Conversations with Women

Regarding their Health and that of their Children . .

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PREFACE.

There are several ideas which readers of these Conversations will do well to bear in mind. I hope they are all clearly expounded in the book itself, but it will be well to advert to some of them here. First, the book is written from the idealistic point of view. That is, the assumption has been made throughout that energy is the immediate cause of material substance, as distinguished from the view commonly, or even universally (?) adopted by science that material substance is the immediate cause of energy. On this view, gravitation (to take an instance) is not a property of matter; but gravitation, a form of the universal energy, incorporates itself in material substance in order to its own manifestation. If the atom, according to the latest, and no doubt profoundly true, views of modern science, is the embodiment of a prodigious amount of energy, we may view this fact from two contradictory aspects. We may view the material atom as the cause of the energy, as the recognised leaders in modern science appear to do. Or we may take the view that energy flows into and incorporates itself in the atom—pro-creating the atom in fact for that purpose—and that energy is liberated or liberates itself from time to time, coincidently with the break up or dissociation of the atom. It is quite evident that for a time at least the facts, as in nature and life we continue to observe them, are explicable on either of these views. On the former view, the atom is the cause of the energy;

on the latter view, energy flows into and pro-creates the atom at one stage, and flows out again (liberating heat I think, always ?) coincidently with the break-up and disappearance or vanishing of the atom at another stage. From this point of view, matter is not eternal, but energy is. And energy is eternal, I think, because its source is eternal and infinite. This being the view which contemplation of the facts and the evidence compels me to take, I commend it to my readers in the hope that the evidence which has so overwhelmingly convinced me may convince them also. I quite understand that it may occur to some that this is a difference of no importance, since gravitation varies as matter, energy varies as material substance, inponderable energy as atom, ion, and electron, co-ordinately, proportionately, simultaneously, successively; so that it does not seem to matter which we assume to be the cause of the other. I do not agree with this view. I think it matters tremendously which view we take, and I think that this becomes much more evident when we pass from the domain of what is termed inanimate nature to what is termed the animate. Between these two, however, there is no dividing line, although it is convenient for us to speak as if there were. But animate and inanimate shade off into one another and merge into one another by gradations so insensible that we cannot say where one ends and where the other begins. They are contraries, in fact, whereas the discussion regarding the dependence of material substance on energy or of energy on material substance involves a question of contradictories, since both views cannot possibly be true, and we are compelled (I think) to make our choice between them.

Turning then to the domain of organisation, and particularly to animal forms, the second idea which I beg the fair reader to keep in her mind is that in these Conversations an animal is viewed as a machine pro-created by zoo-dynamic or the power of animal life to be a house or habitation for the manifestation of all the powers of animal life. And human bodies are viewed as pro-creations by the human power of life (what I have called anthropino-zoo-dynamic) to be fitting habitations for the manifestation of all the powers of human life. These powers act through what are termed the functions of various organs; and the fundamental or primary one of these in the human body, as in the animal body in general, is the function of nutrition or assimilation. This fundamental character of nutrition is proved by the fact that in the human animal, as in all the metazoal animal forms, the first step in development is the turning in of the outer layer of the embryo to form the body cavity, which body cavity is the beginnng of the digestive tract. Now, as if to show how very important in practice is the adoption of correct views theoretically, the discovery soon dawns on us that when, seeing this point clearly, and when, seeing it clearly, we begin to adapt our physiological conduct to it, we incidentally and quite unexpectedly add a large number of years to healthy, happy, and efficient human life. It is very curious and very interesting. A dis cussion which begins in a highly contentious con troversy eventuates in the addition of a large number of years to healthy, happy, and efficient human life. And this without the need for the exercise of any particular care, still less of coddling of the instrument of that life. There is no need and no place for valetudinarianism. On the contrary, valetudinarianism is contemptible, and the healthy mind and the healthy body despise it accordingly. Now I do not say that the satisfactory discovery that a certain theoretic view of the human body results in the practical addition of many years to healthy and efficient life proves that the theoretic view is correct. I do not say this, although we might perhaps be weak enough to think so by arguing in the direction of our interests, and by allowing ourselves, perhaps unconsciously, to be led in that direction. But when the adoption of what seems at first a highly contentious view, because, on an examination of all the evidence, it appeared to be the view for which the most was to be said—when the adoption of the theoretic view eventuates in a practical issue so satisfactory it is difficult to avoid the conclusion that that view was and is correct.

A few illustrations may be taken, in order that we may see how the facts vary according as they are viewed in one way or in the other. According to the received (materialistic) view, the liver has for its chief function the secretion of bile. According to the idealistic view, whenever, in order to effect the various processes of assimilation or digestion, it became necessary to add a substance through which the prevention of putrefaction and the better assimilation of fats might be effected, the liver with its bile-secretion was introduced by zoo-dynamic or the power of animal life for these purposes. On both views, bile is secreted through the liver, healthily or otherwise. But on one view the liver does it. On the other, that form of the universal omnipotent and eternal energy, which we may term the power of animal life or zoo-dynamic, does it. Similarly, on one view, muscles have the property of contractility, and by the exercise of this property, animals move their limbs. On the other view, the necessity that the body or house of animal life should move easily, pleasurably, and quickly, compelled, as it continues to compel, the introduction of muscles for this purpose. On one view, nerve-fibres conduct impressions, nerve-cells are sensible, and associated or consociated nerve-cells are conscious. On the other (the higher purposes of animal life demanding instruments of finer response and fuller appreciation) nerve-fibres and nerve-cells and consociated nerve-cells are introduced by zoo-dynamic for these purposes.

Thirdly, it follows as a corollary from these views, and particularly from the view that nutrition is the fundamental function of the organism, that the main sphere of the medical man is and must be the treatment of the various disorders of nutrition. In the sphere of preventive medicine his main occupation must be to offer advice as to how nutrition is to be kept sound and healthy. Medical men do not treat the powers of life; they treat the organs of the powers of life, and they treat the nutrition of those organs. Medical men do not treat insanity nor sanity; they do not treat blindness nor vision; they do not treat deafness nor yet hearing; but they treat the brain, the eye, the ear, and they treat the nutrition of those organs. What else do they treat or can they treat? Similarly (and it is here that the readers of this book are most particularly interested in this principle) medical advisers treat rather the organs of reproduction and generation than the power of reproduction or what is termed in the book toko-dynamic. And they treat especially the nutrition of the organs concerned, parcularly the nutrition of the ovaries, fallopian tubes, and womb. There is nothing else they do treat or can treat. In Conversation IV. I mention the effects of injuries and accidents, so that I need not say more here than that the effects of injuries and accidents also are greatly affected by the state of the general nutrition of the patients who sustain them. This fundamental nutritional function is paramount and must be so in the mind of anyone who wants to understand the body, and, understanding it, to treat it properly. All practice, medical or other, is founded on some theory. The "practical man" is as theoretical as any. Only he does not know it. He has not thought about it. But he has a theory all the same, to the effect, perhaps, that each case must be treated on its merits, and in accordance with the variations which distinguish it from others. It is a theory which has slowly to be re-adapted to every case; but theory it is, and it determines practice. The view which I have been compelled to adopt, that nutrition is the fundamental function of the body, that respiration is a complementary digestive function, and that the medical adviser is able to do very little, if anything, more than to treat the various effects of mal-nutrition, immediate and remote, is one fraught with practical consequences of the most important kind. Take, for example, the behaviour of the body to micro-organisms, or germs of disease as they are often called. We may take the ordinary view (I suppose it is the ordinary view ?) that these micro-organisms are the cause of the diseases, mostly infectious, with which they are found in constant association. Or we may take the view propounded in these Conversations that micro-organisms arise within the body or macro-organism when the nutritional conditions are suitable for their growth and development. And we very soon see that the conditions suitable for the development of the micro-organisms are unhealthy nutritional conditions in the macro-organism and that in plain English these unhealthy nutritional conditions arise mainly through over-feeding, or at least through wrong or improper feeding. And the practical differences in treatment, flowing from these different theoretical views, are very great indeed. On the one view, treatment of the tubercle bacillus and steps taken to prevent its ingress into the body would be the best means of curing and of preventing consumption. These ends would, therefore, be most likely to be attained by free ventilation, by full feeding, by the use of antiseptics to destroy the germs, and by avoiding sources of infection. But on the other view, while free ventilation would still be recommended as an aid to proper nutrition, and exercises recommended short of fatigue, restriction of the diet would coincidently be recommended, on the ground that over-nutrition of the body is the chief means by which it becomes a fit soil for harbouring the tubercle bacillus. Terror of infection would also be greatly reduced or even removed, because it would be seen that the entrance of a few germs, even if it did occur, would not be likely to do much harm to the body, since it is not the entrance of the germs that is of such consequence as it is the state of the body which harbours and fosters them, that we have to guard against. Further, it would be seen that this is a much more practicable policy than the other, since the germs of infectious diseases or micro-organisms are so abundant and wide spread that, do as we will, it is impossible to avoid being exposed to them; while the rendering of our bodies immune to them, by proper government of ourselves, is a measure well within our power and capacity.

In the fourth place, our ideas of causation being altered, we soon see that neither constant concomitance nor constant succession is the same as causation; and this view also, highly theoretic and contentious as it seems at first, is soon found to compel differences in practice of the most important character. The constant concomitance of the tubercle bacillus with consumption has already been referred to, and we soon see that it would be quite as reasonable to assume that the presence of consumption is the cause of the concomitant presence of the bacillus as to assume that the bacillus is the cause of the consumption. In fact, both the consumption and the bacillus are concomitant effects of a common cause, viz., mal-nutrition of the organism. Perhaps the very commonest fallacy in understanding and treating disease arises through confusing constant concomitance with causation. A woman, for example, who has endometritis or inflammation of the womb, along with pain in the back, is advised that the endometritis is the cause of the backache, and is further advised that an operation on the womb will cure the backache. But, having submitted to the operation she finds, alas, that this is not so; unless indeed coincidently she has been advised to alter her food-habits. But in this case the cure of her backache will be due to the alteration of her food-habits and not to the operation. And the proof of the truth of this proposition is this: that when operation alone is performed without any alteration of the habits, the backache is not improved, while the endometritis also usually returns in a few weeks or months. There is, in fact, no more proof that the endometritis is the cause of the backache than there is that the backache is the cause of the endometritis. The endometritis and the backache are concomitant effects of a common cause and not the cause and effect of one another. And the difference in the practical advice offered to women suffering in these ways is really so wide, according as we adopt one view or the other, as to be not unfairly described as being opposite or contrary.

But if constant concomitance is not the same as causation, so neither is constant succession ; and instances showing this also are very numerous. Constipation, if inveterate and long-continued, is very often succeeded by cancer of the bowel ; and under the belief that the constipation is or may be the fore-runner of a feared cancerous degeneration, purgatives are taken in order to cure the constipation. A wider view would have shown that the constipation is no more the cause of the cancer than the cancerous state is the cause of the constipation, but that both and the succession of the one on the other are due to mal-nutrition or mal-assimilation. And this being so, the wise physician will advise his patient so to regulate her diet and so to diminish it as that the bowels shall be no longer blocked or plugged by too frequent and too abundant feeding. And if in this way he can induce his patient to overcome the constipation he will, incidentally, enable her to free her mind of the apprehension of the onset of cancer in her body. Sick headaches or " bilious attacks" as they are often called, are frequently followed by the onset of grave evils, many of which are incurable. But when, say, chronic crippling rheumatism sets in after such headaches have existed for years, being treated each time perhaps by a day in bed and the taking of two pills and a bottle of medicine, the proper view to take is, not that the rheumatism was caused by the headaches, but that the headaches and the rheumatism were and are successive effects of their common cause, viz., mal-assimilation or indigestion. Even as regards acute disease, the same principle is often found to be in action. Sometimes patients will say—" I have never been the same since I had that attack of influenza "—the suggestion being that the influenza was the cause of a number of ailments of a very trying or even incurable character. But the true explanation is much rather that the influenza was not the cause of the succeeding troubles, but that it was the means of bringing to our notice the long continued and insidious nature of the mal-assimilation which led to our having influenza, and afterwards to the occurrence of the long lasting, slow depressed condition of the heart and circulation, or even of the consumption, which succeeded it. In the sphere of causation, therefore, constant concomitance and constant succession are far oftener the marks of the action of a common cause than they are the cause and effect of one another. It is indeed somewhat difficult to keep this principle in mind; but it is most essential that we should do so, since right treatment is determined by it.

There is a fifth idea which I think ought to be mentioned in the preface, and that is that perversion of function has been added to the other three characteristics which distinguish disease from health. Excess of function, defect of function, and irregularity of function are all recognised as characteristics of disease as distinguished from health. The addition of perversion, in which centrifugal action becomes centripetal, or vice-versa, and in which elimination is changed into absorption with appalling consequences to health and life, has so often forced itself on the writer's attention that he has felt the necessity of declaring it and formally adding it to the differences in which disease differs from health. He hopes that its importance will justify the necessity of its statement. It is in fact rather difficult for him to understand how this necessity does not seem to have compelled a previous formal statement of what every medical adviser must have often felt as a paralyser of his efforts towards the recovery of his patients.

The next idea which ought to be mentioned as expounded in the book is the repudiation by the writer of the Darwinio-Huxleyan view of evolution. According to this view, accepted apparently by almost the whole scientific world, the similarity in the structure of men and apes, and in the structure of apes and other animals, is explained by the suggestion that they have sprung from common ancestors. The writer sees no evidence for the existence of a common ancestor at all, finding a complete explanation of the likeness of animal forms to one another, of the presence of rudimentary organs so-called, and of similarity in embryological development, in the emanation of the various powers of life from one source, and in the necessity of their working alike for that reason. If this view is not quite a logical necessity from the other general positions taken in these Conversations it seems to be a practical corollary from them; and I hope that the evidence which has convinced the writer on this point will convince his readers also. But even if they keep open minds on this point (as I hope they will do) they may still, I think, read these Conversations with intellectual advantage and with great benefit to their health.

As to evolution itself, while repudiating the narrow phase of it which has been propounded by Darwin and Huxley and accepted by their successors, the writer is a convinced evolutionist who sees a hierarchy of powers translating themselves into an ascending hierarchy of corresponding forms. The higher and lower forms succeed one another in time and space, and also co-exist with one another, but each remains separate in its own order, apes remaining apes in infinite variety of pithecoid form and character, and men men in an infinite variety of human form and character also. And although men appear to have succeeded apes, there is no evidence whatever for the absurd view that they are their children or that they are both descendants of a common ancestor or ancestors. And similarly, if in time men are to be superseded by higher forms of life (for why should evolution cease with man ?), these higher forms will not be the children of human beings, although they may succeed them ; but will, no doubt, arise as a new and higher form, complete in all its parts and stages, when the fulness of the time shall come, that is, when the conditions shall be ready for them. And just as apes and lower animal forms co-exist with men, although they preceded us in geologic time, so no doubt may we expect to co-exist with our successors and our superiors for a quite indefinite time to come until they also may be in their turn superseded.

The view set forth in Conversation III. that neither the energy of the body nor its heat comes from the food will, it is hoped, be carefully considered by the reader. It is of the gravest and most fundamental character. If we reflect on the subject it will be evident that it depends on the first idea referred to in this preface, viz., that energy is the cause of substance, and not substance of energy. Food is not the cause of life, but the power to assimilate food is one of the powers of life. It ought to have occurred to myself, for I have been an idealist all my life, but strangely enough it never did ; and I can only express the obligations which I feel to Mr. H. Carrington for bringing to my notice an implicate of the philosophy I had already adopted. From whatever quarter it came to him it has been the cause, in my mind, of a spiritualisation and elevation of view of the functions of the animal and human body to a height higher and fuller than I had before realised. It has strengthened and enhanced the view which on other grounds I had already been compelled to take. The experience has not been unmixed indeed with a certain amount of regret that such a suggestion in a medical matter of prime importance should have come from one who is not himself a qualified medical man. Truth, however, must be humbly received and assented to, from whatever quarter it may come; and for my part I welcome it gladly.

No one, lastly, can be more conscious of the imperfections with which the views propounded in these Conversations are accompanied than is the writer of them himself. He feels utterly unable to deal with the greatness and loftiness of the method of the working of the power of life through the animal and human body. More than once, when giving expression to the thoughts slowly and intermittently evolving during the course of quite an average length of experience, has he been tempted to tear the whole thing up and commit it to the flames. But he has not been able to do this for several restraining reasons. First, there is an immense amount of suffering; and much of it, a very large proportion of it, appears to be avoidable by very simple means. And second, as no man is consulted as to whether he will assent to pass through this life or not, and as some of us might perhaps even have been cowardly enough to refuse at once the privileges and the sufferings of the struggle, if we had been consulted, so I have felt that no one may fail to attempt to express that which he sees to be going on, in the form in which it projects itself to him. That the field in which one or two feeble voices are vainly attempting to make themselves heard will soon be filled by many and much more efficient ones is not to me a matter of doubt, and that these voices will speak to us not only loudly but so persuasively as that we shall be ready to yield them a willing assent is my hope and confident expectation.

A. Rabagliati.

DISEASES OF WOMEN.

CONVERSATION I.

I have for a long time felt that I should like to have a series of conversations with women regarding their illnesses and regarding the management of their own and their children's health. For many years I have had to deal with the diseases to which women are specially subject; and in doing so have myself passed from youth to a stage well beyond the meridian of life, so that, if for this reason only, I do not feel it an impertinence to address you. How you will receive what I have to say, I do not know. You will find the opinion expressed, and that very plainly, that in your case as in that of men also and even of your children, most of your illnesses are brought on by your own mismanagement. Not all, but most. And even of the remainder almost all are induced by human agency. How you will receive this is a question first of all for yourselves; but it does not end with yourselves, for the response you make to the considerations to be put before you will determine your conduct, not only to yourselves but also to your husbands and children, and to all those with whom you come into contact; whatever be your relation to them in life. You will feel whether the truth is being put before you and in what spirit it is said; for truly in life it is not what is said so much as how it is said that is important. As to this, one thing may be added. Although it would not be quite true to say that I have nothing to gain from the way in which you receive my remarks, still, in the nature of things, it is true to say that I have not much to gain. In fact, any gain which I might incidentally have hoped to receive from you has already come, and the needs which compel me to convert life into a gain-producing process are rapidly coming to a termination.

