**On the true first stage of consumption : lectures delivered at the Royal infirmary for diseases of the chest / by Horace Dobell.**




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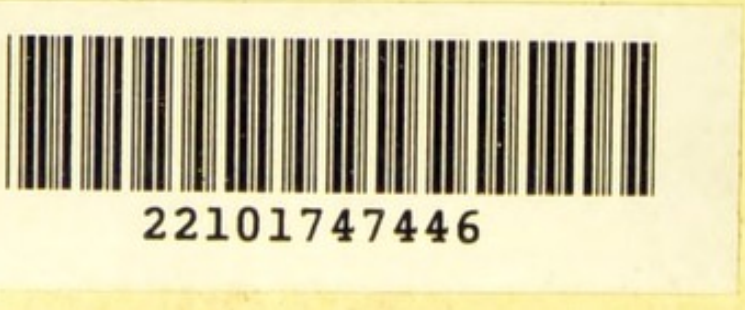
# FIRST STAGE
OF
# CONSUMPTION

Dr DOBELL



ON

# THE TRUE FIRST STAGE

OF

# CONSUMPTION.

LECTURES DELIVERED AT THE

ROYAL HOSPITAL FOR DISEASES OF THE CHEST.

BY

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# PREFACE.

THE following Lectures, having been considerably curtailed, when delivered at the Royal Hospital last January, many of the medical men present were kind enough to express a desire to read those parts which want of time had obliged me to omit, and to study the whole in a connected form. I therefore promised to publish the complete Lectures for their perusal. In redeeming this promise, I have taken care to reconsider the subject to which they relate, and both to add to and take away from my original composition, wherever I thought that by so doing I could make it more worthy of the attention of my medical brethren.

I have only to add a request, that my readers will bear in mind that the disease treated of in these Lectures is Pure Tubercular Consumption, or Tuberculosis.

84, HARLEY STREET, W.
*March*, 1867.

# CONTENTS.

## APPENDIX.

# ON THE TRUE FIRST STAGE OF CONSUMPTION.

RECENT advances in our knowledge of the natural history and pathology of Tuberculosis have made it essential to an enlightened treatment of the disease that we should no longer delay making a radical change in the nomenclature of its several stages.

That which has heretofore been called the "Premonitory stage" ought, in my opinion, to be at once recognised as the True first stage of Consumption.*

There is no doubt that many scientific members of our profession have for some time past recognised that the commencement of Consumption precedes the formation of Tubercle. But so long as the first stage of the disease is said not to begin till the formation of Tubercle, so long will there be a misunderstanding among the majority of practical men as to the importance of any period by which this is preceded. The use of the word "premonitory" to the stage which precedes the deposit of Tubercle is the

* As I do not think we shall ever find a name better suited to the disease than the old name Consumption, I have used it throughout this lecture.

most dangerous snare that could be laid for both doctor and patient. Is it not the proverbial failing of mankind to disregard mere warnings or premonitions, and to leave everything to the last? Even in the preparation for eternity, belief in the efficacy of death-bed repentance has always had a fascination to the human mind; and in the every-day affairs of life this spirit of procrastination still more universally prevails. Who then can be expected to stop in the midst of the absorbing pursuits of letters, politics, commerce, and society, to change all his plans and adopt a rigorous system of hygiene, merely because he is told by his physician that there are "premonitory" symptoms of disease—that is, so far as the patient can understand, signs that he may happen at some future day to suffer from disease.

This is a matter on which we must not be satisfied because, as pathologists, we ourselves understand what we mean by the terms we use. It is essential to our own action in practice that we establish a popular appreciation of the facts of the case. Unless our patients and their friends attach the same importance to the words in which our opinion is delivered as we do ourselves, we may as well hold our tongues, for our advice will be disregarded. You will find as a general rule, and I do not see how it can be helped, that what are regarded by the profession at large to be the most enlightened opinions of the day are several years at least behind those held by the leading members of the profession; and that the majority of the public, even of the enlight-

ened portion of it, are some ten years behind the mass of medical men in what they believe to be the most advanced opinions on medical subjects. This is strikingly illustrated by the case of consumption. The most enlightened physicians attach all the importance in the "curative" treatment of the disease to the so-called premonitory, or pretubercular stage. But with the public, notwithstanding their anxiety to be "cured," no very grave importance is attached to anything less than the stage of softening or of excavation. Unless you can tell the friends of a patient that the lungs are beginning to "ulcerate," it is very difficult to get any very decided action in the hygienic management of the patient.

It is my duty, then, to dwell for a short space upon the medical aspects of this stage which has hitherto been called by the unalarming name "premonitory," and to show why it ought to be called in future "the true first stage of the disease."

The first point which I wish to put prominently before you is the admitted fact, that there are no possible means of ascertaining with absolute certainty during life, the existence of a score or two of scattered tubercles in the deeper parts of the lungs. Yet the formation of one microscopic tubercle is proof of the setting in of what is now called the first stage of consumption. This alone ought to be a sufficient reason for changing the nomenclature. It is utterly absurd, when applied to practical medicine, to make a disease begin at a point at which a serious structural change takes place, but which it is impossible to

identify with certainty during life. The truth is, that these divisions in the course of the disease have been made by the morbid anatomist in the post-mortem room, not by practical pathologists and physicians in the chambers of the sick. It is not surprising, therefore, that they are worse than useless in practice.

In the next place, it is evident that the use of the terms "premonitory stage" and "first stage," as now employed, can have no sense, except on the assumption that the deposit of tubercle constitutes the disease; and thus a false pathology is doubly impressed on the mind of both physician and patient. The sooner, therefore, we alter a nomenclature so damaging to the prospects of right treatment the better.

That of which I have to speak to-day, then, under the name of the "True first stage of consumption" is what is commonly called "the premonitory stage," the stage which precedes the deposit of tubercle.*

What then is this first step in the important series of changes constituting consumption? Have we any signs or symptoms indicating its occurrence upon which we can rely with any certainty at all?

My opinions as to the nature and cause of tuberculosis are before the profession, and have received the acquiescence of scientific men to a sufficient extent that I need not hesitate to speak of them with that confidence in their truth, which is so deeply impressed upon my own mind. You are probably aware that I consider tuberculosis to be due to a defect in the action of the pancreas on the fat taken as

* See Appendix, par. 6.

food, especially the solid fat. "The supply of properly prepared fat is cut off from the blood: 1, by the fats not being brought into a proper condition by the pancreas; 2, by loss of absorbing power in the small intestine, due to the repeated contact of unhealthy pancreatic juice and of defectively prepared food with its mucous membrane. Thus the blood becomes defectively and deficiently supplied with fat-elements from the food; is unable to afford those required for direct combustion; does not replace those taken up during the interstitial nutrition, but, on the contrary, takes up more, to compensate the deficient supply from the food. This having gone on up to a certain point, the fat-elements of the albuminoid tissues* are seized upon, and these tissues are minutely disintegrated in the process. This disintegrated albuminoid matter is *nascent tubercle*; and this process of disintegration is *tuberculisation*."†

I may mention that Professor Frankland has lately written me as follows concerning the chemical part of this theory of tuberculosis:—"I have been much interested and impressed by the chemical considerations involved in your argument. I quite agree with you that tubercle is partially oxidised fibrin or albumen, and that there are very

* The word "tissues" is here intended to include the albuminoid materials employed in the construction and repair of tissues, for it is probable that the fat-elements may be waylaid during the process of tissue-formation.

† On Tuberculosis: its Nature, Cause and Treatment, &c. By Horace Dobell, M.D. Churchill, Second Edition, p. 5.

strong grounds for believing that such an oxidation will not take place in the protecting presence of fat. It seems to me that the view of muscular action which I have advocated, lends great support to your theory, since, if muscular work is totally independent of the oxidation of muscular fibre, it follows, almost as a matter of necessity, that the continual renewal of muscular fibre takes place by the absorption of the latter into the blood and not by its oxidation *in situ*. Hence the oxidation of fibrin or albuminoid substances *in situ* is an abnormal or morbid condition of things."

According to my views, then, pure tuberculosis commences when fats, properly acted upon by the pancreas, first cease to pass in normal proportions into the blood. Tuberculisation, or the formation of tubercle, commences when albuminoid matter is abnormally seized upon for its fat elements. It is to this stage of tuberculosis, beginning with the defective supply of pancreatised fats to the blood, and terminating the moment the loss of fat in the blood has gone so far that the albuminoid materials are seized upon and tubercle produced, that I wish to confine my remarks to-day. It is this which, in my opinion, ought to be called the "*true first stage of consumption*," because it is in truth the beginning of the disease, whereas the formation of tubercle is only an effect of the advance of the disease. It is, in fact, the earliest step in the decay of the body, the first yielding up of the tissues to destruction, as distinguished from their normal wear and

repair. This may be illustrated by the case of an oil lamp. If the oil is not renewed, we may watch it gradually disappear as the flame burns, till at length a moment arrives when the last drop has left the wick, and the wick itself begins to burn. The wick may be saved at any time previous to the disappearance of the last drop of oil, by supplying fresh oil to the lamp. I limit the first stage of consumption, then, to this period before the wick begins to burn. It is impossible to exaggerate the importance of this true first stage of consumption when rightly understood. The normal supply of fat to the blood has stopped, histogenesis is at a standstill, the fat stored up in the tissues is being steadily consumed, every hour brings nearer the moment when this store will fail and the first particle of albuminoid tissue will be yielded up for combustion. At that moment the die is cast, tuberculisation has commenced, and no one can prognosticate the end. Who shall say that the oil will be replenished before the wick is spoilt? We cannot blow out the lamp of life while we pour in fresh oil. It must continue to burn, and all the time required for restoring fats to the blood may be occupied in disintegrating albuminoid tissue and the formation of tubercle.

For practical purposes, we cannot do better than keep before us the comparison of the lamp, for the main points of the simile are singularly near the truth; and they are so simple and familiar that they strike the mind at once, and keep the attention upon

the leading indication for treatment, viz., to throw fats into the blood without a moment's delay.

But the more we are impressed with the meaning and importance of this stoppage in the flow of fats into the blood, the more anxiously must we turn to the question how we are to tell when this stoppage first occurs. It is easy enough in a transparent lamp to watch the consumption of the oil and to anticipate the time when it needs to be replenished. But it is quite otherwise with the human body, in which the whole apparatus is hidden from our view. Not much is left to guide us but the flame itself. And, unfortunately, this may burn so brightly after the proper source of material for combustion has been exhausted, that it is difficult to believe that the flame is depending upon an unnatural source for its support. There is no doubt that even a skilled observer may be completely deceived unless he is extremely watchful—watchful to a degree that no one could be expected to be unless impressed with that imminence of the need which I am attempting to point out.

