, and for all diseased conditions associated with increased nervous or vascular action. It is useful in the very early period of consumption, if the disease be connected with irritable inflammatory pulmonic conditions, in young or excitable persons; it is injurious in all cases associated with nervous debility or passive congestion; and, though it may help to soothe the patient in advanced phthisis, it only renders more rapid the fatal *dénouement*, and it is my opinion that all cases of this latter disease would be better away.

Ventnor has a mild tonic atmosphere, is well sheltered, allows of daily outdoor exercise, and is, perhaps, the best place in England for consumptives in winter.

Bournemouth also deserves to be remembered; and in the pre-tubercular inflammatory states that often lead to phthisis, Torquay, Tenby, and the Cove of Cork in Ireland, are especially beneficial. In summer our breezy northern and eastern shores, or the western uplands, are well suited for phthisical patients, and abroad the Lake of Como offers them the best summer residence with which I am acquainted.

Sea Voyages.—These can be undertaken with comfort or benefit only in the first stage of consumption, and when the patient possesses fair constitutional vigour and a sufficiently good digestion to partake of heavy-character cooking, invariably associated with life on board ship. With these provisos, if he be a fair sailor, and not of a bilious temperament, a voyage to Australia, or the Cape, or South America, or India, or even to Constantinople, may be productive of great benefit and may even set him up; but for a confirmed or advanced consumptive, with an impaired digestion, to embark in England and expose himself to the storms of the Bay of Biscay and to many other bouts of bad weather (for all seas are tempestuous at times) during the course of the voyage, and lie day after day in a stinking and ill-ventilated state-room, is a procedure—and I say it from an experience of over a score of voyages in many latitudes in both hemispheres—calculated not only not to benefit his malady, but to render himself a nuisance to his immediate and enforced sleeping companions.

Alkaline Hypophosphites.—Of the other curative agents to which it is necessary to direct attention in the treatment of phthisis the first and most important is that of cod-liver oil. It is a substance of great therapeutic value, has well sustained its reputation, and in the etherised and phosphorised forms can be borne in most cases. Glycerine is also a substitute of some value, and cream is an adjunct of considerable power; mineral acids, quinia, and pepsine have all been used with advantage. Grapes are said to have wonderful powers in Germany, which, however, according to the best though not the most impartial authorities, are only specific when raised on the vineyard of their own establishments. As regards the value of the alkaline hypophosphites different observers entertain different opinions; their administration is in my experience generally attended with a sensation of exhilaration and ease, but in no sense do they possess any specific influence, and should never be used indiscriminately, the hypophosphite of iron in particular being badly suited to cases of a congestive character and where hæmoptysis is a prominent complication. Dr. Churchill, who first brought the alkaline hypophosphites to the notice of the profession in the year 1857, preferred those of lime and soda in doses varying from ten grains to one drachm in the twenty-four hours, and also expounded elaborate theoretic views, which need not here detain us, to prove their specific action on the tubercular diatheses. But it appears to me that he injures his case by overproof, for he proceeds as follows: 'I know very well they will prove not only as sure a remedy in consumption as quinia is in intermittent fever, but also as effectual a protective as vaccination is in small-pox.' Strong language this, which is confirmed neither by my own experience nor that of other independent observers, some of them, as Dr. Quain, being amongst the most eminent men in the profession.

The experience of Drs. Cotton, Quain, and Risdon Bennett, after fairly-extended trials, led them to the conclusion that the hypophosphites not only possessed no specific action, but were inferior to cod-liver oil or iron or other tonic treatment. Dr. Sinclair Coghill, of the Ventnor Hospital, though he does not go so far, is also clearly of opinion that they possess no specific

influence, and states, 'that while the specific action of these salts has met with but scant acceptance from the profession, they seem now generally to be employed as nervine tonics in cases where phosphorus is indicated.' On the other hand, Drs. Dickson and Thorowgood speak more hopefully of their efficacy; and in three cases which came under my own notice in the first stage, and others where softening was going on, a prolonged administration of these drugs as prepared by Dr. Churchill was certainly followed by considerable improvement. Iron and fish-oil might doubtless have proved equally beneficial, but from individual idiosyncrasy these could not be given, and their place was well supplied by the drug under consideration, with the additional advantage of causing neither headache nor constipation, nor giving offence to the palates of the patients.