My text is : Our sufferings are brought on us, not by fate, not by environment, nor by our ancestors, but mainly by ourselves. It sounds a hard saying. I think indeed that if I had not felt myself compelled to speak, I should have left the question alone. Of course it is settling itself. Questions are always in the course of settlement by Nature in a natural way ; or I should say, the mode in which Nature would settle them is always being pointed out by the processes of Nature and by the events of life. But we are slow of comprehension, and we do not do our part. Nature's settlement, or the inferences which we might have drawn from the facts which we and our predecessors have seen enacted before our eyes for generation after generation regarding her methods of settlement, have passed by unheeded, or at least have made far too little impression upon us. The breach of the natural law of nutrition (like the breach of any other form of natural law) is sin, and the consequences of this sin are illness and death ; and this is so plainly inferrible from the facts of life that one might well be content to hold one's peace about that which each of you can easily see for herself. But two things seem to compel one to speak. First, if death had come suddenly or painlessly, one might have been silent to those who might easily have seen for themselves the course which things were taking. But when death does not come quickly, suddenly, and painlessly ; but on the contrary often after years of pain, inefficiency, wasting and wearing of body, and of depression and distraction of spirit besides; then one feels forced to speak, because of the firm persuasion that the greater number of our sufferings are avoidable, and also that they are avoidable in ways so simple and inexpensive as to be within the reach of a large proportion, if not the large majority, of the race. What I have to say applies to humanity, to the common lot, to men, women, and children alike ; but I speak to you because you have the care and oversight of the children who will become the parents of the next generation ; and also because you have special troubles to bear. And this brings me to the second great compulsion to speak. The processes of Nature include the actions of intelligence, emotion, and will. Natural processes are not confined to the portions of nature, which we term inanimate, with practical if not philosophical demarcation from the animate. If all Nature is a manifestation of energy, and if energy or energies are of different degrees of differentiation, the lower degrees of energy translating themselves into the lower forms of substance which we call inanimate, and the higher into higher and higher forms of substance and organised matter, suitable for the embodiment of higher and higher and more complex forms of energy until we reach structures capable of being used by intelligent, emotional, and volitional and spiritual powers, it must not be forgotten that these spiritual powers are the active agents in the effecting of the evolution of Nature. The actions of intelligence, of love and hate ; of will—good and bad—are as much parts of the processes of Nature as are the actions of attraction or repulsion, of crystallisation, of polarisation right or left, of chemical action, or magnetic, electric and thermal and biological energy. And I put it to you whether you think or are satisfied that we the men among us, or you the women are doing our part in the proper cultivation or education of these energies? I fear much we are not. These are the two reasons compelling me to break silence regarding the course of the things I now wish to talk to you of.

Practically, the view of the human body that you will find put before you is that it is a machine pro-created by that phase or species of energy which we may call human zoo-dynamic or the power of human life, to be a house fitted for the manifestation of human life. In this it agrees with the bodies of the lower animals, which are, each of them, pro-creations by its own form of life-power, of a machine in each case suitable for the housing of that power. Thus an ape's body is a machine pro-created by pitheco-zoo-dynamic or the power of ape-life, in order to be a fit house or dwelling-place for that form of the one universal energy. Hippo-zoo-dynamic and canine-zoo-dynamic, as also feline-zoo-dynamic, pro-create, the first of them a horse's body, the second a dog's, and the third a cat's body, so that each of these three bodies shall be a fit or suitable dwelling-place for the power that pro-creates it, and maintains it in accordance with the laws of its being and functional manifestations as laid down in physiology and anatomy. Fundamentally an animal body is a machine pro-created by zoo-dynamic (which we may distinguish from phyto-dynamic or the power of plant life) to be a suitable house or dwelling place of animal life. Now the fundamental or primary power of animal life (after the power of response which is common to all things, mineral, vegetable, and animal), which all animal forms manifest, is the power of digestion or assimilation, or what we may call tropho-dynamic. So that we may say of animal bodies that they are primarily or fundamentally machines pro-created by zoo-dynamic to be suitable receivers, storers, and transmitters of the phase or species of energy which may be termed tropho-dynamic. And in this the human body, like all other animal bodies, participates. This is plainly to be seen when a comparative examination is made of the animal body as it shows increasing complexity of structure. In the protozoon, the power of assimilation is the only or almost the only manifestation of power which the creature can make. A piece of food suitable for its growth and repair, falling on the protozoon, makes a dent on the surface of the animal's body, is absorbed into the body, and is then assimilated. Zoo-dynamic as exemplified by the protozoon resolves itself into little more than a manifestation of tropho-dynamic, and a low form of that, little more indeed than a mechanical absorption and assimilation. When we come up a little higher in the scale, we find the metazoa, whose ovum or egg consists essentially of a number of organic particles bounded by two layers of cells arranged around the surface of the body. These turn inwards at one place in such a way that the outer layer becomes the inner, and forms the beginnings of a digestive tract, there being also some, though very slight, arrangements effected for the carrying on of relations between the lowly organism and its environment. But the most important mechanism is that of the formation of the digestive cavity as shown in what has been called the gastræa-form or pro-gaster or commencing stomach. After that, and ascending a little higher in the scale, we find the general body cavity in what are called the coelum-aria group (Κοῖλος = hollow). But still the digestive or trophic mechanism is the most important, and at any rate is fundamental, the lungs, for example (as well as the liver) being formed as diverticula from the digestive tract, so that the primary function of the respiration is to relieve the blood of CO_2, a product of digestion. It is on evidence of this kind, which will be found abundantly corroborated and enlarged in books on Natural History, or in such a book as Haeckel's Evolution of Man (so full and well-informed as to its facts, and yet so chillingly disappointing as to its inferences from them) that I base the statement that the animal body is a machine pro-created by zoo-dynamic (a form or species of the one universal, omnipotent, and eternal energy by which all things do consist) to be a fit house or dwelling-place for itself, and that the fundamental power of animal life is tropho-dynamic; in other words, the primary function of animal life is digestion or assimilation. In the higher animals, of course, zoo-dynamic pro-creates for its own manifestation higher and higher forms of structures; but these all depend on the proper functioning of the lower power of assimilation or tropho-dynamic; and unless it is in good order, all the others are apt to go wrong. Thus we get perversions of thinking (noetico-dynamic), of emotion (æsthetico-dynamic), and of will (boulo-dynamic), but in nearly all cases, as indeed we shall see, the assimilating power has been out of order before the disorder of the higher powers sets in. The mechanism even of tropho-dynamic itself has become very complicated as we ascend in the animal scale; and indeed requires a life-time or even several ife-times to master its subtleties. If we come to think of it we shall see that it is not the energy which goes wrong in cases of disorder even of digestion, and still less of thinking, feeling, or willing ; but that in all cases, the mechanism or animal machinery or instrument being disordered, the power can not work through it, and disharmony appears, just as discord is produced when a musical instrument is out of tune. This, however, is the kind of evidence (and it might be much elaborated and extended), on which I base the statement as to the view I take of the human body. In particular I might have strengthened the argument from the individual or embryological development of man, a true development of growth, stage by stage ; but at present this may be left out of account.

The human body thus seems to be pro-created by the human power of life (what we may call anthropino-zoo-dynamic (*ἀνθρώπινος* = human. *ἄνθρωπος* = a man or human being) to be a suitable dwelling place for that human power of life.

I think that all forms or phases of the one universal, eternal, and omnipotent energy pro-create, each of them, the forms most suitable for their manifestation. I therefore do not believe in a common ancestor for different forms of animals ; but I believe that different animals are made alike because the different forms or species of power which pro-create them are all modifications of one universal energy, and that these forms of the one universal energy work alike in all cases because they all spring from a common source. The test of common ancestry in my opinion would be the possibility of having a permanent strain of common or mixed descendants. I no more can believe that apes and men have had a common ancestor, than I can believe that they have now or ever will have common descendants. I no more believe that men are elevated apes than I believe that apes are degenerated men, which some savage peoples assert. There is no evidence for either opinion, and both are false to Nature. But apes and men are both alike with skin, and hair, and bones, and muscles, and limbs, and digits, and sense organs, and brains, and viscera, because anthropino-zoo-dynamic which pro-created men is a sister power to pitheco-zoo-dynamic which pro-created apes, and both these powers being forms or species of the one universal power must work alike for this reason. The similarity of structure of men and apes therefore points, not to a common ancestor but :—

1. to the action of similar forms of power or energy, and
2. to a common source.

This is the view which will always be presented to the readers of this book, as also that the powers of Nature are always struggling to express themselves in forms suitable for their manifestation. Those therefore who are too much prejudiced to entertain this view or give it a candid consideration had better save themselves the trouble of going further.

It may surprise you perhaps to hear that the ailments special to women, depend, like those special to men, and like those special to children, on general causes which lie very much in our own hands and within our own control. I make only a distant reference to the mental, and still more distant reference to the spiritual trials which women have to endure. They scarcely come within my province. There are some trials special to yourselves which you may say are not within your own control. The generally dependent position of women—is not that, you may say, incident to the nature of things ? To some extent truly it is so. As long as men have to earn the wherewithal with which things are to be kept going, is it not necessary that with them must lie the final arbitrament as to what and how much is to be spent ? No doubt. But there are compensations. For if women are necessarily as a rule in a somewhat dependent position, does not that also carry with it a corresponding freedom from financial and commercial anxiety which may be made greatly conducive to their peace of mind ? Which may enable them to set their energies free for the control and management of the home and of the children ? And which may enable them to realise that if they keep within the bounds and limits of natural law, their freedom within the law is almost unbounded, although outside the limits of the law, there is no freedom at all ? I speak, of course, to the majority. Exceptional cases of unmarried and independent women (so called, but what woman or what man is really independent ?) must be dealt with in accordance with the special circumstances of the case. But, independence, if it could be attained, which it cannot, would be that of a traveller in the heart of a desert stretching without an oasis for thousands of miles on every side of him, or of a swimmer in the centre of a landless and sail-less sea extending for miles around. Here again the question of dependence or of independence is one not of sex, but of circumstance, one not limiting women specially but men also and humanity. And of course in a well-assorted marriage, true love, which works for the common good of the family, prevents the question of government from being raised, since both parents work or aim at working in harmony for the common benefit.

THE CAUSES OF WOMEN'S DISEASES.

I fear I must commence my remarks with some general observations on the causation of women's diseases. I am sorry for this, because some of those whom I am most anxious to reach may be perhaps repelled by what they may think to be the abstruseness or the irrelevance of this part of the subject. I propose, however, to say what I have to say on this point (and indeed so far as I can, on all others) in as simple language as possible, and always with a practical aim. That aim will compel a threefold exposition.

1. I shall endeavour to show the causes, or the chief causes, of women's illnesses ;

2. The means of cure, and of the prevention of subsequent illnesses ; and

3. Since, unfortunately some diseases are practically incurable (I do not know if they are theoretically so) I shall aim at showing how other women may, if they wish to, escape from the incurable diseases which may have overtaken their sisters. Further, I am not going to lay down any principles of causation which will not have to be referred to again and again in our detailed consideration of the diseases incident to women.

WHAT IS A CAUSE?

In discussing this question, I must premise that I am considering only scientific and not philosophical, nor yet theological cause and causation. Ultimately, or in the end, all causation has a theological bearing ; and I do not say that in the background of my mind this aspect of the question is non-existent. Indeed, it cannot fail to be present either to the theist, to the atheist, or to the agnostic, which three classes, I conceive, account for the whole of humanity. In one of these three classes, therefore, the writer and all his readers must be from time to time comprehended. But I do not discuss this question, as it is outside of my present province. By scientific cause, I mean sequence ; and in this sense I define a cause as an incident or fact, without which the thing or condition under consideration would not have occurred or have come to exist. Or shortly we may say : a cause is that, without which a thing would not have happened. In the widest sense, the material causes of anything are all the events which have preceded it. The cause of a woman's condition or state of health therefore are all the events in her previous life whose occurrence has made her body what it is. But as a discussion of all such events, even if we knew them, is obviously impossible, in considering the causes of illness we take into account only those previous events which may have seemed to be the most important.

I can imagine someone here objecting that in saying that the causes of women's illnesses are all the events occurring in the previous parts of her life, I am confusing constant succession and constant concomitance with causation. All the previous events of every life have been followed by subsequent ones, as day has always been followed by night, and as night has always been followed by day ; and yet day is not the cause of night, nor night of day. I can only reply, I have not confused the two. I do not propose to discuss here these difficult questions and common causes of error, although I may have to refer to them hereafter. But I beg the gentle reader to believe that the distinction between constant succession and causation as also between constant concomitance and causation has been maintained in my mind throughout. In fact it has been so much in my mind that I have been made to realise that in the end my idea of causation has become so purely spiritual that what I say and the way in which it is said may possibly have the effect of causing in the mind of the reader the same dissatisfaction as is caused in mine with such scientific explanations as that matter is the source of energy, or that matter is the source or cause of gravitation. When two things—matter and gravitation—vary always in direct proportion to one another, it is always difficult to say which is the cause and which the effect. But I may say that it seems to me much more probable that gravitation, a power, is the cause of matter, a thing, than that matter is the cause of gravitation ; or, to put it otherwise, that gravitation is a property of matter—which is the ordinary view. To me it seems far more likely that matter is a property of gravitation, than that gravitation is a property of matter ; or probably gravitation and matter are concomitant and successive effects of a common cause, viz., the universal, omnipotent, and eternal energy by which all things do consist. And the cause of that in turn ? What or who is that ? No ! I have not confused constant concomitance nor constant succession with causation. But if we take as our practical definition that a cause is that without which a thing would not have happened, we shall find this to hold equally on the view that matter is a property of gravitation as on the more generally accepted view that gravitation is a property of matter. On the one view, without matter there is no gravitation ; on the other view, without gravitation there is no matter. Or to put it positively rather than negatively : wherever matter is, there is gravitation ; and wherever gravitation is, there is matter. Which, gentle reader, do you think is the cause of the other ? You will find, I think, that you will have to come to a conclusion on this question. You must accept either one alternative or the other, because you cannot hold both. They are contradictories. Either power is the cause of substance or substance is the cause of power. You must either be a materialist or an idealist, and you cannot be both. It is no doubt open to you—this is often the individual's position, as it is also the agnostic's, to say :—" I will not settle it. I cannot settle it. It is enough for me to realise that power and substance always are correlated, co-ordinated, proportionate, the one to the other." Well, this is one way of thinking ; but every inquirer who takes up this position must feel that he has to that extent shelved the question rather than attempted to settle it. And the agnostic's position is at best a very temporary resting place for the human mind, fitter for a young man's debating society for a night than for a life-long resting place.

This question of causation seems to be one of the most intricate in science and in life. I do not myself know that I should agree with this opinion, for it seems to me very easy ; but I judge from the diversity of the views held on the subject. Take, for example, such a question as what is the cause of the heat of a burning coal fire. " Why, the coal, of course," says almost everyone when asked. But is it ? Let us try to define our answer more accurately. " The cause of the heat is the union of the carbon of the coal with the oxygen of the air." If so, then the air is as much the cause of the heat as is the carbon of the coal. And yet we never say that the air is the cause of the heat of the fire. Why not? Without the air, or without oxygen supplied from somewhere, there would have been no heat in the presence of carbon. Coal will not burn in a vacuum. Certainly oxygen conforms to our definition of a cause, since without it no heat would have been liberated. In my view heat is liberated when chemical power or chemico-dynamic functions or acts. I think that all kinetic energy or all dynamic energy as distinguished from potential, is warm, or at least is so when an organism exists like the human body, capable of feeling it and saying what it feels. Heat, then, is not energy but a quality of acting energy—at least this is my view. Take, again, the puzzle as to whether the egg is the cause of the hen or the hen of the egg. Certainly each must be the cause on the simple view that a cause is that without which a thing would not have been, since assuredly without a hen no egg is laid and without an egg no hen is brought forth. This illustration is, however, excellent for showing the shallowness of the common-sense or practical definition of cause which I have accepted, for assuredly hen and egg and egg and hen are far rather to be viewed as successive effects of a common cause, viz., alectorido-zoo-dynamic or the power of barn-door-fowl-life (ἀλέκτωρ = a cock; ζῶον = a living animal form; δύναμις = power), than as cause and effect of one another. And any one who reflects on this even for a little will soon discover what is meant by saying that causation has a philosophical and theological bearing, and that according as each one thinks on this subject will be his answer. The immediate philosophical question seems to me to be—

is material substance the cause of energy? or is energy (imponderable and invisible but inferrible) the cause of material substance? And the remoter question I do not here discuss. I must say that I think every one has really made up his mind on this question whether he admits it or not. I do not think (this is, of course, my own view only) that one can sit on the fence on this question. The agnostic simply refuses to look and see which side he is on. If there is much to be said for materialistic monism, which holds that material substance is the cause of energy, there is in my judgment much more to be said for idealistic monism, which holds that energy is the cause of material substance and that the spiritual is the only real. Reverting for the moment to the puzzle of the hen and egg, may I venture to put a view of the origin of species, which seems to me far simpler than the Darwinio-Huxleyan one and far truer to Nature. The accepted view defines a species as all the individuals which have descended from a common pair. On this view surprise is exhibited at variations in different individuals of the species. This is not my view at all. I see no evidence of the existence of a common pair, and I am not surprised at variation. I should, on the contrary, have been very much surprised if there had not been variation, and if all leaves had been alike exactly, and all cocks and hens and all apes and all men and women. Very much surprised I should have been that forms of the universal, omnipotent, infinite, and eternal energy had been so limited in any direction of their activity as to have made all the forms and individuals in any species exactly alike. So far, therefore, from feeling any need to account for variety, I should have felt quite unable to account for perfect similarity. It would have seemed to me an unwarrantable limitation of the infinite variety of the powers of Nature. So far as I can see, Nature has not made species at all, but only individuals. It is we who have made the species by seeing likenesses and unlikenesses; and then, pushing our inquiry into likenesses and unlikenesses further, we have made varieties which become so numerous that we are compelled to stop because varieties depending on minute differences really resolve themselves into individual differences, and these individual differences are not transmitted to descendants. From this kind of reasoning has been formulated our definition of a species as all the descendants of a common pair. But what if there were no common pair? Suppose that when the fulness of the time had come, that is, when the earth was fitted for their existence, alectorido-zoo-dynamic, or the power of life of the barn-door-fowl, had procreated all at once hens and cocks and chicks and eggs, in all stages of development? This is what seems to me to have occurred. It is true that I was not there to see. But neither was any of the great scientific men who propound the other view. And it always seems to me a curious thing that the caution of Darwin has not been imitated by his successors, who seem almost unanimously to have assumed as a fact what he offered only as a cautious and tentative suggestion. It seems to me that the whole theory is a pyramid built upon its apex, and we are constantly being compelled in consequence to support it first on one side and then on the other. Why did not Darwin feel himself compelled to show that pouters and fantails and tumblers and homers and blue-rock pigeons became hawks or herons or ostriches sometimes, let alone saurians or amphibians? Why? There would have been some proof of common ancestry then. As the argument and evidence stand at present, and so far as I understand it, I see no evidence of the common ancestor at all. But I do see evidence, on the view that all the powers of the universe emanate from a common source, that they work alike; and therefore all animals seem to be built on a common plan. And as evolution will probably not cease with men; when we are superseded it will be, I expect, not by our children, but by a higher form of life, which, finding the earth ready for it, will produce the new forms fit to house the higher manifestation simultaneously in an infinite variety and in all stages of development. We may even continue to persist for some time along with our successors and supersessors as apes and the lower animals do with us.