We return then to the vital question, have we any signs or symptoms of this first step in consumption? While I am quite satisfied myself that we have, I am fully aware that they are extremely delicate, very apt to elude observation, and open to many sources of fallacy. There can be no doubt that the detection of obscure and ill-defined phenomena, the collection of appropriate collateral evidence not ascertainable without a direct special enquiry, the co-ordination of all these slight points,

and the power to draw from them a sound conclusion, require knowledge, experience, skill and tact of a peculiar kind, only to be gained by a special education directed to a given object. In proportion as we cultivate this kind of power do we acquire the *art* as distinguished from the *science* of medicine. The possession of this power is not less difficult to believe in than to demonstrate, but it is none the less certain that it may be acquired. We readily believe in the *tactus eruditus* of the surgeon, which enables him to detect deep fluctuation in a part where other persons can detect nothing of the kind, because he has only to plunge in his knife to prove himself right or wrong. We do not so readily believe in the judgment of a connoisseur who examines an unsigned painting and tells us that it is the work of a particular artist, because in this case it is more difficult to bring his skill to the test of an *experimentum crucis*. Yet there are men who have attained to such perfection in this art that their judgments are almost always to be relied upon. But the case before us is far more difficult than either of these. If a physician diagnoses the first stage of consumption, and the patient gets well, it is competent for any one to think that the physician was mistaken in his opinion of the case. And not only is it impossible to prove that he was not mistaken, but he may himself easily be perplexed by doubts of his own skill. On the other hand, should the case run on into its advanced stages, it is competent for any one to doubt whether

it was not further advanced than was supposed when originally diagnosed; and thus, in either case, a doubt may rest upon the power of the physician to diagnose the earliest symptoms of disease.

But I would especially urge upon the younger members of our profession not to let these difficulties and discouragements dishearten them, or turn them for one moment from the endeavour to acquire this peculiar kind of skill in their art. There is nothing antagonistic in the art and science of medicine; on the contrary, there is every reason why they should be combined, for the assistance of each other. But it is absolutely necessary to their right working that we should clearly appreciate and candidly admit the peculiar merits and scope of each, and not for a moment pretend that one can take the place of the other.

In the days of Hippocrates, Aretæus, and even of our own Sydenham, they had so little else to depend upon, that the cultivation of the *art* of medicine was all in all to the physician. Since their time the *science* of medicine has deepened and extended, until it has become so vast, that the sort of skill possessed by the ancients has been lost sight of, or even purposely depreciated by teachers of modern physic. Yet it must be admitted by all who candidly consider the subject, that no amount of medical science will make a man a good physician without the addition of skill in his art. As well might we expect that the wonderful art with which Landseer brings upon the canvas all the form and life of the

"Monarch of the Glen" could be acquired by a study of the anatomy of the stag, and of the mode of mixing and arranging colours. In one case and in the other, the art can only be learnt by practice.

I have been led to make these remarks because the case before us, the True first stage of consumption, is peculiarly one which calls for the *tactus eruditus*,—the art—of the physician. It constantly eludes the most scientific medical men if they want this tact; whereas, I have frequently seen it clearly and positively diagnosed by non-professional parents of consumptive families, who have acquired this tact by anxiously watching the inroads of disease on lives so precious to them that their faculties of perception have become excited so vividly as almost to catch impressions of the future. They have, in fact, acquired the art of identifying the earliest sparks of disease by the only means by which such art can be acquired, viz., by the constant and earnest waiting upon health and disease, with the mind on the alert for every passing phase of change from one into another. There is a peculiar aspect which, to the practised eye, is almost unmistakeable, as a sign of the earliest step in consumption; but I do not believe it is more possible to convey such an impression in words than to paint a meteor or to describe the different tinges in the hue of a golden cloud at sunset and at sunrise. This aspect is most important, but it can only be learnt by watching hundreds of cases in all the modifications due to mental and bodily conformation, complexion, tem-

perament, habits, age, sex, occupation, class in society, and the like.

I must pass on, therefore, from this indescribable *tout ensemble*, and endeavour to give you a few guides which, while they have much to do with the production of the aspect to which I have referred, lie more easily within our grasp, and approach more nearly to the character of physical signs.

Three essential elements combine to give the key to all the changes of consumption;—loss of fat and of flesh, loss of strength, and disturbance of temperature and of excitability. Some indication of their existence is very early detectable. They are easily understood if we keep in mind the nature and cause of tuberculosis, as I have attempted to explain it—defective or deficient supply of pancreatised fats to the blood. The immediate effect of this must be an actual diminution in the quantity of fat in the body; but it is important to remember that this does not necessarily involve an immediate diminution of weight or of size. If a person is increasing in fat, it shows that the quantity of fat-making materials taken and assimilated is in excess of the requirements of the body for simple maintenance, that in fact a store is being accumulated. If, then, the supply becomes deficient or defective only to the extent of its former excess, an arrest in the accumulation of fat, but not an actual loss of fat, will be the first effect—the fat will remain stationary. If, on the other hand, the quantity of assimilable fat-elements passing into the blood is only barely sufficient to keep

the fat of the body stationary at a low level, the first loss in the quality or quantity of the supply must be attended by an actual loss of fat. In the latter case, the change may usually be more easily detected, but not always.

There is a very delusive source of fallacy which it is necessary to understand in relation to loss of fat without loss of weight. In some consumptive persons, when the defect or deficiency in the supply of pancreatised fats to the blood first occurs, there is an immense effort made by the nutritive powers to save the patient from the disastrous effects of this loss of a direct supply of fat. The appetite for all other foods, and especially for albuminoid foods, becomes ravenous, and, in those who have the means of freely supplying this demand, carbon is procured by the disintregation of albuminoids in sufficient quantity to replace that which ought to be supplied in the form of fat, while the fat absorbed from the tissues is made to suffice for those histogenetic processes which cannot be carried on without the help of fat. This acts as a sort of temporary cure; and I have taken advantage of the expedient, thus adopted by nature, in the treatment of certain appropriate cases, by supplying them with a diet* in which the carbon, which in a normal diet is supplied by the fats, is made up from the excess of albuminoids. This however can only be a provisional remedy for the defective supply of fat; and unless the normal

* See Appendix, par. 10, Table II.

supply is quickly restored, the patient makes a disastrous descent. For, first, there is overtax of the digestive and assimilative processes by the inordinate consumption of one element of diet; then there is overtax of all the vital processes necessary to obtain, by a complicated route, the carbon from the albuminoid materials; and, lastly, there is the overstrain upon the organs of excretion in getting rid of the excessive waste of nitrogenous matters. And, after all, how totally different is the result from that constant and abundant flow of fat from the lacteals into the right heart, which occurs in the normal state, keeping the delicate albuminoid tissues of the lungs constantly bathed in fatty blood, and thus protecting them from the influence of oxygen. Nevertheless, this inordinate consumption of albuminoid food does take place in certain cases, with the effect of deluding the observer by keeping up the weight of the patient.

There is another source of fallacy against which it is necessary to guard, and which I have often seen lead to misapprehension. Cases are every now and then brought forward, in which it is asserted that tuberculisation has taken place without any defect in the supply of fats to the blood; patients are produced having signs of advancing tuberculous disease of the lungs, but whose bodies appear to be amply supplied with fat, and who assert that they have not lost in size. There is no doubt that, to a superficial observer, such cases are very puzzling and apt to mislead, but the solution of the difficulty

is very simple. It is to be found in the altered consistence of the fat.* The adipose cells remain full, but their contents have lost their more solid ingredients, and only a thin oleinous fat remains; in popular language, their fat "has turned to water." This is just one of those changes which, in its early state, is more likely to be observed by an anxious friend watching a person from day to day than by the medical man, who, perhaps, forms his opinion from a single examination, and has not the opportunity of comparing the consistence of the patient's flesh with what it was in health. In such cases you will often find, on close enquiry, that the intimate friends of the patient have observed that the flesh has become "flabby and puffy," instead of "firm and fat," even though to a stranger there is nothing abnormal in the appearance. It is only necessary to be on our guard against these cases, and to make the necessary enquiries and examinations, to avoid mistake. On the whole, they do not often occur.

One of the most misleading circumstances in reference to the very slight loss of fat accompanying the first steps in tuberculosis is, that the patients themselves are seldom aware of the change. Even after the loss of fat can be proved by scales and weights patients often assert that they have lost none. This I have tested and proved in a very large number of cases under my own observation, and it has often turned out that cases, shown to me

* See Appendix, par. 3.

by medical men as examples of absence of loss of fat, have been known by their friends to have grown thinner, although denying it themselves, and by weighing them from week to week the loss has been shown to be still progressive. It is of no use, therefore, to depend upon the answer of the patient to the ordinary question, "Have you lost weight?"

The *second* element in the general symptoms of consumption is Loss of Power. This is at once explained when we consider what are the sources of power in the organism.

I must assume that every one present is more or less familiar with the results of modern theory and experiment on this important subject. You are aware that, according to modern views, there can be no force in the organism which is not the result of oxidation of the materials of the body, either in the form of tissue or in some intermediate condition between tissue and food. You are aware also that this force can only be manifested in what we ordinarily call "strength,"—or the power to exert potential energy,—by means of muscles and other organs by which mechanical power can be exercised.

These mechanical organs can only act naturally when kept in a condition of normal maintenance and repair, and to this maintenance and repair fat is absolutely essential. The maintenance of normal power or strength, then, necessitates a normal supply of the materials upon the oxidation of which the liberation of force depends, and the maintenance of

normal repair in the mechanical instruments of the body; and it is obvious that to maintain such a combination of conditions involves the necessity for a normal supply and passage from the stomach into the blood of all the required materials for oxidation and histogenesis.

If these conditions comprised all the requirements of the organism, the case would be much simpler than it is. If it were only necessary that the organs of the body should be supplied freely with the materials for their construction and repair, and that this free supply of food should include a quantity sufficient for the liberation of the amount of force requisite for the actions demanded of the organs, there might not be much danger of the apparatus getting out of gear. But the case is in every way complicated by two essential conditions, which happen to be especially connected with our present subject. 1st. As I have already intimated, it is not only necessary that carbon and hydrogen shall be supplied to the blood, but unless a certain proportion of the carbon and hydrogen is supplied in the form of fat, *per se*, tissues can neither be constructed nor repaired. Histogenesis cannot go on without fat. 2ndly. It is absolutely essential to the processes of life in the human body that a temperature of 98° Fahr. shall be constantly maintained throughout the organism. This is the first demand, and until it is supplied nothing else can go on. This heat, as you know, is only to be obtained by oxidation, and the amount of oxidation accompanying the main-

tenance and repair of the mechanical organs is far too little to afford both heat and mechanical force. Hence there is in the organism a constant demand for carbon and hydrogen sufficient to develop enough heat to maintain the whole body at a temperature of 98° Fahr. It may be shown by calculation that about 8,000 British units of heat* are required every twenty-four hours by an adult man of average stature, to raise the temperature of the inspired air to the temperature of the body, to vaporise the pulmonary halitus, and to maintain the animal heat. In addition to this, the mechanical equivalent of about 2,000 British units of heat is expended in mechanical work, more than half of which is absolutely essential for the internal vital work of the organs of respiration, circulation, etc., which require about 400 foot-tons† of mechanical force, leaving a balance of 290 foot-tons for the external work of the body. The whole of this force, equivalent to 10,000 British units of heat, is evolved by the combination with carbon, etc., of the 30 oz. of oxygen known to be consumed every twenty-four hours by an average man.