Notwithstanding, however, the good that I believe sometimes follows their use, I am very far from being disposed to endow them with a specific action, but am rather, on the contrary, inclined to the opinion that Dr. Cotton, quoted by Dr. Coghill, gives the correct estimate of their therapeutic power. He says, 'This remedy may in some cases have tonic and beneficial influence, but to any specific action on tuberculosis it has no claim; like phosphorus itself, it is a simple tonic, adapted to certain depressed states of the system.' Chloride of calcium has been lately given with advantage, and crocodile oil has been found useful in Peru.

Intravenous Injection of Milk.—There is still one heroic remedy with regard to which it is necessary to say a few words. I refer to the intravenous injection of milk, which in the hands of Dr. Meldon, of Dublin, has proved useful in exhausted conditions of pulmonary phthisis attended with pernicious anæmia. The injection of three and a half ounces of milk at a temperature of 100° Fahr. into one of the veins of the arm was followed in every case, as detailed in the *Lancet*, April 3rd, 1880, by immediate and striking results, the patients being not only temporarily rescued from the jaws of death, but placed on the high road to permanent improvement. Dr. Meldon has injected milk in ten cases, in all of which the hours of the patient were numbered, with a result that leads

him to hope of its further success when performed with proper precautions.

The operation is quite free from danger, if two points be attended to besides those which have to be looked to in every case of transfusion: first, that the milk be alkaline; and second, that not more than four and a half ounces be injected at a time.

The cases, according to the report in the *Lancet*, were all attended with pernicious anæmia, and Dr. Meldon believes it is easy to understand how in that disease a small quantity of corpuscle-supplying fluid might alter the condition of the blood, and thereby effect a cure—a result which, in my opinion, seems probable enough as regards the anæmia, but is somewhat difficult to accept as regards the permanent arrest of tubercular disease.

The diet of the consumptive invalid should always consist of nutritive and easily-digested food, which is absolutely necessary to sustain the strength and preserve the constitutional powers against the encroachment of the disease. He should, as a rule (for each individual requires special diet), be allowed game, poultry, white fish, fresh meat, new-laid eggs, bread, butter, milk, and cream, with a certain quantity of oleaginous food in the shape of fat or oil, to which may with advantage be added a daily allowance of an ounce or so of treacle or golden syrup. This substance, as I have shown in the *Lancet*, of January, 1880, greatly assists in the assimilation of fatty and other food; and, from its chemical composition being almost identical with lime-juice when the latter is mixed with sugar as ordinarily given, it is also an antiscorbutic agent of great power.

Salt meat should never be used, as it is more difficult of digestion and of less nutritive value than fresh. Vegetables and fruit should be given with care, as they are liable to produce diarrhœa. The latter, however, when stewed may often, nevertheless, be taken with advantage. Food should be partaken every four hours, and abstained from for a couple of hours before going to bed, as it is likely at this time to produce indigestion and wakefulness; sometimes, however, it

happens that a good night's rest is assured by a little boiled bread and milk taken half an hour before retiring.

For beverages, milk, water, coffee, tea, and cocoa, all of the best quality and in small quantities at a time, are useful. As regards stimulants, stout, light bottled ale, brandy, and wines, such as burgundy, port, or sherry, are often necessary, and should be given at meals or at other times depending on their being called for by a feeling of lassitude, faintness, or depression. Pure Irish whisky is also often useful.