Before going further with the causes of women's diseases, let me put the following considerations. A complete or satisfactory proof of a theory of causation of disease would arrange itself under three heads.

1. The alleged main cause must be a true cause; that is, it must exist in nature, and it must act frequently or so frequently as to appear to be continuous.

2. Cure must be attainable by stopping or diminishing the action of the cause.

3. Either cessation of the cause in future, or proper diminution or regulation of it, should prevent the recurrence of the effects. Now, I want to point out that my alleged cause conforms to all these three tests.

First, it will not be denied that the mal-nutrition which comes of too abundant and too frequent feeding is a real or true cause, or that the mal-nutrition caused by too little food or that caused by a wrong quality of food is a real or true cause of illness.

Second ; at least in the acute febrile diseases, and in inflammations, restriction of the diet is the sheet anchor of treatment. Nature flings feverish and inflamed patients into bed with a furred and loaded tongue, depriving them for a longer or shorter period of the power of taking any food, or almost any food, at all. Both fever and inflammation receive their names because there is burning heat present in the body when these states exist. "Fever" is connected with *Febris*, which is its Latin synonym, and that is connected with *Ferveo*, I burn ; while inflammation is connected with *Flamma*, a flame. But, although both fever and inflammation thus receive their names because there is burning heat present in the body, still both of them may be also viewed as compulsory fasts instituted by Nature or the Power of Life, during the time when, by increased oxidation and combustion, the offending cause of the maladies, slowly accumulated often for a considerable time before the illness, is being in this way expelled from the body.

Third ; (*a*) return to and continuance in mal-nutrition re-induces the diseases, while (*b*) recourse to proper nutrition prevents their recurrence. I believe that the application of these principles and considerations would cure and prevent between two-thirds and nine-tenths of all the illnesses endured by men and animals. And when or if we had dealt with the nine-tenths or the two-thirds of all illnesses in this way, that is by establishing proper food-and-drink-habits, we should then have our energies set free to deal with the tenth or the third of the evil conditions which had not yielded to these arrangements. Of course, I assume the adoption of proper breathing arrangements also, but I have already drawn attention to the fact that the lungs, being a pair of out-growths from the digestive tract (the fore-gut) must be looked upon as supplementary nutritional organs; so that nutrition or assimilation becomes more important than ever. Proper exercises act further as aids to nutrition, so that from all points of view this primary function has its importance enhanced.

NOTE.—Fever is sometimes defined as an acute febrile condition, accompanied or associated with the growth of a micro-organism, or micro-organisms, in the blood or tissues of the patient; while acute inflammation is defined as an acute or severe febrile condition not known to be so accompanied or associated. The progress of bacteriology, however, has been so rapid that micro-organisms are constantly being discovered in the processes both of fevers and of inflammations. It seems likely, therefore, that the differentia between the fevers and the inflammations will before long be seen to depend not upon the presence of micro-organisms in the course of the fevers and their absence in the case of inflammations, but only on the different sorts of micro-organisms which characterise one or the other of these sets of diseases. Should this very probable anticipation soon be verified in fact, we shall revert to the classification of the ancient writers, who mixed fevers and inflammations together under the name of acute febrile or pyrexial conditions. And so we shall be driven in considering the question of prevention, both of fevers and inflammations, to discuss what conditions of the human body cause micro-organisms of a hurtful sort to flourish in it. The writer sees quite plainly that mal-assimilation or abnormalities in the primary function of the animal body (that is, digestion or assimilation) are by far the chief cause. Proper understanding of this function would be sufficient to deal not only with the acute fevers and inflammations, but with those forms of the mild and chronic diseases also, which, because they manifest themselves by signs of depression rather than fever, are almost universally believed to require an opposite mode of treatment. The reason for holding this somewhat paradoxical opinion will appear in the sequel. As to tumors, if they are not made out of the food, or at least if they are not manifestations (like the fevers and the inflammations) of mal-nutrition, it may well be asked: of what, then, are they the expression or manifestation?

THE THREE SETS OF CAUSES OF DISEASE.

The causes of disease (of the diseases, therefore, of women as well as the rest of the human family) have been divided into three sets :—

1. The proximate causes ;
2. The exciting ; and
3. The predisposing.

It is with the last that we are to be most fully occupied, although all three sets of causes are very important.

The proximate causes of disease, as of health (for health shades off into disease by gradations, so insensible that it is often difficult to say where one leaves off and the other begins), are two, and two only, viz. :—shrinking and swelling, contraction and dilation, or tightening and slackening. This fundamental property or power expresses or manifests itself through organised matter of which the body is composed, and through unorganised matter like the metals, clays, and even stones alike. Alike, but not, of course, to the same degree. Whenever contraction takes place in any part of the animal body, the constitution of the part and of the body is such that the contraction in course of time ceases, and then the part dilates or slackens. We may put this shortly by saying : a contracting tissue first becomes indifferent, when it is neither swollen nor shrunk, but is for a short time in a state intermediate between the two, and then it dilates. Contraction, or tightening, or shrinking is always followed by dilation, or slackening, or swelling, the two states being separated by one in which neither shrinking nor swelling, but merely neutrality, exists. Now this seems to be very simple, and so it is. But it is not so simple when we come to inquire further and find that tubular animal structures are often, if not always indeed, made of two sets of fibres—one going along the length of the structure, and another set of fibres which stretch circularly round and round the walls of the structure like the rifling of a cannon. This arrangement is found in such a hollow structure as the intestine, or the womb, and in arteries and veins, though to a less extent, and it will be well to study the action in these parts a little, in order to get some understanding of how the actions of the body are carried on. The intestine will probably be the best part to study. In this the chief object of the structure is to pass the contents of a winding tube (fixed at one side or edge) along its lumen or channel. Now this object is effected by an arrangement by which one set of muscular structures pass along the length of the intestines (the longitudinal fibres) while another set pass circularly round and round the tube (the circular fibres). Of course, no one strand of fibres passes from end to end of the intestinal tube, but bundles of fibres more or less long, are arranged, with their surrounding connective tissues, along the length of the canal, each one of them ready to take on its contracting action in a wave-like manner from above downwards. Similarly, no strand of circular fibres goes entirely round the interior of the tube, but each imperfect circle of bundles of fibres stretches in a circular manner round the interior of the gut, ready to take on its contractile action, also in a wave-like manner from above down. Let us suppose that the longitudinal fibres contract along a portion of the length of the gut. After they contract, they pause, or cease to contract. Then they relax or dilate. But immediately on this taking place a contraction begins to appear in the circular or transverse fibres, one imperfect ring and then another contracting from above downwards in a wave-like manner. When the longitudinal fibres contract, the effect is to shorten and widen the portion of the tube affected, and so incidentally to fill it with contents. But when the contraction of the longitudinal fibres ceases, and the neutral state has appeared, contraction of the transverse fibres occurs, and the effect of this is, while narrowing the intestinal tube to lengthen it, and at the same time to pass the contents of the tube along from above downwards. The contraction of the transverse or circular bowel-fibres is followed by a momentary neutrality of these fibres, after which there immediately again occurs another contraction of the longitudinal fibres which has the effects already described. By this alternation of action, contraction of longitudinal fibres, followed by neutrality of the same and immediately thereafter, or coincidently therewith, contraction of transverse followed by their neutrality, the contents of the bowel are gradually pushed along to their destined expulsion. This process of the alternate contraction and dilation of these two opposite sets of structures occurring normally from above downwards, pushing the bowel-contents on in the natural way, is what is called peristalsis. The intestine is fixed by its serous covering or mesentery, folded in an intricate way, all along the front of the spine. Were this not so the intestine itself would be moved along after the fashion of the earthworm to be later referred to. But owing to this fixation of the posterior edge of the bowel in this way, by means of its serous or its peritoneal envelope or mesentery, to the spine, progression of the contents only occurs, and not progression of the bowel itself. The action may be likened to a wave progressing in water, the wave itself moving in a series of elevations and depressions, while a floating cork, for example, or a piece of wood maintains its position, almost stationary, although rising and falling with the movement of the waves. If, on the other hand, in a case where movement ought normally to occur from above downwards, the reverse action occurs or movement from the periphery to the centre of the body, or from outside to inside, as happens from time to time, through a variety of causes acting abnormally, then what is known as antiperistalsis (usually accompanied by vomiting) takes place; and this inverted action is one of the most serious forms of disease. It is, in fact, perversion of function, and arises when centrifugal action becomes centripetal, and elimination becomes absorption. But natural action is well exemplified in the arrangement of the longitudinal and transverse muscular fibres of the intestine, and is the key to the mode of action adopted in the human body, and, indeed, in organised bodies in general. Various modifications and adaptations of it occur, according as different functional objects are to be attained by the power of life. Incidentally, indeed, a rather interesting fact comes to be observable. While function is carried on by the alternate action in this way of the transverse and of the longitudinal elements of structures, we see that when the longitudinal elements are specially acting, the function of the part is perceptibly heightened or increased. In the case of the bowels the contents are hurried on, and over-action, or a tendency to diarrhœa, is observed. When, on the other hand, the transverse elements are specially acting, especially if there is considerable dryness of the contents, the function of the parts is perceptibly diminished. The bowels tend to be constipated ; or the blood-vessel to be emptied of blood, and so the part supplied by it becomes pale. The former of these conditions, or, contraction of the longitudinal elements of tubular structures, has the name *stimulation* frequently applied to it, while to the latter, the contraction of the transverse elements, the term *tonic*, or *tonicity*, or *tonic-action* is often given, and when carried to excess is called *inhibition*. It will be necessary to keep in mind that the former or stimulant action is usually associated with contraction of longitudinal elements of tubular structures (intestine, vessels, viscera, such as bladder or womb, etc.), while the latter or tonic action is associated with contraction of the transverse elements. Some agents tend to act more on the longitudinal elements of structures than on the transverse, and these get the name of stimulants. Alcohol is the great representative of this set of agents ; and this is how it tends to flush the face and excite a temporary organic activity, because by contracting the longitudinal fibres of vessels, it shortens and widens them and fills them with blood. (It may also coincidently partially paralyse the transverse elements, in which case the "stimulative" effect will be furthered). Cold, on the other hand, especially in moderate degree, is the great representative of agents acting (primarily, at least) in the reverse way, because by contracting, especially the transverse elements of structures, it tends to shrink and narrow, while it lengthens vessels, etc., and so tends rather to check action. An excess of this, indeed, checks action almost entirely, inducing a state of things which has been termed inhibition, slowing the pulse and diminishing action; while an excess of the other or stimulant action ends in the helplessness of narcosis and oblivion and collapse, with a quick feeble running pulse. But we must always bear in mind that stimulation and tonicity are induced primarily by contraction (*a*) of the longitudinal, and (*b*) of the transverse elements and structures, and especially of hollow structures. Great excess of the former action may result in death with collapse and narcosis, while great excess of the latter may result in death from angina and spasm and cramp.

THE MOVEMENTS OF THE EARTHWORM.

It may be well here to consider the movements of the earthworm, in order to see the action of a very simple form of this fundamental mode of movement. Every one has seen an earth worm move, and probably every one has observed how it does it. It pushes its head forwards, fixes a portion of itself on the ground, and then pulls forward the hinder part. If we inquire, however, how it does these things, we shall find the following mode to be adopted. The worm has been formed, like all the metazoal organisms, of two germinal layers, an outer and inner. By a series of foldings, groovings, and curvings, the outer layer forms a tube which becomes interior in the worm and forms its digestive system; while another part forms the skin or outer covering. By means of the former the worm is in relation with its own internal motions. By means of the latter or outside covering, the worm is in relation with the outside world. But in order to suit the relations of the worm to the purposes of its life, such as they are, the cells of these outer and inner layers are grouped in certain ways, particularly in a longitudinal and transverse direction, so that the worm may be looked upon as a long, partially hollow and partially solid tube, or cylinder, with fibres going along its length and others passing round and round its width. The latter are provided with small bristles. Now, when the worm contracts its longitudinal or length-fibres, it shortens its length and widens at the same time its width. The point of pull is that part of the worm, which, for the moment, is resting on the ground, and which we may call the foot of the animal. It does not always seem to be exactly the same point, although it is usually not very far away from the centre of the organism. This point being fixed, whenever the longitudinal fibres or elements have passed through the stages of contraction, indifference, and dilation, the transverse elements take on a similar action. Now, contraction of transverse or circular elements narrows the width of the worm and lengthens its length; that is, it pushes the head forwards. The foot of the worm, at the same time being lifted, the longitudinal fibres or elements then contract, the effect of which is again to shorten and widen the structure. The foot is laid down again, and so, by a series of alternate actions between the longitudinal and transverse elements of the animal structure, slow and intermittent progression is effected, in the way with which every one is familiar. It is on this principle that the tongue is protruded from the mouth, when, for example, we wish to put our tongue out. The transverse muscles pull the sides of the tongue together to the middle line or raphe where they are attached. In this way they narrow and at the same time lengthen the organ; that is, they push it out of the mouth. The action, as in the earthworm, whose motions are effected by the application of a mechanism acting on the same principle, appears to be direct until we come to examine it, when it turns out to be indirect. I may interpolate here the remark, since it is so much on my mind, and seems to become more and more so, the more one examines the working of life, that those who say there is no plan in organisation have many difficulties to account for and explain. How should the metazoa, all the animal forms, that is, above the jelly-like protozoa, all be developed from germinal layers, if there is no plan ? How should this method of evolution apply to all the metazoa, radiata, molluscs, worms, and vertebrata alike, including man, if there were no plan ? And how should a man protrude his tongue by the same method, fundamentally, by which the earthworm performs its slow and intermittent movement, if there were no plan ? It is also exactly by means of this same principle that a double set of alternate actions takes place in the intestine, as we have seen ; or, as we may now imagine, in the womb, for instance, when the fulness of the time has come for the expulsion of its contents ; that is, when the living child is to be brought forth. Alternate contractions and dilatations of the longitudinal and transverse fibres of the organ are the mechanism through which this wonderful event is produced. The same theory of action underlies and suffices to explain movements of the food in the stomach, or the emptying of the bladder when its feeling of fulness acts as the immediate exciting cause of the necessity of that act. In the last three instances a third set of fibres, the oblique, has been introduced, which of course complicates somewhat our power to understand the working of the mechanism, but fundamentally or in principle the mode of action is the same in all, contraction of the longitudinal, of the circular, and of the oblique fibres, being followed in each case by neutrality and then by relaxation, till the next set take on similar actions in turn, and the functions of the different parts of the body are performed. We can see the same principles of construction underlying the mode of action of the arteries and veins, although, particularly in the case of the former, modifications are introduced by the power of life to meet variations in the physiology of the parts. Although in some special arteries longitudinal and transverse fibres can still be made out, the longitudinal muscular fibres are absent from smaller and medium sized ones. Their function being no longer required they are omitted. The heart being the motive power of the blood circulation, the arteries, which conduct blood from the heart, are filled by its pumping action; and so, as there is no need for longitudinal muscular fibres to shorten and widen the vessels and fill them with blood, they are not present. But their absence is compensated for, so far as is necessary, by the presence of elastic fibres in the vessel-coat, arranged for the most part longitudinally. These by their resilience act as would a longitudinal muscular coat and help the onward movement of the blood. At the same time that the heart pumps the blood into the arteries the circular muscle-fibres are in a state of dilatation, but when the vessel is full and shortened and widened in this way, at once the circular fibres contract. They narrow and lengthen the artery and drive the blood along in its course. When the blood reaches the smaller and smallest arteries, naturally the heart's action is less and less felt;

and by the time it reaches the smallest or capillary vessels it is hardly felt at all. From these the veins, which return the blood to the heart, take their origin. And now when the veins, gradually enlarging in size, become in a little while so large that the capillarity of the capillaries would hardly suffice to propel the blood into them, we find longitudinal muscular coats gradually being introduced, whose contraction, by shortening and widening the veins, helps to fill them with blood. The circular muscles, even in the veins, are, still, more powerful than the longitudinal fibres, and when they find the veins filled with blood in this way, they go into action, and narrowing and lengthening the vessels drive on the blood towards the heart. In order to prevent regurgitation when this contracting action occurs, the veins are supplied with valves which have a smooth shiny surface towards the centre of the vessels, and a rougher one on the side of the valve nearest to the vein-wall. This arrangement offers no resistance to the flow of the blood in the natural direction towards the heart, but offers very considerable resistance to its passage in the other direction; and when the circular muscle-fibres contract, any backward flow catches on the rougher coat of the valve and compels it to offer resistance to backward regurgitation. This short, but I hope clear, description, however, explains how the theory of construction of these parts of the body is still the same, however different may be the uses to which the different parts are put, that theory being the alternate action of transverse and longitudinal muscular or other elemental structures; and the account explains also the reason why longitudinal muscular fibres are absent in the smaller arteries, and why they are more noticeable again in the veins.