You are aware that all the forms in which potential energy can be manifested, *i.e.*, all forms of force, are so correlated that they are convertible into one another. But it is, of course, impossible that the same force can exist in two forms at the same time; the potential energy which is being manifested as mechanical force, cannot at the same time be manifested as heat, and *vice versa*. But any

* See Appendix, par. 1. † See Appendix, par. 1.

force developed in the form of heat, if not required in that form, may be made immediately available in the form of mechanical force, and *vice versa*.

In the allwise and beneficent arrangements of nature, full advantage has been taken of this property of force for the economical working of the animal organism, and the maintenance of a safe equilibrium in the processes of life. Anticipating and providing against the probable chances of a fluctuation in the supply of materials for oxidation, it is so arranged that, in the first place, a reserve of carbon and hydrogen, in the form of fat, shall be stored up in the body to be utilized in case of need; and, in the second place, that the oxidisable materials provided for the purposes of mechanical power shall be available for the development of heat, and those provided for the purposes of heating shall be available for the development of mechanical power. So that, under all circumstances, there is a giving and taking between heat and mechanical force to any extent requisite for the purposes of human life and action. But the maintenance of temperature stands first. This, at least, must be supplied, whatever else is sacrificed.

Here, then, we have the explanation of that loss of strength which I have stated to be the second essential element in the signs of tuberculosis. First, as I have shown, comes defect in the supply of fats to the blood, that is, defect in the supply of carbon and hydrogen for oxidation, and of fat for histogenesis. Next comes loss of power, so soon as the

supply of oxidisable materials falls short of the quantity required for histogenesis and for the liberation of both heat and mechanical force. Heat must be maintained at any cost—that cost is first shown as loss of strength, because heat is maintained by taking the materials which ought to be available for histogenesis and mechanical force.

Thus loss of fat and of flesh, and loss of strength become the two first essential physical indications of the True first stage of consumption.*

The *third* element in the symptoms is inseparable from the other two. Perturbation throughout the organism, manifested by general excitability and disturbed temperature.† This is simply the expression of what is going on in the body, viz., vicarious oxidation—oxygenated blood traversing the organism in search of carbon and hydrogen, demanding it in new places and at any expense.

And this is all!—If you look for any other reliable physical signs of the True first stage of consumption you will be disappointed, for no others are at present known. Percussion and the stethoscope tell us nothing of its existence, and are only of use so far as they can inform us whether or not the true first stage has passed and tuberculisation taken place.

If time had permitted I would have dwelt upon two most important topics, viz.:—1st, The *distinctive diagnosis* of the True first stage of consumption, from

* See Appendix, par. 7, 8.

† See Dr. Sidney Ringer's Observations on the Temperature in Phthisis Pulmonalis.

other diseases with which it is in danger of being confounded; and 2nd, the meaning of *hæmoptysis*, and the position it occupies in the earlier stages of tuberculosis. With regard to the latter, I will only now observe that if hæmoptysis ever occurs in consumption previous to the formation of tubercle, it is only so closely before its track that, for practical purposes, tuberculisation and hæmoptysis must be regarded as coetaneous events. No wise man, therefore, will wait for hæmoptysis before commencing treatment in consumption, and when it occurs he will consider it as a sign that the case has passed beyond the stage of easy cure, and entered upon that of difficulties. The former question must be reserved for fuller discussion on some other occasion; but I will just observe that, according to my experience, the two states most frequently mistaken for early consumption are Anæmia and Apepsia.

No greater mistake can be made than to confound anæmia with the True first stage of consumption. It is true that prolonged chronic anæmia may lead to consumption, when it has been neglected for such a time that the sub-oxidated blood has paralysed the pancreatic function by persistent loss of the demand for fat. But deficiency in the red corpuscles of the blood *per se* is antagonistic to tuberculosis. In the advance of consumption, the patient becomes bloodless from want of materials to replenish the blood, and the formation of red corpuscles is arrested together with all histogenesis. But as the blood in anæmia, so called, is characterised by its loss of red corpuscles, and as

these corpuscles are the oxygen-carriers, so do we see that anæmic persons retain and rather accumulate fat from the deficiency of oxygen to consume it, instead of losing fat, from an excess of oxygen compared with the supply of materials for oxidation, as in consumption. The advance of consumption, then, may become attended with anæmia, and the advance of anæmia may, under particular circumstances, become attended with consumption. But the true first step of consumption and acute anæmia are incompatible, yet it is these two states which are so often confounded. Under the head of treatment I shall have to refer to this again, but I have not time now to go fully into the question. (See p. 47.)

In apepsia there is undoubtedly loss of weight and loss of strength, but there is no special interference with the assimilation of fat. The symptoms are simply those of starvation, with the addition of an obvious stomach difficulty, which can generally be easily identified, and with a little hygienic and therapeutical tact is, as a rule, soon remedied. There is not much harm done by mistaking apepsia for consumption, beyond a little unnecessary alarm, but it is never safe to neglect apepsia, especially in consumptive families, for the pancreas may become paralysed in its functions in concert with the other digestive organs, and it is apt not to resume them so readily as the stomach.

We must now turn to the second division of our subject, viz. : the *treatment* of this True first stage of consumption, with the imminent importance of which I trust we are all fully impressed.

Assuming that we have been able to determine that the function of the pancreas is defective,—that it is either depraved, deficient, or both, and that, as a consequence, normally pancreatised fats are not passing into the blood in proper quantities—what is to be done for the patient?

To answer this question in the simplest form first, I will assume—that the defect has been detected at its very onset, that there is no hereditary cause, that there is plenty of fat in the blood and in the systemic reserve to last for some time, and that, therefore, there is no *immediate* danger of tuberculisation,—that there is in fact nothing but a temporary defect in the action of the pancreas.

Narrowed within these limits, the object of treatment is simple enough. We have nothing to do but to correct the defect in the action of the pancreas, as we would a similar defect in the action of the liver or stomach. When we have done this, we shall have saved the patient from all the catalogue of miseries and difficulties included under the head of consumption. We shall have actually cured the disease in its first stage.

The means by which this simplest form of cure is to be effected, must vary with the circumstances under which the defective action of the pancreas has occurred. All depressing influences must be removed; in some cases in which the defect has arisen simply from some sudden depressing emotions, a sudden revulsion to joyous spirits will set all right again. The stomach, liver, intestines, and

kidneys must be unloaded of their contents and their secreting glands and cells freed from accumulations, and stimulated to fresh action; this is especially necessary with the liver and mucous glands of the intestines. The portal system of veins must be thoroughly relieved from congestion and obstruction, so that absorption may be accelerated. The skin must be stimulated into action. The pulmonary circulation and the right heart must be freed from all impediment. Respiration must be set vigorously to work, and the diet must be regulated. In fact, every function of the body must be looked to and called to its account; and, above all, *everything must be done promptly with as little cost to the strength as possible.* The true remedy for defective or arrested pancreatic function must then be applied freely and without delay, that is, cold dry air without wind, and plenty of it; exercise in such air, and exhilarating society. Clear, dry, windless cold, out-of-door exercise and good spirits, constitute the essence of stimulation to the pancreas. It is astonishing how the organ leaps into action under these influences. Immediately it does so and the call comes for food, this should be supplied to any extent demanded, only providing that it be unirritating and unstimulating in its nature, and that it contains plenty of fresh fat, starch, and milk. No more striking example of this treatment and its effects can be found than is seen in America. The New Yorker who has jaded his appetite and his nerves, till he has lost all relish for his complicated table d'hote, has failed to answer

to his "liquoring-up," sees no more charms in crowded rooms and gossip, and even dollars cannot stir his gaunt and fatless body out of its apathy, at last consigns himself to the railway car for St. Paul. And there, in the cold, dry, clear, windless air of Minnesota, he wakes to the excitement of the "hunt," soon calls ravenously for food, longs for fat, and in a few weeks regains his wonted energies and relish for the world. I wish there were a Minnesota nearer home, to which I could despatch the jaded Londoner. It would be the saving of many valuable lives, who now dawdle over physics, quackeries, and intended changes of occupation, till the day for cure has past.

Promptitude in this case is everything. I cannot too strongly describe the value of every day lost, after the flow of fats into the blood is interfered with, for every day brings nearer, at a rapidly increasing rate, the hour when successful treatment will have lost all its simplicity and become beset with difficulties.

Having now sketched, in as few words as possible, the essence of all treatment for the simple restoration of pancreatic function, I shall pass on to consider, as far as time will allow, those *complicated difficulties* with some or all of which nearly every case is unhappily beset, when it comes before the physician.

Hereditary predisposition. Of all the difficulties perhaps none is equal to that presented by hereditary predisposition. The hereditary defect may be in the pancreas itself or in the whole organism. In the first

case we may start with a pancreas that was never made to act consistently and efficiently—that has been either defective from birth, or has become so in the course of development after the model of its ancestor,—a defect analogous to that in the cerebral organisation of persons who inherit insanity. Such a pancreas may have kept up fairly to a limited function, sufficient for the purposes of the individual while all went smoothly in its favour, but is inadequate to any emergency. Such an organ is easily turned from its duty, its secretion perverted or stopped by the slightest unfavourable influence. In the second case, the pancreas, *per se*, may be sound enough, but the individual may inherit such a susceptible sympathetic system that every passing ruffle in the affairs of life paralyses or perverts the pancreatic function. For it must ever be borne in mind that the pancreas, like the mammary, the salivary and the lachrymal glands, is singularly susceptible of sympathetic influences; as we see the secretion of milk in women perverted in a number of ways, gradually lost, or suddenly stopped under the influence of defects of health, mental anxiety, excitement of the passions, emotional shocks, and a host of other influences, so do we see the secretion of the pancreas affected by similar and by other causes. Thus among the forms in which this organ may be affected by family predisposition, must be included as very important, an undue susceptibility to sympathetic perturbations. Without saying more, I think it must be clear that the difficulties introduced into

treatment by hereditary predisposition to consumption are very great. But the following case, which has lately occurred at this Hospital, and which is by by no means unique, will show that these difficulties may be overcome, and that tuberculosis, and even tuberculisation, may be brought to a stand-still, and the health restored, in spite of the strongest hereditary influences, provided a sufficient number of favourable circumstances can be combined in the treatment:—

H. C., male, aged 35, applied to the Infirmary, expectorating small masses of cretaceous matter, which were shown by the physical signs to come from the upper part of his right lung, which was consolidated, and presented signs of recent softening. The history showed that his parents and all his brothers and sisters had died of consumption, and that he himself spat blood and was considered consumptive at fifteen years of age. Having lost all his family at that time, and an opportunity occurring of going to sea, he took office on board a ship, and cruised in the Mediterranean for four years. After going to sea he soon lost his consumptive symptoms, and regained what he considered perfect health, in which he had continued, with very little interruption, up to twelve months before admission, when he got into low health, through engaging in a sedentary employment in a very close shop. Since that time he had lost strength and flesh, his cough had returned, and from time to time pieces of very hard calcareous matter had come up in the sputa. There

can be no doubt that in this case tuberculisation, which had occurred in this patient, as in all the rest of his family, had been arrested at the age of fifteen by the cruise in the Mediterranean with the active duties of a sailor's life. The cure had remained permanent during about sixteen years, and but for unfavourable conditions of life might have continued up to the present time.