Exercise.—The importance of this subject to an invalid suffering from chronic tuberculosis cannot be over-estimated, for it is one of the reasons, as may be conjectured from what has already been said, that renders the selection of a suitable climate so important; for a climate is good in proportion to the amount of outdoor exercise which it permits with impunity. Every invalid, while his strength is sufficient and the weather congenial, should take regular daily exercise in the open air, and in many health-resorts abroad he can walk or drive out almost every day, while here at home he is unable from the nature of our climate to do so. Still in England, and even in London, when protected by a respirator, and warmly clad with woollen stockings and strong boots, a patient in the first stage of phthisis may either walk or drive on many of our winter days, and on some days in spring, not only with impunity, but with the greatest benefit. An invalid should never face the danger of a rainy, a raw damp, or a cutting windy day; snow, in the absence of wind and sleet, offers no impediment if the patient be properly protected. In winter and in autumn dry cold days are admirably adapted for walking exercise, and with snow on the ground and fine overhead there is no objection to a short walk, with the protection afforded by cloth over-shoes or moccasins, similar to those worn in Canada and Nova Scotia in winter.

Abroad, patients must be careful to guard against sudden chills and blasts of cold wind, by being always provided with extra wraps, just as at home it is necessary to carry one's umbrella on the finest day. Foggy London days can never be braved without danger; but on heavy, cloudy days the patient will be all the better, and much less gloomy, for a short walk.

Neither walking nor driving exercise should be continued long enough to cause fatigue; and the former, if possible, should be on a level road—a point worthy of note in selecting apartments at health-resorts. A game of billiards is about the best form of indoor exercise. As to the time of taking exercise, it will vary with the powers of the patient; but as a rule a few minutes' walk before breakfast, and an ordinary drive or walk a few hours after breakfast, and again about three o'clock in the afternoon, will suit most persons. All exercise should stop short of fatigue, and prolonged and violent forms are dangerous. Reading aloud is useful. Some physicians recommend singing, but as regards this, as well as the great benefit said to be derived from playing on wind instruments, as shown by the alleged freedom from phthisis enjoyed by the bandsmen in the French army, great discrimination is necessary, and the effects should be frequently noticed with the utmost attention.

Palliative Treatment of Consumption.—Having discoursed so long on the curative treatment of consumption, particularly as regards the important subjects of climate and hygiene, it only remains for me before drawing this work to a conclusion, and in accordance with my original programme, to touch on the palliative treatment of the disease, which, as it is founded on the general laws of therapeutics, need only be briefly alluded to. It takes into consideration all measures calculated in a special manner to subdue pain, lessen diarrhœa, relieve cough, check perspiration, arrest hæmorrhage, facilitate expectoration, and to aid digestion.

Pain depending on pulmonary congestion, intercurrent pleurisy, neuralgia, or rheumatism may be subdued by poultices, soothing liniments, and by aconite and belladonna externally and internally, and above all, if it be of a chronic character, by the use of counter-irritants, as croton oil, iodine, small blisters, and moxas.

Cough may be relieved by the administration of antispasmodics and sedatives, as morphia, conium, hydrocyanic acid, tartar emetic, and ipecacuanha, all of which should be given sparingly, and, if possible, in the form of inhalation, so as to avoid interference with the process of digestion. The tinctures of hyoscyamus and gelseminum are also useful.

Night-sweating may be checked by the use of aromatic sulphuric, and other mineral acids, while diarrhœa may be brought under control by alum, tincture of benzoin (Friar's Balsam), lead, and opium; bilious vomiting by ipecacuanha wine, and creasote, in two-drop doses frequently repeated, or by chalk and mercury in doses from one-sixth to one-twelfth of a grain frequently repeated. Effervescing alkaline mixtures are also very useful.

Blood-spitting in plethoric subjects may be arrested by aconite and digitalis, and in other cases by hamamelis, tannic, gallic, and sulphuric acids, and by ergot associated with rest and the influence of cold. Dyspepsia must be treated on ordinary principles; and constipation may be overcome by compound liquorice powder, and by nux vomica in small doses continued for a long period. Fever is allayed by quinia in occasional combination with aconite, or, as at Davos-Platz, by brandy and hydropathy.