These considerations seem to pre-suppose a plan. We also see how important in the working of the body are these actions of contraction and dilatation, of swelling and shrinking, which used to be known under the name of proximate causes, and how carefully they ought still to be kept in mind by those who wish to understand the mode of action of the human body.

PROPERTY AND FUNCTION.

There are still, however, some observations to be made under this heading, bearing on the difference between the PROPERTY and FUNCTION of parts. We have to some extent assumed the difference already, though without drawing explicit attention to it. Contraction and dilatation of the intestinal muscular coats or fibres set up the function of intestinal action ; contraction and dilatation of uterine or bladder (vesical) induce genital or urinary functions, and contraction and dilatation of the coats of arteries and veins, along with contraction and dilatation of the heart-walls and fibres, set up circulatory actions. Now the property of muscular fibre, wherever it may be found, is to contract (and dilate), and so we may say that muscular fibre has the property of contractility.

I may interpolate the remark, however, that muscular fibre is not by any means the only organic structure which manifests contractility. In fact all structures, living and not living, and all bodies, organised and unorganised, shrink and swell, and through all animal structures response or sensibility is manifested. Animal structures may be said to respond to various stimuli, as heat and cold, attraction and repulsion, etc. It is difficult to find terms to use for these different functions, without introducing ambiguity. All things respond to stimuli, both what we call inanimate things and what we call animate. They all have the property of responding or of response to some form of stimuli. Between the living and the not-living (so-called) there is really no dividing line, and all contract or dilate, shrink and swell, in response to stimuli. Response (or what I propose immediately to call the apamoebic quality) might then be used as a term to denote the property of responding by contraction and dilatation to stimulus in general. But contractility is a higher or more differentiated form of contraction, and is more properly used of the response of muscle or perhaps of elastic fibre also. (*Irritability* was the corresponding term used in the 18th century for what is expressed by *Contractility* now.) The term response might otherwise be known as the apameibic quality (ἀπαμείβομαι = I respond or answer) or the responsive quality. I am sorry to introduce new terms, but evidently we require a word which shall connote not only the answer to stimuli of living things, like plants and animals, but also of what we arbitrarily call dead or not-living things, like stones or metals. These all respond to appropriate stimuli. By means of the apameibic or answering or responding quality or response, material things are apameibic or responsive to gravitation (hylo-dynamic); crystals to crystallo-dynamic; metals to conductivity—metallo-dynamic; electric apparatus to electro-dynamic; plants to phyto-dynamic; animals to zoo-dynamic; and men to anthropino-zoo-dynamic; and so on—all nature to energy in general, and each species in nature to the species of energy which procreated it.

This leads me here to explain the conclusions forced upon me as to the relations of Function and Property in the structure of the human body, and also as to its relations to the general law of the conservation of energy.

When, for the purposes of life, contraction of a certain height or grade of differentiation has to be manifested, connective tissue is introduced in order to manifest that action through different forms of connective tissue, according as the rigidity of tendon or sinew has to be shown, or the elasticity of the yellow connective tissue, or of the areolar tissue, is required. When a higher degree of contractility is required to be displayed, muscular fibre is introduced in order to effect the purpose. Zoo-dynamic, or the presence of animal life, introduces or procreates organisation suitable to carry out the purposes which (unconsciously) it has in view. It is usually said that the constitution of the muscular fibre is the cause of the contractility, but of course the need to manifest contractility may be the cause of the introduction of muscular fibre with its existing constitution. It is the question of the mutual inter-relations of matter and gravitation over again, and of the relations between substance and energy. As energy and substance vary co-ordinately and proportionally and simultaneously, it is competent to us to take which view we please as to which is the cause of the other. Contractility and muscular fibre vary proportionally and co-ordinately. It depends on the view we take whether we consider that muscular fibre is the cause of contractility, or that the need to exercise contractility is the cause of the introduction of or procreation of muscular fibre. Muscular fibre and contractility are related to one another as structure and property. Their relation may be said to be one of constitution. But according to the different *connections* of muscular fibres, different *functions* are seen to arise. If muscular fibres are in arterial coats, their action promotes or renders possible the function of circulation. If they are located and fastened in intestinal structures, their action promotes peristalsis; and if they are located in the womb, they are concerned with the function of nidification or nest-making, and may be concerned with the function of parturition. This great principle therefore rises up before us: The property of a structure is always the same and is related to the constitution of the structure. The function of a structure, on the other hand, varies according to its position, and is related, not to the constitution of the structure, but to its connections. We know this in other departments of nature. A copper wire is a copper wire always, as long as it exists; and manifests what we call the properties of conductivity, ductility, resistance, &c., wherever it may be, in virtue of its constitution. But if it is attached to an electric battery at each end, it manifests a new function and becomes an electric conductor. Its properties of conductivity, ductility, and resistance are related to its constitution; but its function of *electric conductor* is related to its *connections* to the batteries, and would not exist apart from those connections. Let us, therefore, get into our minds and retain it there, this principle. The properties of an organic structure are related to the constitution of that structure. Its functions are related to its connections.

You may perhaps ask why I do not say—properties depend on or are caused by constitution; functions are caused by the connections of structure? Well, I prefer to use the expression: properties are related to or coordinated with constitution; and functions are correlated to or co-ordinated with connections, because I think this is all that we are entitled to say. If I used the former expression I should rank myself among the upholders of the view that the structure determines the function, that the thing determines the thought, that matter determines mind ; whereas this is not my view. I think, on the contrary, that mind determines matter, that the thought determines the thing, that the necessity to function determines the evolution of the structure through which function shall be possible. Is it necessary for the existence and development of the body as a place of habitation or a house for life that contractility shall exist ? Then muscular fibre is introduced or procreated in order to manifest contractility—to be a means or vehicle for contractility. Is peristalsis, is birth, is parturition a necessity ? Then muscular fibre is introduced into the intestine and into the uterus in order that these functions shall be enabled to manifest themselves. We may go further and we may ask : Is neurility to be manifested in order that muscular structures shall be brought more thoroughly under the dominion of life, of vital energy ? Then a nerve fibre is introduced, that neurility may duly show its presence. Is sensibility demanded for the better manifestation of life ? Then the nerve fibre is found to be connected with a central nerve-cell. Is associated sensibility necessary for the more suitable condition of the body as the habitation for the manifestation of the rising, growing, developing powers of life ? Then one nerve-cell throws out joining threads of delicate structure to unite it with another cell, and this with others still, which come into being as the higher needs of the economy, of the organism arise. The union of a number of nerve cells forms what is often called a ganglion (quasi gangalion from γαγγαλίζειν = to tickle or stimulate) and the functions of associated sensibility or consociated sensibility, such, for example, as we see manifested by ants and bees, may be exercised through ganglia. Up to this point consciousness may be manifested through the rising complication and intricacy of nervous structure. But not necessarily self-consciousness. An animal organism may perceive, for example, without knowing that it perceives, and it may perceive without knowing that it exists. To know that it perceives, or a knowledge of perception, is manifested by means of a still further complication of nervous structure, ganglia being connected with ganglia in increasing intricacy of arrangement and dendritic complexity of structure, as knowledge of perception of existence comes to be necessary for the higher elaboration of the powers of life. Is, further, the consciousness to reach to an appreciation of its own personality and individuality; and, in particular, is it to acquire spiritual perceptions, and to make spiritual and moral reflections and anticipations necessary for the continual growth and development of its being, and for the exhibition not only of consciousness and self-knowledge, but for the exercise of conscience and responsibility? Or is there to dawn on the man some dim appreciation of the magnitude of his opportunities, and some apprehension of the future possibilities of elevation of life and soul and of the ennoblement of the will? Or is an appreciation and some form of collective conscience, greater than the individual conscience, transcending yet not over-riding it—is the exercise of these higher faculties demanded for the growth and improvement of the human race, and for the higher developments of life? Then, in organic and mechanical development of cell and ganglion, and of ganglion on ganglion in gradually increasing intricacy of structure, ganglion being dominated by convolution, and convolution rising on convolution in an orderly and ascending hierarchy of form, these higher powers will no doubt in the future, as they have done in the past, evolve habitations fit for the manifestation of their faculties, and of inspirations and of aspirations so necessary and so noble. The actualities of the present time are not understood completely. The possibilities of the future have not yet been conceived by the mind of man. Like distant mountain peaks, the more accessible of them will come more clearly into view when the lofty duties of the present have been more arduously attempted. But it does not at present appear as if the climbing of ever so many proximate pinnacles will ever bring us to a point from which no higher tops will be apparent. Let us deal with the duties devolving on us, and leave the future to show our successors duties still more lofty, their glittering and fantastic and attractive peaks gilded by morning and evening glories not imagined now. To the scientific and philosophic spirit this universe appears to be the manifestation not of things whose properties are powers, but rather of powers which call into being material things through which they may manifest themselves, since powers, like persons, appear, on this plane at least, to require a material body through which they may be known. But the spirit which sees that the universe, as far as concerns the little of it which can be known, as the material expression or embodiment of a series of co-ordinated and harmonious powers emanating from the Self-existent Source through whom all substances and energies exist, finds itself fundamentally opposed to the spirit though not to the facts, to the conclusions though not to the data of modern science, which has assumed too easily and with too little warrant that things procreate powers. Whichever view, however we adopt, the neutral expression *related to or co-ordinated with* appears to me to meet fully and fairly the facts of the case, and therefore the materialist and the idealist can continue their common study of the facts, and will do well to see that these are stated as accurately as possible. It is quite true—nay, this is my strenuous contention—that it is not facts which are important (though they have their importance, no doubt) but it is the interpretation which we put upon the facts that is of supreme importance to men and women ; and it is because I realise this strongly, if inadequately, that I use the expression "related to or co-ordinated with," and not "caused by."

THE AUTHOR'S THEORY OF ENERGY IN THE UNIVERSE.

If one might venture to throw out some suggestions or reflections on the gradation of powers as they pro-create or attract the material embodiment most suitable for their manifestation, one might perhaps suggest the following. Powers seem to be modifications of one supreme energy, which, emanating from an infinite source, is also itself infinite. These powers or the energy from which they spring, and of which they are modifications, are pro-creators of things in which they embody themselves in order that their existence may be known and appreciated. The various forms of energy which we call powers seem to be related to one another in an order of increasing complexity and of higher and higher gradation in the scale of being. There is, for example, the power of gravitation, which pro-creates and embodies itself in substance or matter, its mass, its resistance, its motion, and its occupation of space. And matter, whether homogeneous or differentiated, obeys this gravitating or attracting power, and not only so, but obeys this power in an orderly as distinguished from an arbitrary way—nay, in a way so orderly that its law has been stated in very precise terms. Ions, electrons, and atoms are the elements used by hylo-dynamic. I know not if my suggestions are in accordance with the order of Nature, but the next phase of power appears to manifest or embody itself in water—what we may call hydro-dynamic, or the power manifesting itself in water, as distinguished from hylo-dynamic (ὕλη = substance), or the power of substance. The science of hydro-statics and hydro-dynamics deals with the powers of water. The next phase of power is perhaps crystallisation, which implies a certain increase of complexity, since crystals are formed by differentiation out of a fluid medium. This power we might term crystallo-dynamic. Crystals differ according to the medium in which they are formed. They have forms very well defined and possess a certain amount of beauty, and are usually bounded by straight lines when formed in water. Crystals bounded by rounded or curved lines appear to demand for their formation a medium more viscous than that of the energy which bounds itself by straight lines. These three phases or species of energy have each precise laws, some of which we know, while others are still unknown. So far as we know them we may term them the laws of hylo-dynamic, of hydro-dynamic, and of crystallo-dynamic. They are sufficiently separate for us to be able to think of them apart ; but of course they are not apart really, as they are species of the one universal energy, and they shade off into one another by gradations, or merge into one another by degrees so insensible that it is impossible to say where one leaves off or where the other begins. Still it is convenient for us and it is even necessary for us to name them separately and to attempt to differentiate them from one another, if for no other reason than because the limitations of the human intellect can better deal with them apart than all at once.

A consideration arises very early regarding the various forms into which these species of powers translate or embody themselves. Are, for example, all the forms of hylo-dynamic—the earths, the clays the metals, the stones—are they all modifications of one original and fundamental substance, or are they pro-creations of various subtly differentiated species of hylo-dynamic which are for ever separate and distinct from one another ? The same question arises in considering the various crystalline forms. Are all of these—the acicular, the rhomboid, the rectangular, the acute or obtuse-angled—all modifications of one original or primary form, or are they forms separate from the beginning, always characteristic, each of its own form of power, and never changing the one into the other ? And the same question arises in respect of the more rounded crystalline forms which appear in more viscous solutions ; are these modifications of one form, or are they forms kept separate always ? This question attains a much more important position and signification when it is asked regarding the forms of plant-life and of animal-life ; and the reader may observe that I have already shown the leaning of my mind against the modification of one original or primitive form, and in favour of the pro-creation by power of a variety of forms separate and distinct and yet like, because proceeding from different species or varieties of the same power.

If we now proceed to inquire further into the order of the powers of Nature, we meet a higher power (or form of energy) than crystallisation, in what is called chemical power or chemico-dynamic. We might perhaps term it the combining power, or power of combination, for whose manifestation a certain amount of differentiation is necessary. Thus we find acids and alkalis attracting one another and coming together to form compounds which are unlike either of the elements which entered into their formation. This differentiation between acid and alkali may be analogous to the different powers of polarisation manifested by some crystals which are found to polarise light differently, that is, left or right as the case may be. In the sphere of chemico-dynamic, however, law and order also reign, many of the orderly successions of forms of bodies having been arranged in series, to which constant additions are being made by experiments both hap-hazard, and also by experiments suggested by the known modes of occurrence of previous members of the series. The various simple bodies or elements, as they are called, which go to form these compounds combine with one another in proportions which seem always to be definite, and always the same or multiples of the same element; or which, I should say, have been believed to be so up till quite recent times. I ought perhaps to have mentioned the power which embodies itself in air and gases before mentioning chemico-dynamic. If we call this phase of energy aero-dynamic then we may have a statement of its laws in the science of aerostatics and aero-dynamics. Each of these forms of energy, it will be apparent, may demand the efforts of a life-time or more to understand and appreciate its many manifestations. Whether, however, aero-dynamic ought to be considered lower or higher than chemico-dynamic may well enough be considered a matter of opinion.

The next form of energy to engage our attention is electric energy, what we may call electro-dynamic ; and this, like chemico-dynamic, seems to embody itself in different and even opposite forms, a positive and negative

Note.—It is possible that positive electricity may not really repel positive electricity, and that negative may not really repel negative. The truth may be that positive attracts negative so much more than it attracts positive that it seems by comparison to repel positive. In the same way the earth may be said to repel a balloon which is compelled to move away from it. But another way of expressing this is that the earth attracts a large volume of hydrogen gas enclosed in the silk cover of a balloon less than it attracts an equal volume of atmospheric air; and so the balloon rises, and it seems as if the earth repelled it. In the same way passengers on board a swifter steamer are apt to think that a slower one is moving backwards, while what is occurring is that both steamers are moving forwards, but one is going more swiftly than the other. The same sensation is often felt when one railway train overtakes and passes another going in the same direction. The same principles might explain the action of acid and alkali in chemistry and of sex in animals. This raises an interesting speculation capable of proceeding in many directions and accounting for the condition of the universe. There may, for example, be no repulsion in nature, but only different degrees of attraction, the slighter attractions appearing to be repulsions when compared with the stronger. Electric powers may attract one another in different degrees, the slighter appearing like repulsions when compared with the stronger. Sex in animals may consist of stronger and weaker attractions of different sexes for one another and for the same. And we see how considerations of this sort may determine our view as to the existence of evil in the world, and as to whether there is any evil or whether all evils are not different phases and perversions of good. In these ways the eternal question is being forced on us at every turn.

form (corresponding perhaps with the existence of acid and alkali in chemistry) which shows the interesting and curious quality that positive attracts negative, and repels positive, while negative repels negative and attracts positive, *i.e.*, like repels like and attracts unlike.

The various phases of electro-dynamic seem to be capable of association with all forms of hylo-dynamic—but while electro-dynamic can travel seemingly through all substances whatever, it can travel apparently much more readily and quickly and easily through metals than through other forms of substance ; and this fact has to be kept steadily in mind if we are to attempt to use the electric power for human purposes.

To proceed with a rapid exposition of the various forms of energy that we find in action in the living universe in which we sojourn, the next form may be called phyto-dynamic, or the energy of plant life (φυτόν = plant). Here we have sex-differentiation introduced, corresponding probably with acid and alkali in chemico-dynamic, with polarisation right and left in crystallo-dynamic, and with positive and negative in electro-dynamic. The question whether all plants have arisen from one primitive form, or whether it is not more likely that a considerable number of varying but similar forms have been pro-created, arises to the mind here, reminding us of the similar questions that arose regarding substance and chemical elements, and suggesting—at least it does so to my mind—the question of the existence of a plan in nature. One universal energy, with an infinity of varieties of form, working always similarly because all proceeding from one source, irresistibly suggests a plan to my mind ; and I state my conclusion for what it is worth. It may be that the evidence which has convinced and overcome me may also convince others. I see very plainly, and I rejoice in the discovery, that this is the day no longer of authority or coercion, but that the day of persuasion has not only dawned but has proceeded for some way on to maturity, and to full shining. The people having consciously taken up the reins of government, are thinking for themselves. They are no longer accepting their theology from the clergy, nor their politics from the statesman, nor their medicine from the doctors, nor even their science from the scientists—although here, unfortunately, prestige still counts for far too much and often stifles candid enquiry. But no theological or political or medical or scientific expert need fear in presence of this change of attitude, because if he is a true expert his mind has learned from the same observation of Nature to which the common mind has to appeal ; and if his lesson has been properly learned, it must and will be found to have anticipated that which the less learned mind will by and bye see also. The true expert need not fear dethronment. On the contrary, he will be much more firmly seated on his seat of advice to those who with less leisure are quite as anxious to come to a knowledge of the truth, and find it absolutely necessary to do so. There is a real danger in ignoring the expert, in any walk of life, because (to take a special instance from medicine) he can often by his advice prevent the incidence of much suffering, which must be undergone by those who ignorantly and blindly rush into circumstances whose meaning they have not gauged, and which may easily overwhelm them. The only *caveat* to be entered, the only warning to be given—and I humbly suggest this to the sovereign people—is that, before they dethrone the expert and follow their own advice, they should be quite sure that they thoroughly understand the problem.