Another very serious difficulty is found in the state of the mucous lining and absorbent system of the alimentary canal. Before the existence of tuberculosis is identified, or at least before treatment is begun, the pancreas may have been performing its functions insufficiently or abnormally for a considerable time. In consequence of this, improperly prepared chyle has been passing through the digestive tract, irritating the delicate glandular structure of its lining and damaging its absorbing and secreting powers, the lacteals have been taking up imperfectly prepared fats, and have thus been irritated and obstructed. Added to all this, the stomach has often suffered by an attempt to supplement the deficiencies of the small intestines, by digesting an undue amount of albuminoid materials; and, by the forced absorption of fluid fats, the portal system has become overloaded, and the condition of the liver materially deranged. Hence it commonly happens that when cases of early consumption first come under our treatment, all this has to be set right before a proper digestion and absorption would go on, even if the pancreas could be made to resume

its functions at once. In the mean time, tuberculosis is going on, and may advance to the stage of tuberculisation before the normal absorption of fats is restored. Yet the inconveniences attending this state are not very demonstrative. They may amount to no more than a certain sort of dyspepsia; and the general symptoms of disease are so unimpressive that the imminent importance of promptitude and energy in carrying out the necessary treatment is with difficulty impressed upon the patient and his friends, who are very apt to think that "too much fuss" is being made about what appears to them a trifling derangement of health. This places the greatest difficulty in the way of the conscientious physician.

Another and a most frequent difficulty in the way of adopting the means requisite for restoring pancreatic function is presented by the susceptibility of almost all delicate persons "*to take cold*" on slight exposure to changes of temperature. Fears of catarrh, of laryngeal sore throat, bronchitis, congestion of the lungs, pneumonia, pleurisy, rheumatism, constantly haunt the minds of the friends of these delicate persons, and stand in the way of the adoption of any of the means calculated to restore digestion, assimilation, and vigorous health. These fears are often well grounded. In a large number of cases, the patient is already suffering from more or less bronchitis, tracheitis, or pneumonic congestion when first brought under the physician's notice. All this has to be disposed of before any attempt

can be made at enforcing those conditions, which I have pointed out (see p. 26), as the best restorers of pancreatic function. Indeed, when the colds have gone, the susceptibility to their return still stands in the way. In many other cases, though there may be no catarrhal complications present, the patient has been kept like a hot-house plant, in the hope of avoiding colds, or has been engaged in occupations requiring such a condition, so that it is only by months of the most cautious management that this hot-house life can be broken through without accidents. All this causes the most dangerous delay in adopting the main treatment of tuberculosis. Before curative treatment can be put into action, such a serious advance in the progress of disease may have taken place as to render such treatment impracticable.

Another of the difficulties constantly presented to us occurs in those cases where the defect in pancreatic function has been brought on by the mental or emotional shock of some great anxiety or grief—blasted fortune—disappointed ambition—blighted love. What can the vigilance of friends or the skill of the physician do to remove such causes of disease? Yet these are among the daily vicissitudes of life, and we are called upon to treat the disease which they have caused, while the cause itself is exerting its full influence upon the case. Every medical man must have seen cases illustrative of the power of these vicissitudes of life to produce consumption, and of the rapid arrest or cure of the

disease if happily the cause be removed in time. Cases of girls suddenly falling into consumption when "crossed in love," and as suddenly recovering when the course was unexpectedly smoothed; of wives, in the midst of health, dying rapidly of consumption after the loss of husbands to whom they have been devoted; of strong men, vexed and worn by struggling with unconquerable difficulties, breaking up and dying of consumption when at last all hope was blasted. These are no dreams or inventions of the novelist, but the stark realities of every day life. With these the physician has to deal, while the power to avert or to remove them is in other hands.

I need not do more than remind you of the great, often insuperable, difficulties placed in our way by a variety of bad habits to which consumptive patients in common with other persons may be addicted; habits which in many cases have played their part in the causation of disease. It is hard enough at any time to induce persons to break bad habits, and even if they give all their energies to the task, time is necessary to success. How much more this is the case when the physical and mental powers are enervated by sickness, must be familiar to all.

Again, I must ask you to call to mind the numerous states of health and of disease which are found as accompaniments of consumption, and stand most seriously in the way of such treatment as I have pointed out for the restoration of pancreatic

function. Among these none are more puzzling than pregnancy and the puerperal state; they are often insuperable bars to the adoption of proper treatment. So are we stopped by spinal affections, diseases of joints, and many other complications, which I need not detain you by enumerating.

Unfavourable occupations and dwellings are at once the most common and the most serious of the difficulties which beset the curative treatment of consumption in all its stages. In my treatise on tuberculosis, I have placed first among the producers of defect in the function of the pancreas "any cause which for a prolonged period greatly reduces its activity, by reducing the normal demand for carbonaceous matters in the blood" (*On Tuberculosis*, etc., 2nd edit., p. 9), and I have described a large group of the admitted causes of consumption as "causes which act indirectly upon the pancreas, by diminishing the elimination of carbon from the blood, and thereby reducing the normal call for the introduction of *fat* from the food into the blood. By these means the pancreas is kept in a state of inactivity and low nutrition, until, in time, its secreting powers are depraved or lost." "It is evident that this heading will include a large number of the recognised causes of phthisis, *e. g.*, all those which diminish respiratory blood-changes for protracted periods, whether it be simply through deficient expansion of the chest, or through the hyper-carbonetted condition of the air presented for respiration; and all causes of deficient excretion by the

skin, especially if combined with defective respiratory action. It will also include cyanosis and chronic alcoholism" (*op. cit.*, p. 37). You will at once see how great is the difficulty presented by this class of causes of defective pancreatic action. The essence of the difficulty consists in the slowness of the process of deterioration. The pancreatic function is slowly and stealthily spoilt, the organ is, as it were, cheated into inactivity until it has lost the power to act. What is to be done? Secretion of healthy and sufficient pancreatic juice is out of the question; the habit of producing it has been lost, the organ is degenerated. Nothing can restore its healthy structure and functions without time, and time cannot be allowed, for every hour is precipitating the patient further into the depths of tuberculosis. If tuberculisation has not yet begun it is dangerously near; there is not a moment to spare. And then remember what it is you want your patient to do, and the class of persons most often subjected to unhealthy occupations, ill-ventilated work-rooms, and unhealthy dwellings. You want to make your patient relinquish the pursuits upon which a family are depending for subsistence, leave a dwelling inseparable from those pursuits, and engage in a variety of hygienic measures calling for an unusual supply of the very means which you are proposing to take away his power to earn. And all this about an indisposition which appears to the patient and his friends utterly unimportant in comparison with the sacrifices you demand. Although

these remarks apply most especially to the case of the poor man or woman whom you wish to take from the workshop and the cellar, they are also applicable, to a large extent, to persons in the higher walks of life. Close offices, chambers, committee-rooms, law-courts, schools, libraries, museums, assembly-rooms, and churches, and engrossing sedentary occupations, may influence those who are far removed from the workshop or the cellar.

I have now pointed out so many serious difficulties in the way of adopting the best, easiest, and simplest means of stopping consumption in its true first stage, that I will not stay to enumerate the many other obstacles which really lie in our path. There is one, however, which is so intimately related to those we have been considering, that I have already been obliged to refer to it more than once; and I must not pass it by, because it is the one which presents the leading indication for that treatment by which we can best escape from the defeat with which these complicated difficulties threaten us in practice, I mean the *imminence of tuberculisation.*

I have already stated that we have no means of positively determining when the first few grains of tubercle are formed, yet there is a point in nearly every case, and it happens to be the one at which even the earliest cases of consumption are most often brought to the physician—a point when it is clear that tuberculosis has gone so far that, if tubercle is not yet formed, if albuminoid tissue is not yet invaded, it may be invaded—tubercle may be formed—at any moment.

To return to our comparison of the lamp. We see that the oil has been all consumed, the flame just begins to flicker, perhaps there is enough oil still saturating the wick itself to save it from combustion while we refill the lamp, but it is a question of moments and uncertainties, the wick may be spoilt even while we are pouring in the oil. This is just the position of ninety-nine hundredths of the cases of the true first stage of consumption when they are first brought to us for advice. Tuberculisation is imminent; and it is in this emergency, in the hurry of this moment, that cod-liver oil is such a God-send to the patient. It is the kind of fat that can be hurried most rapidly into the pulmonary circulation; it is the fluid oleinous kind of fat that can pass by the portal instead of by the lacteal route; it is, as I have said in another place—and you must pardon me for repeating it, because I can find no simile so apt—like water to the uprooted flower. If you have a flower that has been uprooted and left out of the ground till it has begun to droop, you save it by plunging its roots into water, and you plant it in the earth when it has revived. Put it into the earth at once, instead of into water, and it will probably die before its withered spongeoles can convey nutriment to its vessels. On the other hand, if you keep it in the water after it has revived, instead of planting it in good soil, it will droop again and die for want of materials on which to live.

Patients in the True first stage of consumption advanced to near its end, when tuberculisation is

imminent, must be treated like the drooping flower, only that oil must take the place of water. It would be absurd, if it were possible, to set about the restoration of pancreatic function at this juncture. This must be our next consideration; but, first, we must adopt artificial means, by which the blood can be charged with fats much faster than the pancreas could be made to act, even if it were possible to adopt at once those hygienic means which I have pointed out as promoters of pancreatic function (see p. 26). But I have already shown that this is not possible, in consequence of the difficulties by which almost every case is beset. It is in this place that *Pancreatic emulsion of solid fat* comes to the rescue, and assumes such incalculable importance in the treatment of the first stage of consumption. My experience of its action is now so large, and my observations have been so cautiously and doubtingly made, that I dare to speak with a confidence which I trust may be distinguished from dogmatism. Pancreatic emulsion of solid fat is a natural substitute for the inactive or perverted pancreatic function. It supplies the lacteal system with solid fat in a condition fit for absorption, fit for transmission through the lymphatic glands, fit for combustion in the pulmonary blood, for the protection of tissues, for histogenesis, and for general utilisation throughout the organism. By an artificial expedient we supply the missing elements of normal nutrition in a natural form. Thus time is gained, the imminence of tuberculisation is removed, and the means for the restora-

tion of the normal function of the pancreas, by which alone a true cure is to be effected, can be adopted at leisure and in safety under conditions favourable to success.

From these remarks you will, I think, appreciate the position which I assign to cod liver oil and pancreatic emulsion of solid fat in the curative treatment of the first stage of consumption. I have attempted to depict the case of a person in whom tuberculosis is detected at its very onset, and I have endeavoured to show that in such a case the cure is so simply confined to the restoration of pancreatic function that there is no need for either oil or emulsion. But, practically, treatment is never commenced in this stage, and the means for restoring pancreatic function, that is the *cure proper*, cannot be safely attempted without the aid of the artificial introduction of fat—Cod liver oil, if it can be taken, to supply what fluid fat it may by the portal route; and pancreatic emulsion of solid fat to provide a normal supply of properly prepared fats by the lacteal route.