Conclusion.—The latter, in my opinion, should be used only for cleansing purposes, and then in the form of an occasional hot bath at about the temperature of the body, aided by daily tepid sponging with soap and water; or an alkali and water. Care should be taken to expose as little as may be of the surface of the body at a time, and when a bath is given the room should be warm, comfortable, and free from draughts, as the neglect of these precautions may set up internal congestions and call into activity latent forms of tuberculosis, as happened with a fatal result in the now notorious case at Guy's Hospital, which for so long a time occupied the attention of the public press.

APPENDIX.

METEOROLOGICAL TABLES ILLUSTRATIVE OF THE CLIMATES OF DAVOS PLATZ AND SAN REMO AND LONDON.

The following tables, illustrative of the climates of London, Davos-Platz and San Remo, will be found useful for purposes of comparison. They refer, unless the contrary is stated, to the year 1879. This is said to have been an unfavourable year at Davos-Platz. As unfavourable years are, however, not limited by locality, but are generally of European extent, the results remain valid; more particularly as, in point of fact, the weather was equally bad both in London and on the Riviera. These tables are taken from the medical journals, and those referring to San Remo from Dr. Hill Hassal's report, Oct. 2, 1880, in the *British Medical Journal.*

DAVOS PLATZ, NOVEMBER, 1878.

1878.	Max.	Min.	Solar Max.
Nov. 1, Friday ...	35·0° ...	9·0° ...	135·0°
„ 2, Saturday ...	32·5 ...	12·0 ...	123·5
„ 3, Sunday ...	27·0 ...	19·0 ...	93·0
„ 4, Monday ...	24·0 ...	18·0 ...	81·0
„ 5, Tuesday ...	33·0 ...	11·0 ...	135·0
„ 6, Wednesday ...	28·0 ...	14·5 ...	61·0
„ 7, Thursday ...	26·0 ...	8·5 ...	88·5
„ 8, Friday ...	32·5 ...	8·0 ...	126·0
„ 9, Saturday ...	32·0 ...	13·0 ...	119·5
„ 10, Sunday ...	26·0 ...	11·0 ...	47·5
„ 11, Monday ...	34·5 ...	11·5 ...	147·5
„ 12, Tuesday ...	39·5 ...	26·0 ...	136·5
„ 13, Wednesday ...	38·5 ...	11·5 ...	157·5
„ 14, Thursday ...	40·5 ...	24·5 ...	148·5
„ 15, Friday ...	26·5 ...	15·5 ...	76·5
„ 16, Saturday ...	36·5 ...	14·0 ...	150·5

THE CLIMATE OF DAVOS PLATZ.

Meteorological Observations (*January*, 1879).

The following will be interesting as tending to correct many prevalent impressions as to the climate of Davos-Platz, Switzerland.—N.B. The readings of the barometer, maximum and minimum shade thermometers, and solar radiation thermometers are taken at 8 A.M.; the hygrometer readings at 2 P.M. The force of the wind is roughly estimated on a scale of from 0 to 12. For the humidity, 100 represents saturation. For the state of weather, B., blue sky; Bc., blue with clouds: Cb., clouds with blue; O., overcast; Sn., snow; M., mist.