To proceed with the exposition of the various forms of plant life, all plants, even of the same species are not *identical* in form, because phyto-dynamic has many and an almost infinite number of forms and varieties; but still they must all be made in *similar* ways, because they are all pro-created by similar phases of the same power—what for the moment I am terming phyto-dynamic. All the parts of plants may be viewed, if we will, as modifications of the leaf; and there is and must be an almost infinite amount of variability among them, so that an onlooker may easily be deceived, as in the second half of the 19th century the scientific mind was deceived, into inferring a common ancestor, in place of inferring first the action of a similar phase or form of phyto-dynamic, and secondly not a common ancestor but "a common Author." It was a terrible and even awful mistake, especially as for the moment (the moment lasted for half a century and more) it displaced a far fuller, sounder, and more comprehensive conception. Unfortunately the fuller conception was mixed up with some errors of detail, but these might easily enough have been discovered and rectified as fuller information dawned on men's minds. All the discoveries of science—when or if they really are established—all new facts at any rate, should be candidly accepted when proved, and receive their proper place in human knowledge. The inferences drawn or to be drawn from them are of course a very different thing. Any candid inquirer must admit, nay he must declare, that facts and the interpretation of facts are very different things. Facts should be accepted —and their interpretation should be carefully considered.

In the meantime we may see how the almost infinite adaptability and infinite variety of plants might easily induce an observer to infer a common ancestor instead of a common author. Of course it will not be expected that I should go into the question fully—it obtrudes itself on us much more when we come to consider the various phases of zoo-dynamic, and reaches a much higher significance, or at least a much more realistic one, then—but I may ask the question : If the parts of a plant are, as suggested, and as scientific men admit, modifications of the leaf, what is this again but the indication of a plan ?

Before mentioning zoo-dynamic, or the power that pro-creates the various forms of animal life, I wish here to draw the reader's attention to a very curious thing. While attraction, the power of water, crystallisation, chemical power, electric power, and living plant-power—or let us say more shortly, hylo-dynamic, hydro-dynamic, crystallo-dynamic, chemico-dynamic, electro-dynamic, and phyto-dynamic—seem to form an ascending hierarchy of powers (or species of the one power), the higher manifestations of the lower forms of each of these graduated powers are always higher in the scale of power than are the lowest of the higher. This is very interesting. Let me illustrate. Radio-activity is a form of hylo-dynamic, but radio-activity appears to be a far higher form of power than crystallisation, although crystallo-dynamic is a higher power than hylo-dynamic. (Radio-activity, I may observe, appears to justify one in excluding thermo-dynamic and also photo-dynamic from the category of powers and relegating them to the domain of qualities of powers. It appears to me that a study of radio-activity shows that all moving energy is warm and luminous, or that it stirs in us those vibrations which make us feel warm and see light. (The implicates of this conclusion are remarkable ; but of course I should be far transcending my present province if I attempted to follow them.) Crystallo-dynamic again, especially in its higher forms appearing in viscous media, shows far higher manifestations than the lower forms of chemical combinations, although chemico-dynamic appears to be a higher form of power than crystallo-dynamic. The chemical explosions again, liberated by some of the chlorate of potash—or still more of the nitro-glycerine-series—are far higher manifestations of energy than the feeble attractions and repulsions of sealing-wax and pith balls ; and yet electro-dynamic is a higher power than chemico-dynamic. And the working of an electric machine or a thunder-and-lightning electric explosion is a phenomenon far more striking and far more powerful than a low form of plant-life. And, yet, I suppose it would be admitted that, on the whole, phyto-dynamic is a higher form of power than electro-dynamic. And I will add lastly that the higher forms of phyto-dynamic—the lordly and long-lasting oak, or even the striking beauty of many short-lived flowers, is much higher in the scale than lowly forms of animal life, say the protozoa, although nevertheless all must admit that zoo-dynamic is a far higher form of the universal omnipresent changeful energy than is phyto-dynamic.

Next and last on the list is zoo-dynamic, that highest expression of energy which uses for its manifestations or for the building of its house the various forms of animal body with which we are all more or less familiar, and which culminate in the human form. As in the case of plants, so in that of animals, they are made alike, not because they spring from a common ancestor, of which too universally received opinion there is no evidence at all, but because, being pro-created by similar species of power emanating from a single source, they must be pro-created alike, since the power of life must always work harmoniously with itself and therefore similarly in every case. We may believe in a common ancestor for dogs and cats when we find them crossing freely and continuing themselves in an enduring strain ; and we may believe it also when we find pigs and hippopotami, or elephants and rhinoceri doing the same, or giraffes and deer, or apes and men—but not till then.

EVOLUTION TRUE AND FALSE.

No idea probably can be named which has had greater influence, or as great an influence, in modifying men's minds regarding the making of the world and living beings and the universe as the idea of evolution. It has been said over and over and over again, that the introduction of the idea of evolution has not only changed, but has even revolutionised our notions regarding creation and providence and plan and purpose in the progression of things. But there is a true or natural evolution, and an untrue or unnatural one ; and I much regret to say that in my humble judgment the unnatural and untrue or false evolution is the one which has been allowed to hold sway over men's minds for the last fifty years. The true evolution is the evolution or order by means of which higher and higher forms of power are continually embodying themselves in forms or organisations suitable for their expression or manifestation. This form of evolution looks to similar phases or forms or species or perhaps genera of power (if we consider energy as a class or kingdom rather than as a genus)—genera of the one universal, omnipotent, and eternal power pro-creating things and forms and pro-creating them on similar lines and with likenesses to one another, not because they are modifications of one another but because they sprang and spring from a common source. The true evolution therefore is compatible with creation and providence; nay, it implies both of these. For when the fulness of the time comes for the higher form of power to manifest itself, the organic form also appears which is suitable for the in-dwelling or for the housing of the higher form of energy or life, and with the organisation also appears the food which is convenient for it. True evolution does not imagine or conceive of law without a law-giver; evolution without an evolver; it does not believe in natural selection, except indeed in selection under the impulse of a directing power behind it. This power being invisible, the selection appears to be undirected and to be a natural selection. False evolution on the other hand imagines evolution without an evolver, law without a law-giver, and beauty and order and love and life-preservation without any personal power behind phenomena impelling them in these directions. It conceives or seems to attempt to imagine similarity of working without plan or design behind things and directing things. We must make up our minds between these two. We cannot really believe them both, and we cannot be neutral except for so short or long a time as is necessary for us to make up our minds. I have no hesitation in making my choice—a choice compelled by the evidence—and am not without the hope that the evidence which has convinced me may also have the effect of convincing others. No one knows better than I how little important is the opinion of any one person in the totality of things. But in that totality and from that totality each man and woman must come to his own conclusion. Each person's own conclusion is supreme for him and her. Others' conclusions may be interesting—but our own are supreme. And in the hope that the evidence which is to me so overwhelming may also have the effect of influencing others, I have modestly stated the conclusion I have reached. Of course there are difficulties incident to all views, but the one advanced seems to me to offer fewer difficulties than any other.

This digression into the question of evolution being ended, we can now finish the little that remains to be said regarding the proximate causes of disease, swelling and shrinking, as exemplified in the alternate action of the transverse, longitudinal, and oblique elements of structure. As the actions of these may occur in any order, it is evident that a very considerable degree of complexity may be introduced in their occurrence. There are three sets of structures, the transverse, the longitudinal, and the oblique, each of which may and do exemplify two different actions. Now the permutations and combinations of six things taken two and two together are $\frac{6 \times 5}{2}$, or 15; and even if all of these do not occur in actual life, still it is evident that a very considerable amount of complexity may occur, and so it becomes very difficult indeed to follow the changes which may be caused by the occurrence of actions apparently so simple as may be effected by the alternate occurrence of contraction and dilatation in the different elements of animal structure. The movements of the muscular and elastic elements of the various viscera are effected in these ways, and, secretion being influenced by them, we see how increasingly difficult it is for us to understand the organic actions completely. But having brought the action of the proximate causes of disease (and health) in the body to this point, I do not propose to carry it further at present.

THE EXCITING CAUSES OF DISEASE.

The exciting causes of disease and health are such influences as cold, heat, wetness, dryness, calm, wind, storm, fatigue, and so on ; also organic micro-organisms, spores, germs, and organic particles ; and lastly, violence or injury of various kinds. With violence and its effects I do not intend to deal, as I have nothing special to say about them. It is somewhat difficult to differentiate by exclusive characteristics the exciting causes from the predisposing, but probably as good a means of differentiation as any, would be to say that while the exciting causes act once or seldom, the predisposing act often or for a long period of time. Causes which may be termed exciting causes from one point of view may be considered as predisposing from another. For instance, getting one's feet wet, or being in a wind, may be the exciting cause of an attack of inflammation of the lungs or of some internal disorder ; but being more or less continually exposed to the effects of damp or draughts (as for example having to work in a steam laundry) may act as a pre-disposing cause to some long-continued illness.

THE PREDISPOSING CAUSES OF DISEASE.

The predisposing causes of the diseases peculiar to women are determined by the relation of the body to food, to air, and to exercises, with perhaps the influences of anxiety and of heredity added. I shall dismiss the last with the remark that I believe that its influence has been greatly exaggerated both by the laity and by medical men. I might have said the same about the exciting cause of exposure to micro-organisms, germs, spores, and in one word to infection, which we have allowed to alarm us too much in this generation. Infection, unless very intense or unless we were continually and for long periods of time exposed to it, would not, I believe, do us any harm if we were in a physiologically sound and healthy condition. And disease, being an acquired characteristic, is not as a rule transmitted. However, as I deal with this question at some length in a subsequent conversation, as also with the common opinion that diseases run in families, I need say no more about it here.

FOOD THE CHIEF PREDISPOSING CAUSE OF DISEASE IN WOMEN.

The most important predisposing cause of disease in women in my opinion is that which is in relation to their food. It is wrong alimentation. Their relations to air and exercises are no doubt important, and every well wisher must feel gratified at what has been done of late years for the community, and for women as a very important section of it, in the way of providing them with more and better air, as also in recommending them to have reasonable exercise. These good things, however, must be kept in their proper place, and must be viewed in proper scale and proportion if we wish to have really good health.

It may seem ungracious to hint it, but there seems some reason to believe that the good effects of free ventilation and even of open-air exercise may have been somewhat exaggerated. If women spend their days upon the golf-course and leave their children to the care of nurses when they ought to be looking after them and taking them out themselves, the benefit to the community is doubtful. And no amount of exposure to the open air and no amount of exercise will suffice to obtain and maintain good health if mal-nutrition is allowed to accompany them. I therefore go on to consider the effects on women of mal-assimilation of food in producing their peculiar diseases. Mal-assimilation usually begins with indigestion ; not perhaps necessarily conscious discomfort after eating, although this is almost always present. In a few and exceptional cases, however, women will tell one that they have felt no heartburn, no constipation or diarrhœa, no oppression after food, no feeling of being blown up with gas, no fatigue without adequate cause, no toothache or decay of the teeth. But these cases are very rare. Almost always women will admit, if they are asked, that they have suffered in some of these ways ; and of course I do not refer to the admission that they may have suffered in these ways once or twice, but to the fact that they have suffered frequently. I put it then to my readers in short and unmistakable language that in many cases they eat their diseases, and that unless they are prepared to attempt to govern their appetites and restrict their diet they cannot be or remain well. I dare-say that this opinion may raise the ire of some fair reader. "What," she may say, "do you really suggest that I, with my susceptibility to all the sufferings of others, with my romance, my refinement, my keenness of perception, keenness so great that every noise gives me a headache, every noisome smell makes me ill, every touch or knock, even the slightest, makes me black and blue—do you really suggest that these and a hundred other marks of delicacy and refinement of constitution are due in any way to the state of my digestion or to the number and quality of the meals which I eat? Or that the pain I suffer from once a month and which indeed has been coming on oftener than that of late years, or that the internal inflammation of which my doctor recently told me, or the displacement which I am obliged to have rectified by mechanical means, that these things have any relation whatever to the state of my digestion? Or that those splitting headaches which lay me up so frequently (more frequently of late than in former times) and which are so much worse when I am put out or worried—do you mean to suggest that these ailments, and many others from which I suffer, have anything to do with the state of my digestion or are in any way dependent on it?" Well, I am very sorry to be obliged to suggest such a common-place cause for complaints so numerous and so subtle, but I am compelled to do so if any relief is to be effected; and if my fair readers will think a little, I believe that they will agree with me that it not only is so, but that it must be so. The whole of the body and all the parts of it are nourished by the blood and by the lymph. But the blood and the lymph are made from the food, and the perfection or the imperfection with which the blood is made must greatly determine and influence its power to nourish the parts and organs of the body to which it flows. But perfection of blood-making is perfect digestion or (since perfection in all directions is to be aimed at rather than attained) at least implies an approximation to perfect digestion. And imperfection of blood-making is imperfect digestion. Well-performed digestion therefore results in well-made blood (and lymph), and well-made blood nourishes the tissues perfectly, while ill-performed digestion results in the formation of ill-made blood, loaded with the ill-concocted products of imperfect digestion, and it is perfectly evident that such blood cannot nourish the tissues properly. To put this into short and terse language, common alike to the vulgar and to technical speech, we may say: Proper assimilation of food results in the formation of properly made blood, which in turn properly nourishes all the tissues of the body; while improper or imperfect assimilation of food results in the formation of improperly made blood, which in turn does not and cannot properly nourish any of the tissues of the body. If, therefore, a woman finds herself suffering from some affection or disease of her internal organs, from whites, or painful menstruation, or flooding; from congestion or inflammation, or displacement or tumour, she ought to inquire whether in some way either then or at some previous time of life, her digestion has not been at fault, whether this fault has not resulted in bad blood-formation, and whether this bad blood-formation has not therefore been the chief remote or predisposing cause of her illness, whatever it is.

NOTE TO CONVERSATION I.

Peristalsis (περὶ = around, and στέλλω = I send) is a term used to express intermittent as distinguished from continuous motion. It is closely allied in meaning to wave-like or wavy. And yet there is a difference, for peristalsis might legitimately be used of the onward movement of the contents of the intestine along the lumen or channel, while it would hardly be used of the movement of the blood inside an artery. That might be called wavy or pulsatile. Peristalsis would also apply to the movement of the gullet of a horse as he is drinking; and yet the term wave-like or wavy would equally be applicable to this. The term peristalsis may be applied to intermittent motion, as of contents of bowel from point to point, the bowel itself remaining fixed; or it may be applied to locomotion, as of the movement of the earthworm, where the whole animal organism moves intermittently and haltingly from place to place. The term is somewhat loosely used, because if we come to think of it, some actions are peristaltic only, as the movement of the contents of the intestine, some are wave-like or wavy or pulsatile only, as the movement of the blood in an artery—to which we hardly apply the term peristaltic. The term wave-like or wavy only and not peristaltic would be applied to the movement of a wave in water or to the motion of a now floating and then half-sunk cork or piece of wood on the wave. The cork rises and falls but does not move from its place much (it does a little of course). And to show that even the wave does not carry much water with it we have only to recall our experience as sea-bathers in rough weather, when by diving into the advancing wave and slightly under it, we discovered that the whole body of the water was moving very little, for we were left to rise unharmed, after the shallow broken top of the wave had passed on. On the other hand, if we attempted to withstand the advancing wave we were helplessly tossed and turned about like the cork or small piece of wood. Nearly the whole of the movement of the water is confined, as we see from this experience, to a thin layer on the top. But we should hardly call a wave-motion a peristaltic motion.

The mechanism of peristaltic motion is the alternate contraction and dilatation of longitudinal and transverse elements as described in the text. The pulsatile movements in an artery depend on the same mechanism, to which, however, is added the heart's pumping action. But as this last depends on the alternate contraction and dilatation of the longitudinal, transverse, and oblique elements of the heart itself, we see how closely the peristaltic and the pulsatile motions are related to one another.

Antiperistalsis is a term employed when a peristaltic action is reversed. If a peristaltic action which ought normally to move from within out, or perhaps rather from centre to circumference, *i.e.*, centrifugally—if such an action moves in the reverse direction, or centripetally, that is antiperistalsis, and the action is antiperistaltic. Movement of the food and bowel-contents from above downwards is peristaltic movement. Swallowing is an example of peristaltic movement; vomiting is antiperistaltic. The former is healthy, the latter diseased.

The terms peristalsis and antiperistalsis are generally confined to motions of the contents of hollow bodily tubes, or to the movements of the walls of the tubes themselves—the walls of the tubes remaining fixed. But as the movement of the earthworm, which is not only motory, but locomotory, may be spoken of as peristaltic also, a possible confusion of meaning arises which must be kept in mind.

CONVERSATION II.

DIGESTION: ITS RELATIONS TO THE FORMATION OF BLOOD AND LYMPH.