But let us never forget that when diseased changes have been arrested and prevented by these means, when the patient is thus placed in a position of safety, he is scarcely better off than a leaking ship when by means of constant working at the pumps she has been brought safely into a harbour of refuge. Unless advantage is taken of this temporary security effectually to mend the leak, the ship will go down the first time the pumps are

stopped. If means are not adopted to restore pancreatic function while the blood is being supplied with fat artificially, the patient will sink the first time an accident occurs by which the artificial supply of fat is stopped. It is through ignorance or neglect of this vital object of treatment that cases of early consumption, apparently progressing steadily towards recovery, so often relapse just when the improvement ought to have been made permanent, and thus the best chance of a radical cure is lost.

If means for the restoration of pancreatic function could always be adopted directly the need for them is discovered, and if we could be certain of speedy success when we employ them, there might be no particular need for any other remedy than cod liver oil, at least for those persons who are able to take it.* But, unfortunately, as I have attempted to show, it is very seldom that the means for the restoration of pancreatic function can be adopted at once, there are so many difficulties in the way; and still more unfortunately, the normal function cannot always be restored at all; and even when it can be restored it often takes a long time to do it, and relapses into inactivity and perverted action are particularly apt to occur. Hence, under all circumstances, we are thrown upon the necessity of keeping up an artificial supply of fat to the blood for protracted

* Of all the cases reported by me in which cod liver oil and emulsion were both tried, the oil disagreed in about 52 per cent, whereas in the same cases the emulsion disagreed in less than 4 per cent.—See *Lancet*, November 17, 1866.

periods of time. And here it is that cod liver oil so signally fails. Oil, even when it agrees and passes into the blood, does not completely represent the solid fats of the natural food, and therefore cannot permanently take their place. As a temporary substitute for natural fats introduced by the natural route, it answers admirably; but, sooner or later, in some cases very soon indeed, the portal system becomes choked and refuses to absorb more oil, the oil disagrees with the stomach, it rises, it spoils the appetite, and thus not only ceases to do good, but does positive harm by preventing the patient from taking as much food as the stomach might otherwise call for and digest. None of these disadvantages occurs with well made pancreatic emulsion of solid fat.* The consequence is that an artificial supply of natural fat by the natural route can be kept up for an indefinite time if required, while the appetite is usually improved and the digestion also; and, at the same time, a very large quantity of amylaceous food is rapidly converted into dextrine and sugar by the pancreatic action of the emulsion, and thus a most important assistance in the economy of fat is given, by the increased supply of carbon from the carbo-hydrates, at the same time that fat is being thrown into the blood by the emulsion.

I must not omit to take advantage of this favourable opportunity of saying a few words on the

* Up to the present time I have not seen any pancreatic preparations that can be relied upon, except those prepared by Mr. Schweitzer for Messrs. Savory and Moore

nature of the *Diet* which should be ordered in the True first stage of consumption. The objects to be kept in view are very simple :—

1st. To give the diet in forms that shall be unirritating to the alimentary mucous tract.

2nd. To supply enough carbon and hydrogen *in other forms than that of fat*, to combine with the 30 oz. of oxygen introduced every 24 hours by respiration, and thus to provide for the evolution of the 10,000 British units of heat per day, which I have shown to be required as sensible heat and mechanical force (see p. 20). So that whatever fat gets into the blood by natural or artificial means may be available for those purposes in the organism, for which nothing but fat will suffice.

3rd. To supply plastic material in sufficient quantity for the renovation of the albuminoid tissues.

4th. To supply enough fat already pancreatised for histogenesis and the protection of the tissues against oxidation.

5th. To supply mineral matters and water.

These conditions will be found, as nearly as practicable, provided in the Diet, (Table I.),* which my friend Mr. Farrants and myself constructed some time since, and which I have employed for about a year, both at this hospital and in private practice, with unmistakeable advantage to the patients.

The 2nd Diet (Table II.), provides for a large amount of the carbon from the albuminoid articles of food, and is intended for those cases in which albuminoids are more easily digested than carbo-

* See Appendix, par. 10.

hydrates (see p. 15). In a certain number of picked cases I have found this diet of great service, but for general use I much prefer the carbo-hydrate diet (Table I).

A third diet (Table III.), consisting of 78 oz. of milk, 6 ozs. of arrowroot, and 1 oz. of pancreatised fat, yields nearly the same results as the former two, except that the quantity of carbon reaches only 8 ozs., or enough to evolve 7,250 British units of heat. The quantity of carbon, therefore, is not up to the required amount, but it is a diet only intended for a very temporary purpose, viz., until solid food can be borne by the stomach. During this period of treatment the patient may be precluded from engaging in external mechanical work, and some sensible heat may be artificially supplied. I have used this diet in some peculiarly unmanageable cases with very excellent effect, giving the milk in divided doses every four hours, or in half the quantity every two hours, and mixing the arrowroot with it. I find that 78 oz. of milk per twenty-four hours is the largest quantity that the adult stomach will take, and in the average of cases of irritable stomach it is difficult to get beyond 60 oz. The emulsion is best mixed with a little water and given directly after the dose of milk and arrowroot, not mixed with them. To this diet brandy may be added in some cases, and thus the quantity of carbon may be increased.

A most important question arises in the treatment of consumption in all its stages, viz., the amount of fresh air and of exercise to be allowed or enforced.

In the early stage which we are considering to-day the question is a most vital one. The progress of the patient, upwards or downwards, will often be determined by the decision of the physician on this point.

Experience has taught me that in coming to a decision on this vital question, the physician ought to be entirely guided by physiological reasoning, and that his advice will be right or wrong just in proportion as he is shrewd and discriminating in measuring the exact condition of his patient, in each particular case, and in the application of his physiological knowledge. The following leading facts must be borne in mind :—

1. That the labour of walking one mile (if the weight be 150 lbs.) equals 17·678 foot-tons, equivalent to 51·295 British units of heat, the evolution of which requires the oxidation of 0·0566 oz. of carbon.

2. That every 1 oz. of oxygen will combine with 0·375 oz. of carbon, the combination being accompanied by the evolution of 339·84 British units of heat, equivalent to 117·12 foot-tons of mechanical force.

3. That fat is essential to histogenesis and to the protection of the tissues from oxidation, that increased muscular exertion necessitates increased oxidation, and requires increased histogenesis.

If the patient has lost enough fat to make an impression upon his strength, that is to say, if heat is being generated by the combustion of materials which ought to be available for mechanical force

and histogenesis, it is madness to make any avoidable demand upon either mechanical force or histogenesis until all and more than the deficient fat has been restored; and it is equally mad to increase the supply of oxygen to the blood beyond the smallest quantity consistent with life. If, while pouring fat into the blood, we could actually stop the supply of oxygen and stop the demand for renovation of tissue, mechanical force, and sensible heat, without arresting those phenomena upon which the maintenance of life and nutrition depend, we should have the patient as much under our control as we have the lamp, which we blow out while recharging it with oil and thus save its wick from combustion.

But although we cannot do this in the case of the patient, our object should be to approach as nearly to this condition as is consistent with the maintenance of life and nutrition.

It must be confessed that the proper regulation of this matter is one of the greatest trials of the astuteness of the physician, and it is almost impossible unless he can make the patient and his friends comprehend its meaning and importance. But not less does it test the skill and judgment of the physician to decide upon the moment when restrictions upon fresh air and exercise ought to be removed. The argument so often used when a patient appears to be doing well, that "it is best to let well alone," may be fatal if applied in this case. The very fact that he is "doing well," may be the sign that he must not be "let alone," that he is now in a

state in which it is safe to make a call upon his mechanical force, to accelerate histogenesis, to supply fresh oxygen—in a word, to set about the restoration of active nutrition and healthy pancreatic function. And then, again, how scrupulously these new tasks should be set! How carefully watched in their effects, lest even now they cannot be continued with safety! On the first sign of their being badly borne they should be moderated or promptly stopped.

Another question which is in my opinion of the gravest importance, and which according to my experience is generally decided in the manner exactly contrary to what is best, is that of the administration of Iron.

If, as we have the best reasons for believing, Iron when taken into the system, increases the number of red corpuscles in the blood, and if, as we have equally good reason to believe, these corpuscles are the means by which oxygen is distributed throughout the tissues, it is surely totally at variance with common sense to give iron, and thus increase the activity of the process of oxidation, so long as there is the slightest deficiency of carbon in the organism. Yet Iron, being regarded as an excellent tonic, is commonly given to consumptive patients with an idea of strengthening them, regardless of its incongruity with the leading objects of treatment. The fact is, as I have already pointed out in this lecture, (p. 24), that so long as there is a deficiency of fat and carbon in the blood, anæmia is a protection against abnormal oxidation of tissue. Let me

caution you then, never to give iron to a consumptive person until you have effectually supplied all deficiencies of fat in the system, and never to give iron to an anæmic person, till you have ascertained that there is no defect in the supply of fats to the blood.*

It is quite otherwise with Quinine. Quinine is our most valuable tonic in consumption. It increases the appetite and thus promotes the ingestion of an increased quantity of force-producing materials. The only caution required in giving Quinine is, to avoid giving enough to excite the circulation, for all excitement of the circulation accelerates oxidation and does harm. Quinine given in cautiously regulated doses combined with an alkali, or with an acid according as the one or the other is indicated by the state of the digestion is of infinite service in nearly every stage of consumption, and as a general rule, patients who have once taken it crave for its continuance.

The next point on which I ought to speak, and the last for which we shall have time, is Climate or change of air. What is the proper kind of climate for the "True first stage of consumption." There is no subject on which more conflicting opinions have been expressed by experienced authorities. There certainly have been few means of treatment which

* While writing the above my attention has been called to the remarks of M. Trousseau and of Dr. Millet on this subject (see Appendix par. 5). It is a striking coincidence that I have predicted as necessary to the nature of Tuberculosis, a fact which they had learnt from observation but could not explain.

have been so whimsically employed, by which such remarkable injuries and remarkable benefits have been conferred upon consumptive persons, as by change of climate. And up to the present time no rational explanation has been able to be given for the good and for the harm often done to different persons by the same climate. The whole mystery appears to me to be explained by the views I have enunciated of the physiology and pathology of tuberculosis.

In order to make this clear as briefly as possible, I will divide the objects of climatic treatment in the True first stage of consumption under three heads:

1. The restoration of healthy pancreatic function, *i.e.* the radical cure of Tuberculosis.

2. The economy of fat and carbon in the organism and the protection of the lungs from undue oxidation, *i.e.*, provisional protection against Tuberculisation.

3. Removal or prevention of catarrhal affections of the air passages, of chills to the general surface, and of local congestions, *i.e.*, the collateral treatment of Tuberculosis.

Now it happens that the climates necessary for the 2nd and 3rd of these objects are utterly different from those required for the 1st, and that the climate required for the 2nd object, is frequently unfit for the attainment of the 3rd.