Date.	Barometer in inches.	Maximum in figures.	Minimum in figures.	Radiation Thermometer.		Hygrometer.				Wind.		State of Weather.
				Solar Maximum.	Terrestrial Minimum.	Dry Bulb.	Wet Bulb.	Dew point.	Humidity.	Direct.	Force.	
1	24·90	44·0	20·5	109·0	...	40·C	23·0	24·0	49	S., N.	2·1	Cb., B., O.
2	24·80	42·5	20·0	134·0	...	32·0	31·0	28·7	87	N.	2·1	Sn., M., O., Sn.
3	24·87	33·0	13·0	76·5	...	37·0	33·0	27·3	68	S, S.W.	1·2	Cb., O., Bc., O.
4	24·57	40·5	16·0	140·0	...	32·8	28·6	20·0	57	N., N.E.	1·7	O., B., Sn.
5	24·90	37·0	20·0	141·0	..	19·5	17·5	4·0	47	N.	4	Sn., O., B.
6	24·87	22·5	7·5	96·5	...	17·0	15·0	2·0	41	N.	1	B.
7	24·78	19·4	7·0	119·5	...	19·4	16·4	5·6	33	N.	2	B.
8	24·42	21·5	5·5	124·0	...	14·0	13·8	12·2	92	S.W.	1	O., Sn., O.
9	24·35	15·8	4·0	34·0	...	16·5	16·5	16·5	100	N., S.	1·3	O., Sn.
10	24·40	18·2	5·2	44·0	...	20·2	18·2	4·1	48	N.	1	B., Bc., O.
11	24·50	22·5	0·8	127·5	...	23·0	22·0	15·7	72	S.	1	B., Cb.
12	24·80	27·8	10·0	121·2	...	30·8	28·0	20·3	63	S.	1	Bc., B.
13	25·15	34·0	8·5	132·0	...	24·0	23·5	19·2	85	S.	1	B., Bc., Sn., O.
14	25·10	28·2	7·0	122·5	...	34·2	32·0	28·2	78	N.	1	B.
15	24·92	38·8	13·5	132·0	...	29·8	29·8	29·8	100	N.	5	Bc., Sn., Cb.
16	24·69	36·5	9·0	131·5	...	21·8	21·0	15·8	76	S.W.	1	Cb., B.
17	24·70	27·2	10·5	93·5	...	27·0	26·6	24·8	91	N.	4	O. Sn., O.
18	24·82	28·8	1·2	53·0	...	21·8	21·0	15·8	76	N.W.	1	B., Bc., O.
19	24·90	27·3	8·5	132·5	...	25·0	23·5	14·0	64	N.W.	2	O., Bc, B.
20	25·01	28·3	0·8	87·0	...	28·2	23·5	4·2	30	N.	1	B.
21	24·79	30·4	0·0	135·0	...	25·2	20·8	3·8	36	S.W.	2	B., Bc., Cb., B.
22	24·92	29·0	3·5	124·0	...	30·5	30·5	30·5	100	S.W.	2	O., Sn., O.
23	24·95	41·0	22·5	55·0	...	44·0	42·0	39·6	84	S.W.	2·51	Bc., O.
24	24·92	45·0	35·0	116·5	...	45·0	42·5	39·6	81	S.W.	2	Cb., B.
25	24·97	47·5	24·0	132·0	...	44·0	42·2	40·0	85	S.	1	Bc.
26	24·99	45·4	19·0	127·6	...	40·5	35·0	28·0	61	S W.	1	B., Bc.
27	25·10	41·4	20·0	110·0	...	39·8	33·0	24·5	54	S.	2	B., O.
28	25·05	42·3	20·0	138·6	...	35·2	33·0	29·5	79	S.	1	Bc.
29	25·05	39·6	24·0	97·5	...	37·2	32·0	24·7	60	S.W., N.	1	B.
30	25·04	42·5	11·6	131·0	...	35·0	31·8	27·0	68	N.	1	Bc., Cb., Bc.
31	25·02	36·6	10·8	108·0	...	34·5	32·0	27·8	74	N.	1	Bc., Cb.

THE CLIMATE OF SAN REMO, AND BY INFERENCE THE RIVIERA GENERALLY, FOR THE WINTER SEASON 1879-80.

TABLE I.—*Mean Monthly North-Shade Temperature.*

	9 A.M.	3 P.M.	9 P.M.	Mean Monthly.	Mean Day Range.*	Greatest Day Difference.	Mean Night Minimum.	Mean Day Maximum.	Mean of Maxima and Minima.
November...	52·60	56·60	51·40	53·50	6·8	13·4	48·40	59·40	53·90
December ...	43·50	49·90	42·20	45·20	8·3	13·1	39·20	51·80	45·50
January.....	45·50	52·10	44·98	47·54	7·8	14·0	40·80	53·30	47·00
February ...	50·07	55·89	48·55	51·50	5·8	11·5	45·61	57·32	51·46
March	55·00	58·60	51·40	55·00	5·1	8·8	47·70	60·10	53·90
April	59·90	61·70	56·30	59·30	4·3	10·0	52·80	64·10	58·40
Mean ...	51·09	55·80	49·14	52·00	6·3	11·8	45·76	57·67	51·70

* The difference between the 9 A.M. and maxima readings.