In order that we may have in our minds the essential process by which blood is made, for the nourishment of the various organs and tissues of the body, it is necessary to give a short sketch of the processes of digestion. I assume that a mixed diet is required, referring those who wish to know more on this subject than our limits allow, to some of the numerous works written upon it. It ought, however, to be premised that whoever takes the trouble to study these writings ought to consider present doctrines in view of the somewhat revolutionary opinion stated in our next conversation regarding the functions of food in the body and its relations to energy and heat. The processes of digestion, however, not being affected by this view, we may state that the food, when taken into the mouth, undergoes the action of mastication by the teeth, whose function is mainly one of mechanical trituration. At the same time (and the better will this be effected, the more completely is that mastication or trituration and grinding by the teeth performed), the food ought to be slowly and well mixed with saliva in the mouth, coming from the salivary glands. Foods have been divided, since the time of Liebig, the great physiological chemist, who died in 1872, into four great classes, according to their chemical composition. (1) Those foods which contain nitrogen, and are called proteids or nitrogenous foods. The most important examples of this class are such foods as meat and flesh of all sorts, fish, eggs, milk, cheese, the cereal grains, and pulses belonging to the pea and bean tribe. (2) The group of foods represented by sugar, arrowroot, sago, tapioca, &c., and called non-nitrogenous or carboniferous or carbonaceous. The latter names are, however, bad, since the nitrogenous foods also contain a carbonaceous part. With the division, however, of foods into nitrogenous and non-nitrogenous, no fault can be found, although the notions of Liebig have been considerably modified by subsequent inquiries as to the parts played by the different kinds of food in the economy; and indeed have of late years been almost wholly controverted. The non-nitrogenous foods have been divided into two groups, first, the sugars and starches already referred to, and secondly, the fats (oil, butter, cream and fat), which form the third division of food stuffs. The first division of foods, the nitrogenous, are alone capable of repairing completely the waste of the body-flesh or muscle, since it contains nitrogen in its composition. But although the purely carboniferous or carbonaceous foods contain no nitrogen, the nitrogenous foods contain considerable quantities of carbonaceous stuff, and are therefore capable of performing all the functions in the body which can be performed by the non-nitrogenous foods, with the power of building up again the nitrogen-containing tissues in addition. The great function which the non-nitrogenous foods subserved in the body was by Liebig and his successors believed to be the maintenance of the body-heat; and this they were believed to do both by the sugar and starch group and by the fats. The habits of Arctic denizens who, we are told, consume readily large quantities of blubber, tallow, etc., were pointed to as corroborative of this view. But it seems to be overlooked by persons who reason in this way that Nature produces oil abundantly both in temperate regions, as olive oil in North Italy, and other warm temperate countries, as also ground-nut oil and palm oil in tropical countries, not to mention milk and butter in both. While it is easy to take too much carbonaceous and fatty food and too much proteid food, in any country, deprivation of the carbonaceous foods makes persons unduly thin and removes rounding and padding from their bodies whatever climate or country they happen to live in. Sugar again, a heat-giving substance according to Liebig, is produced abundantly in tropical countries in the form of cane sugar, and in temperate countries in the form of beet-sugar ; while in the form of ripe-fruits, grape-sugar is produced abundantly in both. Starch again as we know is abundant in the tropical and sub-tropical countries, in bananas and maize and rice, as well as in wheat, oats, and barley of temperate countries. Why should Nature produce oils, fats, sugar, and starch so abundantly in tropical countries if their chief function as foods is to maintain animal heat ? On the other hand I have known rupture (inguinal hernia) occur in a person who in order to get cured of asthma, bronchitis, and rheumatism was recommended to go on the Salisbury diet of beef and hot water. This diet is wholly starch-free and nearly fat-free also, and when the padding-function and contour-rounding function and connective-tissue-formation-function were removed, there was too little padding to support the bowel and its covering, and a rupture or hernia ensued.

The fourth division of food-stuffs is the mineral portion made of salts of alkalies for the most part, as compounds of potash, soda, lime, and common salt, with smaller quantities of sulphur, &c., entering into their composition. Lastly, and so important is it that we may consider it as forming a fifth division of food stuffs, water enters largely into the composition, and forms from two-thirds to three-fourths both of the foods used in the body and of the body itself.

Now the saliva coming from the salivary glands in the mouth, and being there well mixed with the food, has little or no action on the proteid or nitrogenous part of the food proper, has little or no action, *e.g.*, on fish, flesh, fowl, or eggs or cheese ; but exerts, on the other hand, a very considerable effect on the non-nitrogenous starches and also on the non-nitrogenous portion of nitrogenous foods—of bread, for instance, or of rice—the starch of which it converts into grape sugar. Starch must be converted into grape sugar before it can be used in the economy, so that the need for good chewing and for efficient mixing with saliva becomes more apparent from this consideration. The food, being now ready for swallowing, is passed along the gullet (which exerts comparatively little action on it) into the stomach. There it is met by the gastric juice, considerable quantities of which (from a pint to two pints) are secreted into the stomach from its walls, each time that food is taken. The gastric juice is sometimes called the gastric acid because it has an acid reaction, while the reaction of the saliva is alkaline. A proper appreciation of the fact that so much gastric juice as two pints is poured out when a meal is taken, is highly important in determining the quantity of food that ought to be taken at a meal. The children of a past generation—the advice is not so common now as it was then, nor so common as it ought to be—were advised to stop eating before they felt that they had had as much as they could take, or before, as the phrase was, they felt full. Now this was very wise advice, for if we go on, either children or adults, eating till our stomachs are full, how are we to make room for the pint or the quart of extra material when gastric juice to that amount has been poured into the stomach? But we *must* make room for this extra quantity of material, because the presence of gastric juice is absolutely necessary if food is to undergo gastric digestion and to be converted into chyme. There can be no doubt, indeed, that the too widespread habit of eating to satiety, even if it is not carried quite to fulness, is, after the necessary amount of gastric acid has been added to the stomach contents, the chief cause of that feeling of distress and weight or pressure which is so apt to be felt by all of us from half an hour to two or three hours after eating a hearty meal. Taking a less amount of food would have allowed more room for the necessary gastric acid, and would have prevented the feeling of weight and heaviness. The fact also incidentally alluded to that digestion in the stomach goes on for many hours, shows, by the way, how futile is the advice sometimes given to us that we should lie down for say half an hour after taking a meal. In half an hour, or even an hour, the digestion of a townsman or townswoman has reached only its initial stages, and if it is necessary to lie down half an hour or an hour after eating, it is because we have taken more at the meal than was good for us. To suggest that we should lie down for three or four hours after eating would probably meet the case; but to do this would be to behave like a boa-constrictor, and would be to raise eating into the "chief labour of life," while no amount of physiological rest after food consumption could ever undo the evil effects of over-ingestion of food, especially if that process were frequently repeated.

Another practical conclusion of the utmost consequence, besides the one just come to, that we ought to stop eating before satiety is reached, is that we ought to eat slowly. This is so obvious that it ought almost to be unnecessary to state it ; for if saliva is to act on the starchy portions of our food, it must be well mixed with the food in order to do so, and this can be effected only by thoroughly chewing the food as it is taken. Very many persons, perhaps even a majority of us, make the great mistake of eating too quickly, and so of failing to masticate and triturate properly the food we take. Eating slowly is in fact a help against the error of eating to satiety, because we have more time to appreciate the state of fulness that the stomach gets into after ordinary eating, and so we are helped by slow eating to stop before we have taken too much. The simple device of chewing each morsel of food taken, say twenty or thirty times (some have said fifty or sixty and even more times), before swallowing it, would greatly help towards forming the habit of slow eating ; and this in turn, as it would greatly aid digestion and assimilation, blood-making, and tissue nutrition, would have the most potent influence on the maintenance of health and the prevention of illness.

The gastric juice or gastric acid acts specially on such nitrogenous foods as meat, fowl, fish, and cheese, and, helped of course by the preceding action of the saliva, and by the rolling action exerted by the muscular walls of the stomach itself, converts the whole contents of the meal into a grey grumous fluid mass called chyme. Not yet, however, is the food ready for absorption. It has to be passed out of the stomach through the pylorus into the small intestine ; and immediately on its reaching this part of the digestive tract, it meets with the secretion from the pancreas and that from the liver. These secretions have again an alkaline reaction. The former finishes the digestion of any starch which may have escaped the action of the saliva in the mouth, converting it into a state fit for absorption, either directly into the blood, or indirectly to the same destination by means of the intestinal villi. These last structures are found in the small intestine, and contain each a small lacteal vessel, whose mouth opens and absorbs some particles of chyle. These particles are passed on by the lacteal vessels, and find their way into the thoracic duct, in the way to be immediately described. The action or influence of the bile from the liver on the other hand is mainly to prevent putrefaction in the highly unstable contents of the digestive tract, and to complete the digestion of particles of fat, butter, cream, &c., and fit them for being mixed with the contents of the small intestines, the chyle. This chyle is completely elaborated and rendered ready for absorption on meeting with the alkaline secretion from the small intestine itself. Entering the venous blood from the small intestines, it is carried by the portal vein to the liver, while some of the chyle-particles enter the lacteals and thoracic duct, being emptied by it directly into the venous blood at the root of the left side of the neck. This venous blood, if we follow it in its course, will be found, by means of the superior or descending vena cava, to be carried to the right side of the heart. How much of the chyle finds its way by means of the portal vein to the liver, and how much by means of the lacteals and thoracic duct to the superior vena cava, does not seem to be quite known. In any case, that which goes to the liver, after being laid out there by means of its very extensive circulation, and after having some very important changes effected in it, finds its way back again by the hepatic vein and the inferior vena cava into the general venous circulation, so that in time all the chyle is emptied into the venous blood, either directly by means of the thoracic duct, or indirectly through the portal circulation. Being carried in these ways to the right side of the heart, the blood, dark and venous, and loaded with the carbonic acid gas and other products of oxidation, which it has received from the tissues as it was passing through them, is carried by the pulmonary artery to the lungs right and left. There it gives up its carbonic acid gas or carbon-dioxide, and takes in oxygen from the inspired air, changing coincidently its colour from crimson-black to scarlet. There ought to be no oxidation or combustion in the lungs according to the laboratory physiologists, a mere passing of carbon-dioxide from the venous blood taking place, accompanied by the entrance of oxygen from the air. But when, from the blood containing too much material in it from unused food, an exudation from the blood has taken place into the mucous membrane lining the lungs, or into the substance of the lungs itself, it may happen that oxidation and excess of combustion does occur here as in any other inflamed place in the body. When this is so, no doubt the limit of health has been transcended, and disease has set in. Physiology has begun to shade off into pathology. But this is unfortunately far too commonly the case, pulmonary affections or diseases of the respiration being among the very commonest affections of the body.

THE LARGE INTESTINE.

The function of the small intestine being then, as has been seen, to complete the digestion of food, or almost to complete it, and form chyle, what are the functions of the five or six feet of bowel which form the large intestine? It is divided into three parts or divisions.

(1) the caecum with the appendix attached.

(2) the colon with its three parts :—

(*a*) ascending on the right side of the abdomen,

(*b*) transverse, crossing over to the left side, and

(*c*) the descending part which goes down the left side of the abdomen to what is called the sigmoid or S shaped flexure or bend, till it becomes continuous with (3) the rectum or terminal straight part of the great bowel.

Study of this large intestine seems to suggest that it has become developed in order to allow animals freedom from continually having to answer the calls of nature as birds have to do. In the case also of animals which have to run long distances either for flight from enemies or for other purposes it would be inconvenient if they were obliged to stop continually for the purpose of emptying the bowel. However, with this I do not propose to deal at length, except to note in passing, that if it is so, here is another indication of plan or purpose in the evolution of animal structure, the added function of life (long-distance running) leading to the introduction of the organs through which the function shall be manifested.

As to the immediate nutritional or trophic functions of the large intestine, these are three. First, the contents of the large intestine become solid and consistent as compared with the liquidity of the contents of the small intestine, by the absorption of much of the water of the contents. The large intestine is, therefore, an absorbing structure. Next, it secretes mucus, whose function it is to moisten gently the contents whose watery part has thus been absorbed, and to render easy the passage of the contents. That is, it tends to prevent constipation. No doubt in many cases constipation sets in, mostly in the large intestine ; but this is always caused by mis-management of the nutrition of the person, and most commonly by too frequent and too abundant food-ingestion. The last function of the large intestine is to collect and pass on the debris of the food, and also to excrete from the blood itself and to eliminate from the blood and body any waste matters requiring expulsion. It is important to keep in mind the waste-separating function of the large intestine, because the suggestion has been often made that separation of the debris of the food alone is the function of the organ. The presence of strawberry and raspberry achenes, of grape-stones and apple-pips, etc., in the bowel contents, as well as the alteration in colour caused by free ingestion of such a food as bilberries, sufficiently demonstrate the waste separating or debris-separating function of the large intestine. But in addition to this, any digested portion of food which is still too large to pass into the lymph spaces, lymph-ducts, and lymphatic-glands is passed out of the body by way of the large intestine and rectum. And besides this, the mucus glands contribute to separate not only mucus but un-usable stuff from the blood. As regards absorption of the watery part of the bowel-contents by the large intestine, it is well to bear in mind that this is a possible means by which poisoning of the blood may occur. If, for example, from too rapid or too frequent eating, digestion has not been properly effected in the small intestine, and if fermentation and more or less putridity has been set up there, then when the lymph-vessels of the large intestine proceed to absorb the watery part of the bowel-contents, they are apt to take up putrid and poisonous water which may poison the blood. There is, then, no need for actual poison to be swallowed. Any food taken in excess, eaten too rapidly or too frequently, even if its quality is good (but still more so if it is bad), may be the means of poisoning the blood by the setting up of fermentation and the generation of putrid gases. Even then, the last line of defence remains, and the lymphatic system of the large intestine may still be able to so elaborate these pernicious stuffs as that they may be returned sweet and wholesome to the blood. But obviously this is not sufficient to trust to, especially as reasonable care in eating, and reasonable ideas as to its necessity, will so readily keep us right in respect of preventing putrefaction in the digestive tract. Offensive odours of the bowel-contents ought always to act as a warning to us that in some way we must have been mismanaging our digestions, and what that way or those ways are, ought to be a subject of inquiry in order for rectification. The way in which the waste matters are passed on by the large intestine is interesting, and may well demand a little attention. The mode of action is in accordance with the arrangements of the longitudinal and transverse bands of muscular fibres which act as we have seen as the machinery of movement in animal bodies or the machines constructed by zoo-dynamic or the power of animal life. The longitudinal bands show arrangement quite different in detail from the more uniform distribution in the small intestine and are collected into three long, strong bands running along the length of the bowel from the caecum all along the colon at almost equal distances from one another. The action of these is obviously to shorten and coincidently to widen the bowel which is thrown into sacculi or small sacs or bulgings which thus mould and give shape to the contents. These sacs ought to be moderate in size and roundish, so as to give the characteristic form to the stool; but if coincidently the transverse muscular fibres of the large bowel are too much developed (by over-nutrition) then the contraction tends to the formation of very small sacculi in the course of the gut, and to the formation of those small pellets approaching the character of sheep-droppings, with which those of us are too familiar who have suffered from constipation in its various forms.

The mucous membrane of the large intestine has no villi like those found so abundantly in the small, but there are very numerous tubular glands or crypts distinguished by containing large numbers of mucus-cells for secreting the mucus which keeps moist the contents and renders their passage easy, as also for separating waste-matters from the blood. There are also lymphoid nodules all over the large intestine, but most numerous in the caecum and the vermiform appendix.