No wonder then, that attempts to cure consumption by change of climate, undertaken without any clear appreciation of these important distinctions should, so often fail, and that, when they succeed it

should appear to be attributable to a sort of "good luck."

I will attempt in as few words as possible, to explain these incongruities. The first object—restoration of pancreatic function, *i.e.*, the radical cure of consumption—is the one about which there is the greatest misunderstanding. Places are picked out for the consumptive, because they are "mild and equable," or because they are "sunny and stimulating," or because they are at once "warm, equable and bracing," and the like; whereas none of these qualities is the one especially called for by the necessities of the case. It is true, that in those cases where pancreatic function has been perverted by some mental or emotional shock, a sunny stimulating atmosphere may be of some use by its exhilarating effects upon the depressed spirits. It is true, that in a warm and bracing air a weak person may be rendered less conscious of the sense of weakness, and that an equable climate may improve the digestion and the appetite, by allowing a delicate person to be more constantly out of doors; and thus all these are good in their way. But the real exciter of pancreatic function is clear dry cold (see p. 26). It is neither the equability, nor the stimulating, nor the bracing quality which makes the demand upon the pancreas, and wakes it into life, but the cold, *per se*. The cold must not be damp and must not be accompanied by darkness, because damp and darkness interfere with the special action of the cold, producing what

we commonly understand by *chill*, and depressing at once the animal spirits and the processes of life. The cold therefore must be clear and dry and light, and in this cold, exercise must be taken, so that carbon may be peremptorily demanded for the supply of both heat and mechanical force. Typical of this treatment I may mention "hunting" in Minnesota.

But remember how dangerous all this must be if tuberculosis has advanced far enough to make tuberculisation imminent. Such means can only be adopted with safety while the tissues are still well protected with fat, or when the blood, at least, is fully charged with it. They are utterly at variance with all those precautions I have insisted upon for protection against tuberculisation. Again, no one suffering from catarrhal complications or local congestions can be exposed to these hygienic conditions without risk to life. But this is the treatment to be constantly kept in view, to be adopted promptly whenever other conditions will permit. Whatever modifications and dilutions of this treatment may be required by circumstances, we should never lose sight of the fact, that our treatment of consumption only becomes truly curative in proportion as it includes these means for restoring healthy pancreatic function.

The second object of climatic treatment—economy of fat and carbon in the organism, and protection of the lungs from undue oxidation, *i.e.*, provisional protection against tuberculisation—is of the greatest

importance. It is the object of treatment which most often demands our first anxious attention in cases of the true first stage of consumption as ordinarily presented to us in practice. Tuberculisation is imminent, and nothing else must be thought of until we have safely provided against it.

It is evident that if this object is to be met by climate, we must look for an atmosphere which, while pure, may yet convey as little oxygen to the lungs as is consistent with the continuance of life and nutrition. It must, therefore, be either rarefied, or diluted with some unirritating matter. The combination of a certain amount of rarefaction with a considerable dilution with aqueous vapour is most readily to be found. Again, we must look for an atmosphere sufficiently warm to save some of the demand for carbon to supply animal heat, and we must look for a place where this warm diluted air can be freely breathed with as little exercise as possible, so that histogenesis may be passive, and the demands for mechanical force reduced to their lowest degree. At the same time, we must try to combine a bright and cheerful landscape and pleasant society, to encourage the pursuit of a vegetative life without depressing the spirits. I cannot better typefy such a place in this country than by mentioning Torquay.

The third object—removal or prevention of catarrhal affections of the air passages, of chills to the general surface, and of local congestions, *i.e.*, the collateral treatment—may sometimes be attained in

the same climates as the second object; but very often this is not the case. These collateral affections are frequently dependent upon collateral diatheses, independent of the consumptive, such as the gouty, rheumatic, syphilitic, hæmorrhagic, etc., and can only be benefitted by climates specially suited to each case. Thus in the commonest catarrhal and rheumatic complications, the aqueous vapour with which the warm air is diluted, in such places as I have referred to under the second heading, may be positively injurious, and a warm, dry, stimulating air may be absolutely necessary to their removal; hence if we are bent upon climatic treatment, we may have to seek for a different class of climates to any yet mentioned, such, for example, as Cannes, or even Upper Egypt.

Thus you will see how diverse may be the reasons why one consumptive patient may seem to be cured by the same climate that kills another. While we are curing our patient's catarrhal complications at Cannes or Thebes, tuberculisation may be taking place, for want of the conditions to be found at Torquay; and while we are protecting him against tuberculisation at Torquay, his defective pancreatic action may be becoming permanent and incurable, for want of the conditions to be found at St. Paul.

When we consider how little these distinctions enter into the reasons which guide consumptive persons in resorting to this or that change of climate, I fear we must attribute the cures which occasionally take place more to "good luck" than

to anything else; this "good luck" consisting in the spontaneous resumption of pancreatic function during some favourable phase of the case — some period of arrested tuberculisation, during which the weather fortunately turned cold, or during which the patient, feeling better, indulged in more air and exercise just at the fortunate moment, and set the pancreas into action. Or, as I have suggested before, the perverted pancreatic function may have been simply due to the influence of some depressing mental or emotional cause, which happened to be removed in time.

If we could send our patients here or there exactly at the right moment, and each time to a place accurately adapted to the passing phase of his case, we ought unquestionably to select those strongly marked distinctive climates which I have described. But, practically, how seldom we can do this. And let me remind you of what happens every day in practice, to the infinite risk of the life of the patient, and of the reputation of the physician. Patients consult their physician, and receive, we will assume, advice as to the choice of climate cautiously and wisely adapted to their condition at the time; and after such advice is given, circumstances occur which alter their plans, and delay their seeking the prescribed change, until their state has so far altered, that if they consulted their physician again, he would certainly reverse his former judgment. But instead of giving either themselves or him this chance, they carry out, at

great expense and inconvenience, a plan of climatic treatment utterly unfit for the condition of their case.

On the whole, therefore, under ordinary circumstances, more good and less harm may often be obtained by climates which to some extent combine the qualities I have described—even though they have not either of them developed in perfection—provided they are near home, within reach of friends, and the management of a judicious physician who can watch the changing aspects of the case and point out the time and mode in which to take advantage of this or that feature in the climate of the place.

It is in this way that such places as Bournemouth, the Isle of Wight, and Hastings retain their hold upon the public and the medical profession. In each of these places there are the means, to a considerable extent, of pursuing the second and third objects of climatic treatment; and when the time comes for adopting the first, patients can come out of their warm quarters, and on the cliffs and hills can find some amount, at least, of the *clear dry cold* necessary to rouse their pancreatic functions.

But whether the treatment is conducted at home or abroad the principles are the same, and must be steadily borne in mind by the physician, who must carry them out in the way that the means and opportunities of his patient render practicable.

In conclusion, I will attempt to epitomise some of the chief facts on which our treatment is to be founded.

1. A supply of fat, *per se*, to the blood is essential for histogenesis and for the protection of the tissues, and is also of importance for general use as a source of heat and mechanical force.*

2. Heat and mechanical force may be supplied by the carbo-hydrates and albuminoids, but they cannot take the place of fat in histogenesis and protection of tissue.

3. Fats may be supplied by absorption into the portal system, by absorption into the general lymphatic system, and by absorption into the lacteal system. But the latter is the means by which the principal supply of solid fat is carried into the blood, and is the most important.

4. The first step in tuberculosis is an arrest or perversion of the supply of fat by the lacteal route, in consequence of arrest or perversion of pancreatic function and of consequent disease in the lining of the intestinal canal.

5. The mean consumption of oxygen by an adult man of average stature (weight 150 lbs.) taking ordinary exercise, is about 30 oz. in twenty-four hours, and the heat evolved by each 1 oz. of oxygen, in combining with carbon, hydrogen, etc., is about 340 British units. Hence 10,000 British units of heat will be evolved every twenty-four hours by the combination of 30 oz. of oxygen with carbon, hydrogen, etc.; therefore the food of an adult man under ordinary circumstances, should be such as

* See Appendix, par. 2.

may, in addition to other purposes, evolve at least 10,000 British units of heat.

6. Practical experience in the dieting of large numbers of men, and other means, have enabled us to establish the fact, that such an average man as I have spoken of, requires for the maintenance of health, a diet which shall contain about 4 oz. of plastic materials, 3 oz. of fat, and 10 oz. of carbo-hydrates ;* and, on careful analysis of this diet, we find that it can supply the required 10,000 British units of heat, viz.—2,516 from the plastic, 3,357 from the fat, and 4,150 from the carbo-hydrates ; total, 10,023.

7. Assuming these statements to be approximately correct, the point which especially concerns our present subject, and which is of extreme interest and importance, is the mode in which these 10,000 British units of heat are disposed of, and the purposes which they serve. This may be seen in the following calculation which has been made as nearly correct as possible.† 8,000 British units are required as sensible heat, to raise the temperature of the inspired air to the temperature of the body, to vaporise the pulmonary halitus, and to maintain animal heat. The mechanical equivalent of 2,000 British units (equal to 690 foot-tons) is expended

* See a Manual of Diet and Regimen, by Horace Dobell, M.D.—Churchill, 3rd edition.

I am indebted to the kindness of my accomplished friend Mr. Farrants for valuable assistance in arriving at these results.

in actual work, more than half of which is employed in internal vital work (the mechanical work of the heart alone is equivalent to 200 foot-tons; respiratory and other vital movement may be estimated as equivalent to nearly 200 foot-tons more) leaving about 290 foot-tons available for external work, which may be represented by the labour of walking sixteen miles; but of course only so much is available for actual walking as is not used in the other external movements of the body which we daily perform.

8. From these calculations it is clear that the demand for 8,000 British units of heat—to raise the temperature of the inspired air, to vaporise the pulmonary halitus, and to maintain animal heat—may be diminished by so much as we can maintain these increments of temperature by artificial means. For example, if by the combustion of carbon in the form of wood or coals, we can keep up the external temperature of the body, and warm the food and drink which enter the stomach, and if by any means we can raise the temperature of the inspired air to that of the body, we shall save the combustion of carbon, etc., within the body by the combustion of carbon, etc., out of the body, and to that extent diminish the demand for a supply of carbon, etc., to the blood from the food. We must, however, bear in mind that it is the oxygen brought into the blood by respiration which makes the demand for carbon and hydrogen; we must therefore diminish this supply of oxygen at the same time that we

supply the heat artificially, if we wish to attain our end of reducing the demand for a supply of carbon and hydrogen from the food. This reduction in the supply of oxygen can be made by rarefying and diluting with aqueous vapour the air supplied for respiration, and by reducing the amount of air respired, by means of rest, etc.*

9. Of the 690 foot-tons of force available for mechanical work, we have seen that 400 are employed in the internal vital work of the body; very little can be done therefore to reduce the amount of this demand. Even here, however, something can be done by tranquilising respiration and the action of the heart as much as possible. But we still have left the 290 foot-tons of force expended during ordinary health and under ordinary conditions of life for the external work of the body. It is over this that we have the greatest control. We have, in fact, the power to save about 18 foot-tons of force by every mile of walking, or its equivalent in other work, of which we can deprive our patient.