The mean temperature for the whole season, deduced from the three daily readings was 52·000; and from the maxima and minima readings, 51·70.

TABLE II.—*Mean Monthly Temperature at the Meteorological Observatory at San Remo.*

	9 A.M.	3 P.M.	9 P.M.	Mean Monthly.	Mean Night Minimum.	Mean Day Maximum.	Mean of Minima and Maxima.
November ...	53·2	57·2	51·3	53·9	47·6	59·7	53·6
December ...	45·2	51·0	44·0	46·7	40·4	53·4	46·9
January	46·4	53·0	46·4	48·6	41·2	55·2	48·2
February ...	51·2	56·8	50·3	52·8	47·1	58·6	52·8
March	55·5	60·0	53·3	56·3	48·8	62·3	55·6
April	60·1	63·6	57·2	60·3	53·5	66·1	59·8
Mean.....	51·9	56·9	50·4	53·1	46·4	59·2	52·8

According to the above table, the mean temperature for the whole season, deduced from the three daily readings, is 53·1°, and, from the minima and maxima readings, 52·8°—being in the one case exactly 1·1° and in the other 0·1° Fahr. higher than my own readings.

TABLE III.—*South-Shade Temperature.*

	9 A.M.	3 P.M.	9 P.M.
January	47·5	53·0	45·1
February	52·9	56·2	48·5
March	56·7	58·3	51·5
April	60·1	61·8	56·4
Mean	54·3	57·3	50·4

TABLE IV.—*Sun-heat and Sunrise.*

	Maximum Sun-heat.	Average Sun-heat.	Days of Sunshine.	Hours of Sunshine.	Possible Sunshine.	Mean Daily Sunshine.
				h. m.	h. m.	h. m.
November...	—	—	24	182·00	286·07	7·58
December ...	120·3	113·0	28	226·00	271·30	8·07
January.....	128·0	114·3	30	227·17	279·04	7·34
February ...	135·6	118·5	27	208·42	293·28	7·46
March	135·4	123·1	29	264·14	363·38	9·10
April	146·1	129·7	28	222·37	398·13	7·57
Mean	133·08	119·72	27·6	221·40	315·20	8·05

TABLE V.—*Rain and Rainfall.*

	Days of Day Rain.	Hours of Day Rain.	Rainfall.	Mean Relative Humidity.	Highest Humidity.	Lowest Humidity.	
		h. m.	Inches.				
November...	6	31·30	2·40	65·6	94·4	44·2	Strong N.W., W., and N.E. winds.
December ...	3	20·00	1·65	58·7	93·1	33·3	Strong N.E. wind.
January.....	1	·10	·08	63·2	84·6	44·2	Strong N.E. wind.
February ...	5	27·00	2·70	74·0	95·8	53·0	
March	3	3·00	·20	75·0	85·9	47·7	Strong N.E. wind.
April	9	35 30	3·30	70·6	84·6	50·6	S.E. gale.
	27	117·10	10·26	67·8			

TABLE VI.—*Sea Temperature.*

	Mean Temperature.	Highest Temperature.	Lowest Temperature.	Mean Temperature of Air.	Sea Warmer than Air.	Greatest Difference.
	9 A.M.	9 A.M.	9 A.M.	9 A.M.	9 A.M.	9 A.M.
November...	60·2	63·2	58·8	52·6	7·6	19·6
December ...	52·8	56·4	51·6	43·5	10·3	18·4
January.....	52·8	54·9	52·1	45·5	7·3	16·4
February ...	53·8	55·0	52·2	50·0	3·8	6·7
March	55·2	56·2	52·1	55·0	·0	6·0
April	57·4	60·4	55·7	59·9	2·5	8·8

CLIMATE OF LONDON.