Like lymphoid structures elsewhere, these exist for the purposes of picking up any nutritive material in the blood that may not have been used by the tissues, as it circulated in them, and of returning it to the blood after re-elaboration, so that nothing shall be lost. As to the vermiform appendix itself, it is in all its characters a portion of the large bowel, for it is lined by mucous membrane like that bowel. That mucous membrane, as in the large intestine, has numerous lymphoid nodules in it. Like the large bowel, the appendix has muscular fibres distributed along it. Like the large bowel, the appendix has a lumen or open channel, although it has a blind end. And lastly, for its three to six inches in length it has its mesenteric attachment and is covered by peritoneum or serous membrane. To all intents and purposes, therefore, the appendix vermiformis is a portion of the bowel and is further a portion of the large bowel. Further, it is a structure constantly found in the human body. It always has been found in the body of men when it has been looked for and it always will be found as long as men exist on this planet. When, therefore, a surgeon ventures to say that the appendix vermiformis is a useless and obsolete structure, and that it may safely be predicted that the man of the future will not have so useless an appendage hanging from the caecum, he is talking nonsense and presumptuous nonsense besides. If the appendix vermiformis has not atrophied in the 7000 years or more during which we know that man has been on this planet—what is the likelihood that it is going to disappear in say the next 1000 years? We should not prophesy unless we know. But it is very easy to prophesy when neither we nor our hearers shall be here to answer as to whether the prophecy has come true or not. In fact, long before then, it and we shall have been quite forgotten. In any case, so long as we remain dwellers on this earth we shall have the appendix as part of our bodies—we always have had it—and we must lay our account with it. Similarly we always have had and we always shall have a little tubercle which we can feel with the tongue on the back of our upper canine teeth, left there to show that our teeth have been built on a bicuspid model. But not only have we been told that the appendix vermiformis is useless and obsolete, but even the large intestine itself is said to be quite useless. This is a curious conclusion to come to when the same writers suggest that the large intestine, acting as a reservoir for the fœcal contents, prevents the need for frequent emptying of the rectum, as in birds. A structure that ministers to the decency and cleanliness of life and allows of long-distance running is useless! Just imagine what interference there would be with life—how would refinement be possible, how could social intercourse exist, how could conversation be possible, not to speak of elegance and beauty, if this structure had not been introduced to make these amenities possible? Where is the reticence, where is the caution, where is the humility that we have been led to expect in the scientific mind, and where the reverence, when we hear men say that the large intestine even is a perfectly useless structure? It becomes the seat of a pernicious intestinal flora, we are told. This pernicious intestinal flora produces toxins which poison the body. This is no doubt true, or may be true in many instances. But how does this pernicious intestinal flora arise? Is it not from over-loading of the nutritional powers of the body? Is it not from too frequent and too abundant feeding? From having one meal follow another at less than say seven or eight hours' interval? It is from this cause that the pernicious flora arises in the large intestine; it is from this cause that toxins are formed, which, being absorbed, poison the lymph and the blood; it is from this cause that the vile-smelling gases, putrid with rotten-egg and sulphurous odours are formed. Mr. Horace Fletcher has told us that normal fœcal excreta ought to be odourless or having an odour only like a smoked biscuit, and this is true for all of us who manage our digestion properly, and particularly who do not set up putrefaction by too frequent and too abundant feeding. No doubt patients have lived without the large intestine. No doubt. The human machine is very beautifully and very wonderfully constructed by anthro-pino-zoo-dynamic or the power of human life. And so well adapted is it for the purposes of life, that even without the presence of various parts introduced as the higher purposes of life demanded organs suitable for their various expression—so well has it been constructed and adapted for its purposes, that it can go on and live even without the presence of an arm or a limb, or a sense organ or tonsils, or a large intestine, or even sometimes without a portion of the brain substance, as we occasionally see when through accident a portion of it has been lost, and still the mental qualities are unimpaired. All these things are true. But to say that because these things are true, therefore the organs are useless through which various functions are performed, is—well it is not scientific, however eminent may be the man who says these things—it is not philosophical—and it does not show respect to the majesty and order of Nature on the part of those who inquire into the methods of her government, in face of the fact that the inquirers are themselves, according to their own assertion and according also to the fact, a part of the very processes into which their inquiries are being made. Shall the organism formed say to the power that formed it—Why was I made thus ? And find fault with the manner of its making ? Not but that judicious and judicial and humble inquiry will always obtain an answer. We need fear no inquiry at the oracle and into the facts and into the interpretation of the facts of nature. If, however, the meanest intellect is satisfied with the statement that the large intestine is useless, after an inquiry into the facts, I shall be surprised. Excision of organs has become very common of late. Would it not be better for us to attempt to inform the people how to live with their various organs intact, than to be so frequently suggesting excision? No doubt, amputation of the head would be a perfect cure for neuralgia of the face; but it is not likely to become a recognised mode of treatment even if the law did not step in to prevent such a barbarity. True, the same authority that tells us that the large intestine is useless also says that he "does not suggest that removal of the large intestine can be thought of as a means to prevent the pernicious effect of the intestinal flora"—an amount of consideration for us and for our large intestines for which it is to be hoped that humanity will be duly grateful, especially as we learn that when the large intestine has been removed, there may still be digestive putrefaction and that persons are apt to suffer from diarrhœa. A proposal has recently, however, been made, apparently quite seriously, that every child, on arriving at the age of two or three years, should have its abdomen opened and the large intestine removed, so as to prevent the growth of a pernicious intestinal flora. It is to be hoped that the anti-vaccinationists will never hear of this—nor the suffragettes. But I should like to put again to my readers this question: What are we to think of a philosophy which, under the name of evolution, logically ends in a conclusion like this regarding such an organ as the large intestine ? Does not the suggestion arise in our minds that evolution as it has been propounded to us is false, or at least imperfect ?—that it is no explanation of the structure of animals or men ? Is there not a truer and more complete evolution ? The evolution of purpose or plan ? And is there not much evidence for the existence of that true form of evolution ? A theory of evolution which confuses a predecessor with an ancestor seems to me—I submit this respectfully and confidently—to be a poor thing. In any case a theory which arrogantly culminates in a statement that the large intestine is a useless organ seems to stand self-condemned. I do not believe that Charles Darwin would have assented to it. I scarcely like to add, because it may have the appearance of comparing the small with the great ; but I cannot help adding that neither do I, nor from expressing the hope that none of my readers will do so either. The time seems now at least to have fully come when we are called upon to reconsider our position as to this great question, and to ask ourselves this—Is there not a truer, sounder, and more complete form of evolution than that of the common ancestor ? Shall we not refrain from confusing predecessors with ancestors, or even from confusing a primordial form with a common ancestor ? And may we not better explain the universe in all its phases as the manifestation of an energy, infinite, eternal, changeful and omnipotent, working always in similar ways and in great variety of action, to pro-create things, plants, animals, and men because it itself in all its varieties emanates from an infinite source ?

To return now to the account of the digestion ; we had traced the chyle to the venous system of the body, and had found it being conveyed in the pulmonary veins after having been laid out in the lungs for oxidation. The pulmonary veins contain arterial or oxygenated blood. This blood is carried from the lungs to the left side of the heart, thence to be distributed all over the body, for its nourishment and for its waste-repair. We see from this short summary how the function of food is to make blood and to enrich the blood, and how it is the function of blood to nourish the body. It is only therefore by ellipsis that we can speak of the function of food as being to nourish the body, to repair its waste, and to build up its tissue. The food does all these things, but not directly or immediately, since it does them mediately or indirectly through the blood. And in the attempt to understand the diseases and ailments of the body it is absolutely necessary that we should keep these steps of the processes of nutrition and of digestion separate in our minds. By means of this consideration also we can introduce order into the study of medicine and of diseases, and so substitute simplicity for chaos and confusion. The multiplicity of diseases, for instance, the immense number of them which come under our notice, either because we ourselves or our friends or acquaintances are suffering from them, are apt to fill us with despair as to the possibility of our ever being able to understand them or see their causal connection. But let us once get into our minds the facts that the blood goes everywhere all over the body, and that the blood is made by changes which through the digestive processes are effected in the food, and then how simple do these apparently complicated diseases become. For if the blood goes everywhere all over the body, then it may nourish the various parts properly, if it is itself in good condition, that is, if digestion or assimilation has been properly effected, and if the proper quantities and qualities of material have been poured into it; while, on the other hand, it may fail, and will fail to nourish the various parts properly, if it is itself not in good condition, that is, if digestion or assimilation has not been properly effected. In the former case the various tissues will be so properly nourished that they will be healthy; and so, as they are acting normally and painlessly in reference to their various functions in the body, and in relation to one another, we remain unconscious of their very existence, feeling only the general pleasurable sensation of health and well-being. But if, on the other hand, the blood going to the various bodily tissues has not been properly made by the digestive processes; if, for example, as often happens, it is loaded with badly assimilated materials, we can easily understand how it may deposit in any of the various tissues some of its ill-formed material, and how this, by disturbing the exercise of the various functions and the relations of these functions to one another, may translate itself into pain and discomfort, and may give us an unpleasant consciousness of the existence of parts and organs, which knowledge we might otherwise have been enabled to escape. In this way we may suffer from bronchitis, or pneumonia, or pleuritis (pleurisy), according as the ill-made and waste-laden blood deposits an exudation into the mucous membrane lining the lungs, into the lung tissue itself, or into the pleura or serous membrane covering the lungs. And in the same way any and every organ and tissue of the body may be affected, the names of the affections of different parts being as various as the different tissues and organs themselves, while their various symptoms differ from one another according to the very various functions of the different parts affected.

I have already referred shortly to the portal circulation, and with one or two words more our sketch of the blood-making processes may be completed. The blood-vessels which come from the stomach (where probably some absorption of chyme takes place, although the mass of it passes on through the duodenum into the small intestine), those blood-vessels which come from the small intestine, filled with the products of digestion there, that is, with the chyle; as well as the blood-vessels which come from the spleen and pancreas, join together to form the portal vein, as it is called, because it is found at the gate-way or door-way (*porta* = gate or door), so to term it, of the liver. The portal vein carries its contents received from these four most important viscera, the stomach, the small intestine, the spleen and the pancreas, to the liver, which is the largest digestive viscus and one of the most important organs of the body. This organ, which weighs about four pounds when out of the body, is said by physiologists to contain, on occasions, about 29 or 30 per cent. of the blood contained in the body of a rabbit. By generalisation, this proportion is supposed to obtain in the case of other mammals and man. Whether it does so in this proportion or not does not really very much matter. What does matter is that the liver receives through the portal circulation an immense quantity of blood. It is indeed difficult to believe that in man the quantity of blood received by the liver can reach so high a proportion as 30 per cent. at any one time, since this would imply that three or four pints out of the twelve to fourteen pints of blood contained in the body would be in the liver at one time. As, out of the body, the liver weighs about four pounds, the addition of three and a half or four pints of blood would increase its weight to about double ; and although no doubt the liver differs immensely in weight, according to the different states of digestion, it is not easy to believe that from time to time it actually doubles in weight. That it varies very much indeed at different times is no doubt true, and is all that need concern us. And whoever properly appreciates this fact will be able to rate at its proper value the statement, for example, of a patient, who said that his doctor had been able to reduce the width of his liver by about an inch since beginning his attendance on him. If he had told us the comparative times of digestion at which the measurements were made, we should have been better able to judge the value of the statement ; but that an empty or comparatively empty liver should be reduced by an inch when it had been overgrown or hypertrophied by that amount, is a statement which would require to be supported by a good deal of evidence before it was accepted.

While I am on this subject let me mention some other statements of the physiologists regarding the facts of the distribution of the blood in the body. These facts, let me repeat, are taken from the rabbit, and what amount of weight ought to be attached to them when applied to the circulation in man must be carefully considered. The muscles, they say, contain about 30 per cent. of the blood also. If this is true for man, then we should have about four pints of our blood in the muscles. I think we have quite that proportion. On the enveloping membranes of the muscles, blood-vessels are carried freely, as also on the finer forms of envelopes which surround bundles of muscular fibres, down through still finer and finer processes, till we finally reach the finest covering of all, or the sarco-lemma, as it is called, enveloping the ultimate muscle-elements. On all of these, arteries finer and smaller according to the increasing refinement of the enveloping membranes, are carried till they are lost in the very finest sarco-lemmatous processes, where, however, lymph-spaces are not absent. It can therefore readily be believed that four pints of blood or more are distributed to the muscles of the human body. And the significance of this seems to be very great. The muscles are the active agents of the body, or the agents through which the active powers of motion, locomotion, and mechanical work are performed. It is likely, therefore, that they will require a large supply of blood, in order that their active work may be possible ; and whether this supply amounts to 30 per cent. of the whole of the blood or not, it is evident that the supply of blood to the muscles is free and abundant.

Continuing our examination of the blood distribution in such an animal as the rabbit, we come upon other very interesting facts. The heart and great blood vessels, the great arteries and veins of the body, with the addition of the lungs, do not, say the physiologists, contain more than 22 per cent. of the total volume of the blood. This is very curious when we reflect that we are in the habit of thinking of the heart and vessels as the organs of the circulation *par excellence*. If this proportion holds in the case of man, only about three pints of blood out of his fourteen, or only 2.6 pints out of a total of twelve pints, will be contained in the heart, blood vessels, and lungs at any given time. That is to say, the blood-contents of the organs of circulation and of respiration added together do not reach the amount contained either in the liver or in the muscles (assuming, of course—what is not certain—that what is true in the rabbit obtains also in the case of man).

The physiological significance of these facts must be very great, and we may reasonably draw these inferences; (1) The liver exerts an enormous influence on the blood-making processes; (2) The muscles play a great part in the blood-using processes. In order that they may do the work of the body they require a large blood supply, which, if they are active, they call upon the food to supply. And, no doubt, the greater the muscular activity of the body, the larger will be the amount of blood in the first place, of waste of bodily substance in the second place, and of food in the third place, which they will require. On the other hand, the less the bodily activity, and the lighter the muscular work done, the less blood do the muscles require, and, therefore, the less food. Now let us set beside these facts another one also vouched for by the physiologists. The brain, they say, of a rabbit, and its spinal cord together, the governing and controlling structures, ordering and willing so far as a rabbit can govern movements, can order and can will, can think and can feel, the cerebro-spinal nervous system contains only about 1.5 per cent. of the blood within it at any given time. If this is true of man, his brain will contain about one-fifth of a pint of blood out of the twelve or fourteen pints contained in his whole body. It may be said that probably the brain of a man is better supplied with blood in proportion than is the brain of a rabbit; and this does not seem to me an unreasonable idea, considering what very different work a man's brain performs from that done by a rabbit's. But if the human brain is twice as well supplied with blood in proportion as a rabbit's, this would only give two-fifths of a pint of blood in the human brain, as compared with three or four in the muscles; while, if the human brain contains even 5 per cent. of the blood, as compared with 1.5 per cent. in the rabbit, this would only amount to from three-fifths to seven-tenths of a pint of blood. Even then, on a rather high and free computation, we seem to be driven to infer that the brain does not require a large amount of blood for the conduct of its operations, while the requirements of the muscles are very considerable, in order that they may perform their work, at the same time that the requirements of the liver for the purposes of digestion and assimilation of food are very great also. The supply of blood, therefore, seems to require to be large in order that the lower functions, so to call them, of the body, the functions of locomotion and of digestion, should be well performed; but in order to the performance of the higher functions of cerebral activity, ordering, feeling, perceiving, judging, thinking, reflecting, and willing, not nearly so much blood seems to be required. This is a rather remarkable conclusion to come to, but I think it is a sound one; and there are some other very remarkable physiological facts which point in the same direction, and appear to bear it out. For instance, it is surely a very remarkable fact that although the blood supply all over the body, and in all its parts, except the brain, is and remains under the government and control of the heart, it is not so in the brain; but the blood supply of the brain passes under a different government whenever the internal carotid artery enters the lacerated opening in the temporal bone in order to pass in to supply the brain. Whereas in the common carotid artery in the neck, before the internal carotid artery branches off for the supply of the brain, and whereas in the external carotid artery going to the face and *even to the brain membranes*, and in all the other arteries of the body wherever they are distributed, the circulation is and remains synchronous with the pulsations of the heart, that is, heaving at the rate of from 60 to 90 times a minute, the motion of the blood in the vessels of the brain itself is synchronous not with the heart's pulsations, but with the respiration, *i.e.*, it heaves and throbs and moves only at the rate of from 13 to 17 or 18 times a minute. The full significance of this remarkable arrangement does not seem to me to be completely appreciated or understood; but it appears to me to be partly at least because the brain does not require a very large amount of blood-supply in order that it may perform its functions well; and that in fact it is rather hampered than otherwise, and hindered in its functioning if a very large supply of this fluid is sent to it. The large supply of blood, however, sent to the digestive viscera and to the locomotor organs seems to suggest to us that the immediate or primary uses of the body are for digestion and locomotion and work—what we may call, in view of the terminology used in Conversation I, Tropho-dynamic and Erg-dynamic. Thinking, again, and feeling (in the sense of appreciation rather than of common sensibility) and willing, would seem to be secondary or indirect functions of the body performed by means of the lymph secreted from the blood in the ventricles of the brain by means of the choroid-plexuses—of which more will be said immediately—rather than directly (like Tropho-dynamic or Erg-dynamic) by means of the blood itself. Translating these functions into similar terminology, our proposition takes the form that while the body is constructed primarily as a machine for the direct working of Tropho-dynamic (digestion and nutrition) and for Erg-dynamic (locomotion and work), it is indirectly yet not less efficiently, because more elaborately, constructed as a machine for the action of noetico-dynamic (knowing *ηόησις* = knowledge, *νοέω* = I know), Æsthetico-dynamic (perception, emotion, or sensibility: *αἴσθηϛις* = perception, or feeling), and Boulo-dynamic (*βουλὴ* = volition or will). When we come to inquire, we find that higher functions and faculties still may manifest themselves through this marvellously constructed machine, but these must suffice for the present.

Another fact seeming to bear on the circulation of the brain, and to point in the same direction, is that the arteries in the brain end as end arteries, each to its own small portion of cerebral substance, and do not anastomose with other fine arterial endings, going to neighbouring parts, as other arteries do in other parts of the body. The object of this may be to ensure that if by chance a fine cerebral vessel becomes blocked, the disease and the impairment of vitality and power consequent on this condition may be confined to its own portion of cerebral substance and be prevented from spreading to other portions of the brain. But the fact, so far as it goes, seems to have for its object, or, at least, for its effect, the limiting of blood supply to the brain. Now as blood is made from food, this seems to mean that persons who use their brain largely should not take much food, lest they should make too much blood, which, finding its way in too great volume to the brain, might cloud and interfere with the finer and subtler working of that governing and controlling and thinking and feeling organ.

This seems to be a remarkable vindication by physiology and anatomy of the correctness of insight of the poet who sang that there was a close connection between "plain living and high thinking." The finer functions of the brain, indeed, do not seem to be performed through the blood supply so much as secondarily they seem to be associated with the formation and with the state or quality of the fine lymph which is found in all the brain cavities or ventricles, as they are called. This fine, subtle, clear, spirituous fluid exists to a considerable extent, especially in the large lateral ventricles in the anterior parts of the brain, as well as in the smaller third ventricle, and has set apart for its production a special arrangement of blood vessels known as the choroid plexuses. (There is a choroid plexus even in the fourth ventricle.) These choroid plexuses are collections of blood vessels carried on prolongations of the finest brain membranes, and from them seems to be secreted the fine spirituous fluid, which used to be called by older writers animal spirits, and which they appear to have thought to be the medium through which the higher powers of the brain were conducted. As this fine fluid or animal spirit (the animal spirit or animal spirits we see to be fundamentally a physical fluid, although in mediæval and modern language the expression seems never to be used in this sense, but always in a metaphysical or psychical or spiritual sense) is found in all the cavities of the brain, as it flows between the membranes of the brain, moistening and lubricating them; and as it passes even between the membranes or sheaths of the nerves also, which pass out from the brain and spinal cord, we may be quite certain that the function of a fluid so widely distributed must be an important one.

No doubt it plays a great and important part in acting as a medium to hold intact the nexus between the brain cells and the more or less remote parts of the body, which in so remarkable a way recognise the authority of the brain, and respond to its commands.