10. Supposing then, for the sake of example, that we could by artificial means reduce the demand for sensible heat from 8,000 British units to 6,000, we should not only save the whole amount of heat the mechanical equivalent of which (400 foot-tons) is required for the internal work of the body, but we should have a balance equivalent to 290 foot-tons.

* See Appendix, par. 9.

And supposing that we could also stop all the *external* work of the body we should thus gain another 290 foot-tons. So that by the combined influence of rest and artificial heat we should save all the carbon and hydrogen required for producing 580 foot-tons of mechanical force, or about 1680 British units of heat; that is, as much as would be evolved by the combination of about 5 oz. of oxygen, or $\frac{1}{6}$ of the whole quantity required in 24 hours under ordinary circumstances.

11. If then we have a patient suffering from a defect by which his supply of carbon and hydrogen is cut off from the blood at its principal channel, we shall best protect him from the effects of this defect by placing him in those conditions of rest, warmth, and diminished respiration of oxygen which I have pointed out, until the deficiency in the supply of carbon and hydrogen is artificially provided for, or the defect itself removed.* And let me especially call attention, in this place, to the fact that by the rest from mechanical work, whether external or internal, we save the wear and tear of the frame, and thus diminish the demand for that histogenesis for which *fat*, and fat only, will suffice. By these combined means, therefore, we not only reduce to its lowest point the demand for carbon and hydrogen, but we especially reduce the demand for them in the form of fat.

Finally, let me repeat, what I have already endeavoured to impress; that all these important measures

* See Appendix, par. 4.

of protection are but provisions, necessary for the purpose of placing the patient in a position of safety in which the means for restoration of healthy pancreatic function, that is, the radical cure of tuberculosis, may be pursued without risk.

# APPENDIX.

(*Par.* 1.)

## Heat and Mechanical Force.

A foot-pound is the amount of mechanical force required to raise a pound weight a foot.

A British unit of heat, is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

This amount of heat (a British unit) may be converted into mechanical force sufficient to raise a pound weight 772 feet.

This amount of heat (a British unit) is generated by a pound weight falling through a space of 772 feet; hence 772 foot-pounds is called the mechanical equivalent of a British unit of heat.

One ton weight is 2,240 lbs.; $\frac{772}{2240} = 0{\cdot}34465$; therefore the heat units multiplied by 0·34465 will always give the mechanical equivalent in foot-tons.

(*Par.* 2.)

## Importance of Fat.

"In view of the preceding facts, it may therefore be concluded that the interior source from which the adipose tissues are supplied is the fat contained in the plasma of the blood, into which it has been poured through the thoracic duct, or otherwise obtained from the digestion of food in the small intestine: and since the blood-cells contain a higher percentage of oily

material than the plasma (2·2 per cent may be extracted from them by ether, either as a phosphorised fat or glycero-phosphoric acid,) they constitute reservoirs of supply to meet the exigencies of the system, there being a necessary relation between the quantity they can thus retain in store and the quantity contemporaneously existing in the plasma, a diminution of which at once establishes a drain upon the cells. Thus charged with these hydro-carbons, the plasma passes wherever there are adipose cell germs, furnishing to them the special nutriment they require for their development into fat-cells, the wall and the nucleus of which are derived from the blood, or, as we have mentioned, in certain cases actually from the muscular tissues. The amount of fat which can thus be held in reserve depends in part on the number of germs, in part on the supply of fat from the digestive organs, and in part on the supply of appropriate material for the walls and nucleus."—Draper, *Human Physiology*, 1856, p. 251.

"When fat thus stored up is wanted, the cell-wall in many cases deliquesces or wastes away, surrendering its contents back to the plasma, but probably much more frequently a transudation of the hydrocarbon takes place through it, analogous to what has been described as occurring in the blood-cells themselves. This demand upon the adipose tissue may arise from many reasons, since there may be a necessity for fat in the accomplishment of the various histogenetic operations going forward, or for those of retrograde metamorphosis, or for the maintenance of a normal state of the blood as respects its oleagenous ingredient, or for the production of heat by immediate and final oxidation into carbonic acid and water.

"It is not to be supposed, however, that this final oxidation into carbonic acid and water always takes place at once or abruptly. Everything shows that fats pass through successive gradations of retrograde metamorphosis, perhaps gradually losing by oxidation two atoms of carbon and hydrogen; and indeed there is reason to believe that on special occasions the opposite changes happen. Thus stearic acid may arise from margaric acid by deoxidation. It does not occur to any considerable extent in vegetable food, having thus far been only found in cocoa butter."—DRAPER, p. 252.

"In a summary of the uses of fatty substances may be mentioned the production of a high temperature by oxidation; their agency in metamorphosis, as displayed by the assistance they lend in gastric digestion; the function they seem to discharge in cell-life which would appear to be important if it be true that the nuclei of some cells are composed of fat; their selection in the formation of bile and their probable connection with the production of hæmatin. Among their physical uses may be mentioned the equable manner in which they propagate pressures in all directions when they are in a liquid state, as is often the case; the manner in which they fill up vacuities, and communicate a soundness and solidity to the system; their low conducting power as respects heat, which enables them to economise the warmth of the body; their diminishing of friction among moving parts, as in the case of the muscles; and that they discharge some highly important function as respects the nervous system is proved by the manner in which they uniformly occur in tubular nervous tissue. In the general metamorphosis of the system they seem to take an important

part. This may be inferred from the fact of their presence wherever cells or fibres are forming. . . . It is obviously incorrect to regard them as constituting a purely respiratory element."—DRAPER, p. 252.

(*Par.* 3.)

FLUID FAT.

"The fattening of cattle with linseed-cake gives rise to an accumulation in their adipose tissue of an oily material of unusual fluidity."—DRAPER, p. 250.

(*Par.* 4.)

MEANS WHICH PROMOTE ACCUMULATION OF FAT.

"In the artificial fattening of animals the indications to be complied with are very obvious; they are, First, To furnish an abundant supply of oleaginous material in the food. Second, To prevent as far as possible waste by oxidation.

"The first indication is satisfied by the purposed employment of oleaginous articles, as for instance, linseed cake, or by the selection among ordinary food substances, of those which, like Indian corn, abound in oil. It is to be remarked that the increase of weight of an animal may take place in two ways: first, by adding fat to the deposit in the adipose tissues; or second, by development of the muscles. It might perhaps be permissible to speak of the former as adipose fattening, the latter as albuminised. According as it has been subjected to one or other of these processes,

an animal will be very differently prepared for undergoing severe exercise. A horse fed with Indian corn cannot under those circumstances maintain himself as well as if he had been feed on oats. In the former case his adipose tissues have been developed, in the latter his muscular.

"The second indication is met by resorting to every expedient which can restrain the action of the respired oxygen. A state of perfect quiescence is therefore to be observed. Muscular movement of every kind increases the activity of respiration. On the contrary, rest diminishes it. If in addition to this state of quiet or rest, sleep likewise be indulged in, the object is still more perfectly attained; and if a high temperature be resorted to, since this checks the oxidation needful for maintaining the system at its due temperature, this also diminishes the waste of fat.

"Under such circumstances, where everything is done to give a supply of fat, and everything to prevent its consumption, it may be caused to accumulate in the tissues to an extraordinary amount. But this very soon interferes with the action of the liver, one of the functions of which we have seen is the preparation of fat."—DRAPER, pp. 251, 252.

(*Par.* 5.)

IRON IN RELATION TO ANÆMIA AND CONSUMPTION.

In a lecture delivered at the Hotel Dieu, by M. Trousseau, and reported in the *Medical Circular*, January 25, 1860, after relating two very marked cases in which rapid consumption followed the apparent cure of chlorosis by preparation of iron, he goes on to

say, "This time I had received a lesson not to be overlooked. I had occasion also to see in the practice of my colleagues very serious pulmonary symptoms succeed to relapsed chlorosis treated by iron, so that it seemed to me extremely probable that in individuals predisposed to tubercular phthisis, iron administered and continued for a certain time only favoured and hastened the development of the accidental productions. This great probability has become for me a well-founded certainty, and I have become convinced of this more especially for this reason: I have seen chlorotic patients spit blood after using ferruginous preparations and become more chlorotic than ever; and I have remarked that the more the chlorosis becomes confirmed, the less does the tuberculisation show itself, so that, during more than twenty years, I have stood by the opinion that chlorosis *in some sort of way* excludes phthisis; or, rather, that it is a safety-valve against the ulterior explosion of tuberculisation. Not only do I not give iron in chlorosis when there is a marked disposition to pulmonary phthisis; but every time I am consulted on the subject of chlorotic disease, I inquire with the greatest care into the family history, and when I happen to find suspicious precedents (of consumption in the family) I energetically proscribe the use of martial preparations."

In the *Bulletin Général de Thérapeutique Medicale et Chirurgicale* (1862), Vol. 62, p. 507, Dr. Millet, Physician to the Colony at Mettray, speaks strongly of the danger of giving preparations of iron in early phthisis. He gives notes of sixty cases, and says he has seen a great many more in which the treatment of anæmic girls with iron has been quickly followed by fata

galloping consumption. He arrives at the conclusions, (1.) That iron should never be given without previous careful auscultation of the patient, and must always be withheld if there is the least suspicion of tubercle. (2.) That iron never does any good in consumption, but always accelerates it.

(*Par.* 6).

PREMONITORY STAGE.

Dr. Pollock gives the following graphic description of what is usually called the "*Premonitory* Stage" of ordinary consumption. "We have now to consider the value of the earliest symptoms. When any physical signs of established deposit in the lung are present, the disorder has ceased to be premonitory, and a certified lung disease is present. Stethoscopic evidence must, then, be excluded." . . . . . .

"The earliest symptoms are the coincidence of emaciation and the febrile condition, and wasting is in almost all instances the first. Its earliest manifestation is an absorption of the adipose tissue, and a thinning of the muscles. Its diagnostic character depends on the absence of sufficient cause. The appetite may be good, the secretions regular, the supply of food abundant. There may be no drain on the system, yet emaciation beyond the lowest average of the individual steadily proceeds. This emaciation is more marked in individuals of middle life in whom the processes of nutrition have long been impaired; but it is also, as we believe, present in all cases of phthisis, excepting those of the most acute form. It is more marked in those who have been previously stout and more perilous. It

is progressive and not recovered from, and it is thus distinguishable from the transient alterations in weight dependent on seasons of the year, variations in diet and exercise, etc., which many undergo harmlessly. The sensation of weakness is also greater than in these latter. The absence of any preceding acute disease should of course be ascertained. Dyspepsia, in its various forms, may reduce the weight, and it will be necessary to distinguish the functional gastric disorder from that which so commonly attends all stages of acute phthisis.

"Wasting alone is not sufficient to alarm. It is the coincidence of this symptom with the febrile state which indicates organic mischief. Dry heat, chills in the afternoon, and occasional intermitting perspirations, with an accelerated pulse, uniformly too high, but increased towards evening, form a group of characteristic symptoms.