The Prolonged Absence of Sunshine is Noteworthy.

Meteorological Readings, taken daily at 8 *a.m. by Stewart's Instruments.*

The Lancet Office, Jan. 9th, 1879.

Date.	Barometer reduced to Sea Level, and 32° F.	Direction of Wind.	Wet Bulb.	Dry Bulb.	Solar Radia in Vacuo	Max. Temp Shade	Min. Temp	Rain fall.	Remarks at 8.30 A.M.
Jan. 3	29·36	S.E.	41	41	...	45	31	0·66	Raining
„ 4	29·70	N.W.	...	33	...	40	31	0·12	Foggy
„ 5	30·08	N.W.	...	33	...	38	28	...	Bright
„ 6	30·28	N.W.	...	27	...	35	24	...	Overcast
„ 7	30·10	N.W.	33	34	...	35	25	...	Foggy
„ 8	29·58	S.E.	...	30	...	35	26	...	Overcast
„ 9	30·09	S.E.	...	34	...	36	26	...	Overcast
Feb. 7	29·48	S.W.	46	47	...	52	43	...	Stormy
„ 8	29·49	S.W.	43	45	...	53	43	0·11	Cloudy
„ 9	29·38	W.S.W.	49	51	...	54	43	0·35	Cloudy
„ 10	29·97	S.W.	49	50	...	51	48	0·11	Raining
„ 11	29·00	W.	46	48	...	52	45	0·85	Overcast
„ 12	29·63	N.E.	36	38	...	45	36	0·08	Cloudy
„ 13	29·84	S.W.	39	41	...	43	37	...	Overcast
Mar. 14	30·26	N.E	33	35	...	43	32	...	Snowing
„ 15	29·84	W.	41	43	...	52	33	0·11	Cloudy
„ 16	29·72	W.	43	48	...	55	40	...	Overcast
„ 17	30·13	E.	39	40	...	45	38	0·04	Overcast
„ 18	29·92	S.E.	42	43	...	53	39	...	Cloudy
„ 19	29·73	E.	45	48	...	63	41	0·14	Foggy
„ 20	29·80	E.	43	47	...	58	44	...	Overcast
Apl. 23	30·09	W.	50	46	97	63	40	...	Cloudy
„ 24	30·08	W.	55	51	84	60	43	...	Cloudy
„ 25	29·98	N.W.	54	49	93	59	46	...	Cloudy
„ 26	30·01	N.	51	47	85	53	40	...	Overcast
„ 27	30·26	N.N.E.	45	41	77	51	35	...	Hazy
„ 28	30·13	N.N.E.	47	43	...	52	40	...	Cloudy
„ 29	30·23	N.	47	44	94	56	41	...	Cloudy
May 9	29·73	W.N.W.	41	43	73	55	40	...	Overcast
„ 10	30·06	N.E.	37	41	89	51	33	...	Cloudy
„ 11	30·04	N.W.	42	46	61	51	38	...	Overcast
„ 12	30·13	N.W.	49	51	97	64	44	0·09	Cloudy
„ 13	30·13	W.	51	56	92	60	44	...	Cloudy
„ 14	29·85	S.W.	49	54	93	58	48	...	Cloudy
„ 15	29·99	N.W.	44	50	70	50	43	0·17	Cloudy
June 20	29·76	W.	58	62	107	71	57	0·12	Cloudy
„ 21	29·81	S.W.	55	57	82	62	54	0·08	Raining
„ 22	29·92	N.W.	54	58	85	64	53	0·19	Cloudy
„ 23	29·96	W.	53	58	98	65	49	...	Cloudy
„ 24	29·59	W.	54	58	105	65	52	0·06	Cloudy
„ 25	29·58	W.	51	53	97	66	50	0·50	Raining
„ 26	29·79	W.	53	58	93	56	48	...	Overcast