"If to the foregoing we add a general feeling of *malaise*, of depressed nervous power, and of insufficiency for the requirements of business or the daily occupations of the patient, we shall have a sum of vital phenomena, inconclusive it is true as regards the actual seat of the organic mischief, but indicative of blood changes of a serious character.

"Some local symptoms may at this time exist, as cough, dyspnœa, pain in the subclavicular regions, and hæmoptysis; but they are rarely present unless the physical signs of deposit in the lung are sufficiently established to be recognisable by a skilled observer. They do not, therefore, enter into our present considerations." — *Elements of Prognosis in Consumption*, pp. 80-82.

(*Par.* 7.)

## Emaciation.

Dr. Pollock regards the wasting of the body in consumption as an example of the "resistance opposed by the system to the progress of all lowering structural changes." He considers it, therefore, in the light of a conservative vital act.

"There is a preparation to reduce the volume of the circulating fluid, and to waste the tissues in order that the systemic requirements may not be beyond the powers of the injured organ to supply. This is accomplished by increased secretion and by muscular waste, by absorption of fat from the tissues, and, to some extent, by deposit of morbid material."—p. 17.

"Nor are the systemic changes less characteristic of resistance to the progress of chronic morbid changes than the local. The reduction of the solids of the body, the emaciation, muscular waste, and absorption of fat, are necessary, in order to establish a balance between the system as a whole, and the organs which are to supply it."—p. 23.

"Early emaciation is, therefore, the result of a conservative process, which, while it weakens and emaciates, retains the organs comparatively sound. The ultimate changes by which, in the tubercular habit, deposit takes place in the brain, heart, intestines, mucous and serous membranes, and in the bones, are delayed till the blood has become so overcharged with impurities, and the resisting powers of the system so enfeebled, that organic life yields in the struggle."—p. 41.

It will have been seen how entirely I disagree with Dr. Pollock in his interpretation of the phenomena which he has so carefully observed. While fully admitting and appreciating the conservative action of the organism in disease, I fail to see an example of it in the wasting of consumption, which appears to me to be the unavoidable effect of an arrest in the supply of an essential material for combustion, and for hystogenesis, an arrest in the supply of that for which it is impossible to stop the demand while life continues. On the other hand, I can see an example of conservative action, in the attempt instinctively made by the patient to stop this demand by lessening respiration, abstaining from exertion, and seeking artificial heat—phenomena which Dr. Edward Smith interprets so differently.—See par. 8.

(*Par.* 8.)

LESSENED RESPIRATION.

Dr. Edward Smith sees in the *lessened respiration* attending the earliest stages of consumption, the cause of tubercle. He says, "It has been proved that the essential feature of phthisis is lessened action of the lungs in general, and of the air vesicles in particular." (p. 42.) He speaks of "tubercle and lessened vital processes due to lessened inspiratory action of the air vesicles of the lung." (p. 43.) And he sees the cure in all means by which respiration is increased. "The essential treatment is to increase respiration."—(p. 44.) While fully admitting with Dr. Smith that in early phthisis respiration is diminished, I believe that he is totally wrong in his interpretation of its meaning. It

is a law of animal nature to save a tender part. And I see in the attempt at lessened respiration in early phthisis an example of the operation of this law. The blood in the pulmonary circulation is deficient in the materials which the inhaled air seeks—the delicate texture of the lungs is exposed to injury by the air, through deficiency in its usual protection of fatty blood —and Nature comes to the rescue by attempting to diminish the quantity of air that is brought into the unprotected lungs; just as she cuts off the access of light from the inflamed retina of the eye by closing the iris or the lid. See par. 7.

(*Par.* 9.)

### Effects of Exercise on Pulsation and Respiration.

"My recent experiments upon myself have proved that walking in health at one mile per hour increases the respiration from 500 cubic inches to 800 cubic inches per minute; at two miles per hour, to 1,000 cubic inches; at three miles per hour, to 1,600 cubic inches; and at four miles per hour, to 2,300 cubic inches per minute. Whilst, with running moderately at six miles per hour, it is more than 3,000 cubic inches per minute. The depth of inspiration is likewise increased from 35 cubic inches to 100 cubic inches per respiration; and hence both the mechanical distension of the lung, and the chemical and physical changes of respiration, are greatly increased."

"Riding in a carriage increases respiration, but the degree varies with the oscillation of the carriage. In

an omnibus the increase is fully half of the original quantity. On horseback at a walking pace, the increase is more than half, in trotting, three-and-a-half times, and cantering, three times the original quantity."—p. 45.

"Of all the modes whereby the respiration is increased there are but two which do not, at the same time, increase the rate of pulsation, viz., the voluntary deep inspiration and cold bathing."

"Walking at the rate of four miles per hour will increase the rate of pulsation to about 130 per minute, and running at six miles per hour, to about 180 per minute, and even in gentle exercise there is some increase in the rate of pulsation."—p. 46.

On "*Chronic Phthisis*," by Dr. EDWARD SMITH.

(*Par.* 10.)

## DIETS FOR CONSUMPTION.

IN the following diet tables it is assumed that no fat is assimilated except that artificially pancreatised:—

In Table I. The required amount of carbon is supplied by an excess of carbo-hydrates.

In Table II. The required amount of carbon is supplied by an excess of albuminoids.

In Table III. The amount of carbon is kept low, because it is only intended as a temporary diet to be used during periods of rest in a warm room. The arrowroot and some of the fat of the milk are pancreatised by mixture with the "pancreatised fat."

## DIETS FOR CONSUMPTION.—TABLE I.—CARBO-HYDRATE.

| | Oz. | Plastic. | Fat. | Saccharine. | Total Carbon. | Carbon from | |
|---|---|---|---|---|---|---|---|
| | | | | | | Nitrogenous. | Non-Nitrogenous. |
| Cooked Meat | 6 | 1·350 | ·534 | .. | 1·152 | 0·732 | 0·420 |
| Bread | 10 | 1·000 | ·070 | 4·530 | 2·470 | 0·540 | 1·930 |
| Potatoes | 8 | 0·136 | .. | 1·840 | 0·832 | 0·072 | 0·760 |
| Sugar | 2 | .. | .. | 1·800 | 0·848 | .. | 0·848 |
| Milk 20 Fld. oz | 2½ | 1·000 | 0·700 | 0·840 | 1·440 | 0·540 | 0·900 |
| Liebig's Food for Infants | 2 | 0·300 | 0·116 | 1·064 | 0·720 | 0·162 | 0·558 |
| Farinaceous Foods | 6 | 0·300 | 0·020 | 4·900 | 2·350 | 0·160 | 2·190 |
| Fermented Liquor* | .. | .. | .. | .. | 1·000 | .. | 1·000 |
| Pancreatised Fat | 1 | .. | 1·000 | .. | 0·740 | .. | 0·740 |
| TOTALS | 37½ | 4·086 | 2·440 | 14·974 | 11·552 | 2·206 | 9·346 |
| Deduct Carbon from Non-pancreatised Fats | .. | .. | .. | .. | 0·945 | .. | .. |
| Total available Carbon | .. | .. | .. | .. | 10·607 | .. | .. |

* Either—Half a pint (Imperial) of Port, Sherry, or Marsala; Or, One pint of Burgundy, Claret, or other similar Wine; Or, One pint of good Ale or Stout; Or, A quarter of a pint of Rum, Whiskey or Brandy, diluted with one pint of water.

## DIETS FOR CONSUMPTION.—TABLE II.—ALBUMINOID.

| | Oz. | Plastic. | Fat. | Saccharine. | Total Carbon. | Carbon from Nitrogenous. | Carbon from Non-Nitrogenous. |
|---|---|---|---|---|---|---|---|
| Cooked Meat | 8 | 1·800 | ·712 | .. | 1·536 | ·976 | ·560 |
| Pigeon or Game | 6 | 1·300 | 0·830 | .. | 0·830 | 0·740 | 0·090 |
| Dried Fish | 3 | 1·310 | 0·055 | .. | 0·745 | 0·710 | 0·035 |
| Cheese | 1 | ·308 | 0·256 | ·024 | 0·366 | 0·166 | 0·200 |
| Vermicelli | 3 | 1·425 | .. | 1·164 | 1·293 | 0·777 | 0·516 |
| Bread | 4 | 0·400 | 0·030 | 1·810 | 0·990 | 0·220 | 0·770 |
| Rice or Arrowroot | 6 | 0·300 | 0·020 | 4·900 | 2·350 | 0·160 | 2·190 |
| Sugar | 3 | .. | .. | 2·700 | 1·270 | .. | 1·270 |
| Milk 20 Fld. oz | 2½ | 1·000 | 0·700 | 0·840 | 1·440 | 0·540 | 0·900 |
| Green Vegetables | 6 | 0·060 | 0·012 | 0·468 | 0·234 | 0·030 | 0·204 |
| Fermented Liquor* | .. | .. | .. | .. | 1·000 | .. | 1·000 |
| Pancreatised Fat | 1 | .. | 1·000 | .. | 0·740 | .. | 0·740 |
| TOTALS | 43½ | 7·903 | 3·615 | 11·906 | 12·794 | 4·319 | 8·475 |
| Deduct Carbon from Non-pancreatised Fats | .. | .. | .. | .. | 1·410 | .. | .. |
| Total available Carbon | .. | .. | .. | .. | 11·384 | .. | .. |

* Either—Half a pint (Imperial) of Port, Sherry, or Marsala; Or, One pint of Burgundy, Claret, or other similar Wine; Or, One pint of good Ale or Stout; Or, A Quarter of a pint of Rum, Whiskey, or Brandy, diluted with one pint of water

## DIETS FOR CONSUMPTION.—TABLE III.—FLUID DIET.

| | Oz. | Plastic. | Fat. | Saccharine. | Total Carbon. | Carbon from Nitrogenous. | Carbon from Non-Nitrogenous. |
|---|---|---|---|---|---|---|---|
| Milk 78 Fld. oz..... | 10 | 3·900 | 3·730 | 3·276 | 5·620 | 2·106 | 3·510 |
| Arrowroot ..... | 6 | 0·300 | 0·020 | 4·900 | 2·350 | 0·160 | 2·190 |
| Pancreatised Fat ..... | 1 | .. | 1·000 | .. | 0·740 | .. | 0·740 |
| Totals ..... | 17 | 4·200 | 4·750 | 8·176 | 8·710 | 2·266 | 6·440 |

This diet is to be given as follows:—

8 ozs. of Milk and 1 oz. of Arrowroot every 4 hours (6 times in 24 hours) for 24 hours.

10 ozs. of Milk and 1 oz. of Arrowroot every 4 hours for 24 hours.

12 ozs. of Milk and 1 oz. of Arrowroot every 4 hours for 24 hours.

13 ozs. of Milk and 1 oz. of Arrowroot every 4 hours for 24 hours.

The last quantity to be continued until solid diet can be borne by the stomach.

$\frac{1}{6}$ of an oz. of Pancreatised Fat is to be mixed with a little water, or with a portion of the milk, and given directly after each dose of Arrowroot and Milk, not mixed with the whole bulk. See p. 43.

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