Date.	Barometer reduced to Sea Level, and 32° F.	Direction of Wind.	Wet Bulb.	Dry Bulb.	Solar Radia in Vacuo	Max. Temp Shade	Min. Temp	Rain-fall.	Remarks at 8.30 A M.
July 5	30·10	W.	59	60	102	74	55	...	Cloudy
„ 6	29·99	N.W.	61	66	110	80	58	...	Cloudy
„ 7	30·01	N.W.	60	68	116	77	57	...	Cloudy
„ 8	30·04	E.	58	64	97	73	58	...	Fine
„ 9	30·10	W.	60	65	114	77	55	...	Cloudy
„ 10	29·90	N.W.	58	63	105	70	56	0·03	Cloudy
„ 11	29·88	W.	56	60	99	69	56	...	Overcast
Aug. 22	29·68	S.W.	63	58	108	71	56	0·24	Cloudy
„ 23	29·82	S.	58	57	...	69	55	0·20	Raining
„ 24	29·95	S.W.	69	62	103	73	59	0·78	Cloudy
„ 25	29·79	W.	63	59	104	71	53	...	Cloudy
„ 26	29·65	W.	61	55	94	65	54	0·05	Cloudy
„ 27	29·75	S.W.	56	55	...	64	53	0·73	Raining
„ 28	29·52	S.W.	60	60	...	69	55	0·57	Raining
„ 29	29·77	W.	61	56	89	68	56	0·37	Cloudy
„ 30	29·98	W.	57	54	103	71	49	0·02	Overcast
„ 31	30·00	W.	61	56	104	69	51	...	Overcast
Sept. 1	30·30	N.E.	52	51	90	67	45	...	Hazy
„ 2	30·48	W.S.W.	54	50	98	71	47	...	Hazy
„ 3	30·22	W.	58	53	105	73	47	...	Fine
„ 4	30·11	N.	53	52	91	70	47	...	Hazy
„ 12	29·11	S.W.	60	57	80	65	55	...	Overcast
„ 13	29·73	W.	59	56	83	67	54	0·12	Cloudy
„ 14	29·83	W.	60	57	91	66	53	0·68	Cloudy
„ 15	30·04	W.	55	53	90	66	49	...	Foggy
„ 16	29·99	E.	58	55	93	67	51	...	Cloudy
„ 17	29·93	E.	60	59	...	65	56	0·02	Overcast
„ 18	29·98	E.	60	59	...	64	57	0·03	Overcast
Oct. 10	30·47	N.E.	46	45	...	58	39	...	Foggy
„ 11	30·55	E.	45	45	...	53	44	...	Foggy
„ 12	30·53	E.	47	44	...	55	42	...	Foggy
„ 13	30·43	E.	45	45	...	52	42	...	Foggy
„ 14	30·20	W.	49	48	...	55	44	...	Overcast
„ 15	30·18	N.	43	40	...	49	38	0·02	Fine
„ 16	30·24	N.	40	36	...	50	34	...	Bright
Nov. 8	29·49	W.S.W.	42	45	...	46	35	...	Raining
„ 9	30·13	N.	34	37	...	50	33	0·13	Hazy
„ 10	29·62	W.	48	49	...	52	35	0·43	Raining
„ 11	29·48	N.W.	40	42	...	45	38	0·26	Overcast
„ 12	29·43	W.	33	35	...	41	32	0·02	Hazy
„ 13	29·41	N.E.	35	38	...	45	32	...	Overcast
„ 14	29·48	N.E.	38	40	...	46	36	0·07	Overcast
Dec. 5	29·69	N.	26	...	...	36	20	...	Overcast
„ 6	29·97	N.E.	30	...	...	35	25	...	Overcast
„ 7	30·46	W.	25	...	...	35	18	...	Foggy
„ 8	30·48	N.E.	35	34	...	39	25	0·04	Overcast
„ 9	30·64	S.	33	32	...	37	29	...	Overcast
„ 10	30·43	S.W.	37	36	...	40	31	...	Foggy
„ 11	30·63	S.W.	25	...	...	35	22	...	Foggy

INDEX.

THE END.

BAILLIÈRE, TINDALL & COX, 20, KING WILLIAM STREET, STRAND.