But it is now time to consider more thoroughly the nature, and character, and origin, and relations of this fine spirituous fluid having this peculiar and interesting relation to the brain and nervous system. It belongs no doubt to the same class of secretions as are found all over the body, under the name of lymph, and may be considered as a finer form of the same, distilled, so to say, or secreted from the choroid plexuses in the brain. How important the lymph is, finer and coarser, will be apparent when we reflect that, although the exact quantity of it in the body is not known, it amounts in the aggregate to probably not less than thirty or forty pints. It is in fact not unlikely that occasionally, or even frequently, more than this quantity is present in the body of an average sized man, who has, on the other hand, only twelve, or thirteen, or fourteen pints of blood. This fact of itself invests the lymph and its circulation with great importance. Let us try to realise more clearly what the lymph is. It is the watery or clear fluid basis of the blood, uncoloured, or very slightly coloured, and it contains also a considerable number of corpuscles, some not larger than very small pin-point granular masses, and some a little larger, some not unlike in size to the corpuscles of the blood, though not coloured red like them. It is collected in interstices that exist between the layers of the tissues of muscle sheaths. There are spaces also in the very substance of connective tissue, like muscle sheaths, nerve sheaths, periosteum, sarco-lemma, neurilemma, &c., &c., and in these spaces, sometimes lined by very fine layers of membrane, called endothelium, the lymph, or watery part of the blood, collects. From these interstices, in the substance of the connective tissue, and from the spaces between its layers, the lymph is conveyed away by channels which, gradually becoming lined, form lymphatic ducts and lymphatic vessels, which conduct away the lymph collected in this way, and take it to structures, called lymphatic glands, of which more detailed mention must immediately be made. Meantime, we must bear in mind that the lymph is itself collected from the blood after the blood has been carried to the various structures of the body, in order that it may nourish them. The arteries which convey the blood to these various structures (the definition of an artery is that it is a vessel which conveys blood *from* the heart, while a vein is a vessel which conveys blood *to* it) break up into finer and finer branches, until they end in capillaries, wide enough only to convey one blood corpuscle at once. The blood corpuscles, conveyed in this way, find themselves in relation with the ultimate cells of the tissues, being separated from them only by a layer of the finest membrane, through which nutritional changes pass between the blood corpuscles and the tissues, these changes having the effect of building up, repairing, strengthening, and vivifying the tissues so as to fit each different form for the performance of its own special function. But after these nutritional changes have been effected, and after the blood has parted with its nutritive materials to the tissues, something is still left over, and this something is picked up in the form of lymph, as above described, and finds its way first into lymph spaces, and then into lymph ducts, to be carried further into the body, where we must now follow it. The lymph ducts go in the vertebrata (there is no lymph circulation in invertebrata, we are told—the true inwardness of which fact is of intense interest) to the lymphatic glands, which are found in numerous places in the body, particularly at the sides of the neck, in the arm pits, and in the groins, as well as in many internal parts, as the roots of the lungs, intestines, &c. Entering these lymphatic glands, they coil about in an intricate manner in their interior, and an important elaboration of the lymph must occur, because after it has passed through these glands, it is found to contain many more corpuscles, generally also larger corpuscles, than it contained before it entered the glands. In some cases the lymph passes through as many as two or three of these glands before it joins the thoracic duct. For it is important to bear in mind that the lymph is carried into the thoracic duct. Now as the thoracic duct contains the particles of chyle which have been absorbed by the villi and lacteals of the small intestines, and as the contents of the thoracic duct itself are poured into the large vein at the root of the left side of the neck, for the purpose of being mixed with the blood, in order to enrich the blood and enable it to perform its function of nourishing the tissues of the body, and repairing their waste, it is evident that the lymph also assists in these important processes. The lymphatic vessels, therefore, may be considered as existing for the purpose, or at least chiefly for the purpose, of collecting, and so of getting used over again, any constituents of the blood whose powers have not been wholly used up in the nutritive processes. The lymphatic vessels are a part literally of the *economy of nature*, which will not allow, so to say, if she can avoid it, any waste to take place in the body. Any nutritive materials, whose powers have not been completely exhausted, are re-collected by these vessels, and carried by them to join the thoracic duct, charged with the products of digestion, so that, after being elaborated by the glands, they may be used again in the body without waste. The flat or expanded structures, in which the lymph spaces and the lymph vessels arise, form investments and supports for most of the organs of the body. They are called fibrous tissues, according as they form investments, or sheaths, or supports for muscles, nerves, bones, and the outside of joints; or serous membranes, according as they form investments and supports for organs like the lungs, liver, intestines, heart, the inside of joints and of internal organs generally. Their structure, although seemingly made of one layer of fibrous or serous tissue, really consists of several or many layers, as can be easily seen when, through inflammation, or congestion, or engorgement with lymph, the layers have been somewhat separated from one another. In between these layers, and in interspaces which are scarcely visible in the substance of the individual layers themselves, the lymphatic system of vessels begins, and these interspaces become filled with the watery part of the blood, containing also white granular and corpuscular particles, after it has been squeezed out of the organs, and particularly when it has been squeezed out of the muscles, after the blood has parted with some of its nutrient materials for the supply of those organs.

Now in order better to appreciate the part played by this arrangement, let us attempt to realise what the effect of too frequent feeding will and must be in the body. When this interesting arrangement has come into operation, some hours after food has been taken, and when the lymphatic vessels are engaged in picking up this watery and corpuscular part of the blood for re-use in the body, let us suppose that the person in question has meantime taken another meal. There is the most unmistakable evidence present from time to time by which it can be demonstrated that, when persons are engaged in performing the light duties of town life, food has not left the stomach for five or six hours (frequently much more than five or six hours) after it has been taken. Even after it leaves the stomach, let us remember that some considerable time longer must elapse before, having reached the small intestine, it has been taken up into the blood in the form of chyle by the thoracic duct, or by the portal vein. Now let us suppose that in a case which requires five or six hours for gastric or stomach digestion to be completed, a new meal is taken in four hours after the previous one. Let us suppose that a person who breakfasts at 9 o'clock takes dinner or lunch at 12.30; or, since digestion is probably more rapid in the forenoon than it is later in the day, let us ask ourselves what will happen if a person who has had lunch at 1.0 or 1.30 takes afternoon tea, and cake, and bread and butter, at 4.30 or 5.0. Plainly, before one meal has left the stomach (not to speak of the small intestine), another one is ingested some hours before any need for it can possibly have arisen in the economy. Evidently, therefore, before digestion of the previous meal has been completed, the digestion of the next will have to be begun, and more gastric juice will have to be poured out into the stomach, before the previous contents have been properly dealt with. In fact, digestion will be going on at two different stages in the same stomach at the same time. Now, if even it be admitted that this might conceivably happen once or twice without doing much damage (but even once or twice is once or twice too often) it is quite obvious that the repetition of the process must be most deleterious. Besides the fact that digestion is going on at two different stages in the same stomach at the same time, and that all the other digestive processes are apt to be simultaneously disarranged by the same or similar causes, we must consider the changes effected by the same causes in the lymph circulation. Obviously too much lymph must be finding its way into the blood through the thoracic duct. Before one supply has been properly elaborated and mixed with the blood current, another supply is on the way. This must interfere with proper assimilation in the first place, and in the next must lead to overloading of the blood with excess of nutritive material. Then, nextly, where such overburdened blood has been carried to the muscles to restore their waste after the performance of mechanical work, there will be a larger over-plus in the form of lymph to be absorbed by the lymph spaces, and to be thence passed on to the lymphatic trunks, by them to be carried to the lymphatic glands for further elaboration, before the contents pass on to be poured through the thoracic duct back again into the venous blood. The lymphatic vessels, let us suppose, do this work well. They rid the blood of material which is unused, and pass it on for re-use in the economy. But long before they have succeeded in doing this, another supply of lymph and chyle has entered the thoracic duct and the portal vein, and from these has been poured into the blood. The blood carries all over the body, and particularly to the muscles, the materials for their nutrition and for enabling them to act as the vehicle of mechanical work The same round re-commences, the same overwork is thrown on to the lymph spaces, and the lymph vessels, and the lymphatic glands. The muscles become heavy and achy, and the person feels languid and unable or unwilling to move, and low and weak, not from taking too little food, but from taking it too often and too much. Nevertheless, she feels weak, and further finds herself relieved for a short time by taking more food, the heat of hot tea (which is accompanied by bread and butter or cakes) stimulating the digestion to assimilate some of the unused stuff in the digestive tract and in the blood; while unfortunately, despite even the occurrence of a headache or an unheeded bilious attack, the efforts of the lymphatic system to relieve the blood are rendered nugatory by the perpetual re-ingestion continually going on, at too short intervals, of food in excess of the requirements of the body. Obviously the economical arrangements of nature may be opposed or thwarted by unphysiological management. Before the lymphatics have had time to collect the lymph, more materials for lymph formation have been ingested into the body. The new digestive processes occur too soon. Too much material finds its way into the blood, and, especially if this arrangement is repeated frequently and at too short intervals, it is evident that the lymph spaces may become blocked, and that the lymphatic glands may become congested and inflamed. When the congestion and inflammation proceed further, pus-formation or suppuration occurs, and in this way we can easily account for those enlargements of the glands and for those disfiguring suppurations and abscesses in the neck which often occur among the people, and especially among the children, of this country. In the same way, and from the same causes, the lymph spaces in a serous membrane like the pleura or that lining the interior of such a joint as the knee, may become over-filled with lymph, and so an attack of pleurisy or pleuritis may ensue, or a white swelling, as it is called, may occur in the knee joint of a child. If these are theoretical ways in which such diseased conditions may arise, I have no doubt that they are also in most instances the practical ways in which they do arise. A curious thing is that in the diseases I have mentioned, the tubercle bacillus is very often found to be concomitantly developed in the blood and tissues, and, these diseases being then shown to be of a tubercular character, are looked upon further as signs or marks of delicacy of constitution, as the phrase is, in those who suffer from them. It is doubtful, however, or more than doubtful, whether this is a just view. It depends on the definition we give to the term constitution, or what we mean by it. If by constitution we mean resistance, then it would not be inept or unsuitable to use the term as meaning simply that the child in question had a somewhat low digestive resistance, and that in this sense he had a weak constitution. But if we mean (as we generally seem to do) that the original powers of the person were too weak, that somehow or other and from the very first his stamina was poor and low, and much below the average, it is more than doubtful whether we are justified in using the term constitution in this sense; and for my part I think it is a wrong and unjustifiable use to make of it. Meantime, let it be stated that it is not necessary to suggest that the lymphatic derangments described have created the tubercle bacillus. It is, of course, possible, that when the fulness of the time had come, that is, when unhealthy conditions had been brought about in the ways suggested, the tubercle bacillus might have arisen in order to meet and to combat the unhealthy conditions. Some may, however, think this impossible, or, at all events, a most unlikely thing to happen, especially if some simpler explanation were forthcoming. We have, of course, to account for the first case. But on the other hand it does not seem at all impossible, or even unlikely, that, if the tubercle bacillus were in the body, it might be attracted by the increased activity going on in those lymph-engorged parts; and that it might there set up its characteristic actions. Most of us contain in our bodies, most probably, numbers of these bacilli (and numbers of other sorts also), but so long as we are healthy we oxidise them off and take no harm, or perhaps they lie dormant for a time and then die. They must have come into existence at some time of course. The inquiry into the course of nature seems to suggest that things and organisms come into existence when the fulness of the time arises, that is when the conditions suitable for their manifestation arise. But however this may be, and however they may have arisen, if such organisms are ingested into the body by being, for example, eaten in meat, or swallowed in milk, we can easily imagine them lying dormant in the body so long as it is healthy; but when excess of activity has occurred in any part through the lymph engorgement referred to, we can suppose them finding their way to that part, developing and multiplying there, because they find the pabulum suitable for their growth, and so from that place they may find their way all over the body; and, setting up their characteristic actions, may in this way destroy the body. If this suggestion seems far-fetched to any reader of these remarks, let me remind her of what takes place in agriculture when we treat with basic slag grass land producing no clover, or, at least, so little that it escapes our notice. For some years after grass land has been treated in this way, fine crops of clover are grown where no notable amount of clover grew before, and not only so, but the weight of the grass crop is very much increased. Now the basic slag did not contain the clover seed. Being manufactured in the process of making iron, it was white hot at one stage of the process of its production, and nothing living could survive such a condition. Unless, therefore, the clover seed had been added to the basic slag at some time after its production, it could not possibly contain any ; and, of course, we know very well that this was not done. The clover seed must, therefore, have been in the ground, or it could not have grown. In some way, therefore, the addition of the basic slag, while not containing the clover, modified the conditions of the soil and caused to thrive the clover which, perhaps, before, managed to live some sort of a weak life, being possibly kept down though not destroyed by the grasses among which it grew, until the addition of the basic slag somehow altered its environment and made it thrive. The precise form of the explanation is immaterial to the argument. What is material is that the addition of a manure not containing clover seed made clover grow where it was practically unknown before. There might be other explanations as to how this occurred. But however this may be, who does not see the close analogy between the facts of clover production in this way and the causing to thrive, in the body of man or animals, the hostile micro-organisms of the tubercle bacillus ? That in the case of the agricultural experiment we wished the seed to thrive, and that in the case of the tubercle bacillus we did not, is beside the argument, which is on the other hand to this effect, that when we alter the soil (by manuring land, or feeding the animal body, as the case may be) we alter the conditions or the environment, and so organisms spring up which did not formerly do so, or if they did spring up before, did not come to the maturity of development which they subsequently attained. To account for the original origin of the tubercle bacillus, or of any other organism, is part of the problem of creation, and may transcend the wit of man ; but to account for the presence of the tubercle bacillus in any given place may or may not be difficult, and as it generally lies within the powers of human investigation and explanation, may profitably occupy us. To decide whether organism or environment was first ; to declare whether structure was before function or function was before structure, are problems which may transcend the powers of human faculty. It is not, however, essential to our happiness or comfort in this wonderful and practically infinite universe, extending beyond the utmost stretch of our imagination in all conceivable directions, that we should be able to solve these mysterious questions. It is enough for us that we should see that organism and environment are co-ordinated and correlated, that as the one alters so does the other, that as the other alters so does the one ; and that structure is co-ordinated with function and function with structure in such a way that, as one alters, so does the other in a corresponding manner. In the same way we may perceive that the tubercle bacillus tends to grow in tissues, whose activity is heightened by the long continuance of inflammatory blood congestion and lymph congestion in them, whatever may have been the original way in which its existence may have been brought about; and this knowledge carries with it, or may carry with it, the practical conclusion that we may be able to prevent the growth of that and other micro-organisms in our bodies, if we see to it that these bodies, besides being properly treated as regards air and exercises, have also their food nutrition properly managed, by being supplied with neither too much food nor too little, and by being fed neither too often nor too seldom, in conformity with the demands of the nutrition in relation to the work and the kind of work which they are called upon to do.

CONVERSATION III.

THE USES OR FUNCTIONS OF FOOD IN THE HUMAN BODY.

I have introduced the preceding short account of the digestive processes, in order to show the way in which the blood is made from the food, and also to emphasise the meaning of the lymph circulation (that economical arrangement introduced into the working of the animal organisation when in the ascending scale organic form reaches the level of the vertebrata) in order that none of the nutritive materials stored in the blood shall be lost. I have an impression, received from reflection on the significance of these arrangements, that the existence in the human body of 30 or 40 pints of lymph, as against some 12 or 13 or 14 pints of blood, is already a mark or at least a suggestion of the existence of disease. The proportion seems to be too high. Whether, however, this be so or not, it is evident that vertebrate animals, and, among these, human beings, cannot with impunity violate the economy of Nature, by taking more food and so making more blood and lymph than they require. Particularly must we see to it, that, when Nature provides a way in which any surplus of nutritive material in the blood, not used by the tissues in the previous circulation round the body, shall be used again in a subsequent circulation by being poured again into the blood—most particularly must we see to it that nothing shall be done to violate this plainly indicated intention of Nature. Now the chief way in which this plainly indicated intention of Nature is violated is in too frequent eating. The chief difference between the food habits of men and of women may be described by saying that if men eat too much (as they undoubtedly do) women eat too often. Of course this difference does not obtain in infancy or childhood. But after adult life has been reached, ladies are apt to have their glass of milk with bun or cake in the forenoon when they are out shopping, even although they have had breakfast at 8 o'clock. Similarly the servants at home will in many houses have a cup of tea or bread and butter or cold pastry (" something light, you know, Doctor," said one of them to me once, " some cold tart left over from yesterday ! ") about half past ten o'clock. Both the ladies and the maids say, in justification of this practice, that they are faint and hungry. Faint, no doubt, they are, as the alcoholic is faint from want of his morning dram, as he believes, while really he is faint from having had too many drams the day before. He mistakes indigestion and gnawing at the stomach for thirst, and meets it accordingly by a dram, which no doubt relieves him immediately, although mediately or remotely it does him a great deal of harm, re-inducing or tending to re-induce a similar round of thirst, a dram to relieve it, and more thirst again. So with the woman who eats too often ; she mistakes indigestion and gnawing at the stomach for hunger. She meets this by taking more food, a cup of tea and bread and butter perhaps. This immediately relieves, but in an hour or two is followed again by the gnawing and the feeling of hunger which is similarly treated ; and so the round goes on until a series of recurring illnesses, a succession of colds, or of influenzas, of headaches or of fevers with special names attached to them, ends in confirmed and chronic illness, such as chronic rheumatism or gout, or Bright's disease, or heart disease, or cancer, or some condition which no one can cure. Acute and short-continued illnesses thus become recurrent or intermittent before they become chronic or long-continued. And the illnesses may be of the same sort, say a succession of attacks of influenza or recurring headaches ; or of different sorts, say a sore throat at one time, and bronchial catarrh or broncho-pneumonia at another ; or an attack of rheumatic fever at another. These attacks may be separated by longer intervals of time or by shorter ones ; but if a woman (or a man or a child for that matter) finds herself suffering from a succession of illnesses of any kind, either of the same sort or of different sorts, she ought to look for a constant cause for them. Nine times out of ten this constant or frequently repeated cause will be found in her food-habits, since it is through the food that the blood is made and the waste of her body restored. The law suggested by this series of observations is this : A constant or frequently acting cause affecting the body shows itself not in constant but in intermittent or periodic effects. And conversely if we find ourselves suffering from a series of recurring illnesses, either of the same kind or of different kinds, we ought to search for a constant or a frequently acting cause, such cause being to be found much oftener than not in some error in diet, since the body is a machine whose primary function is the manifestation of digestive energy or Tropho-dynamic. This law seems to me to be one of the most important, if not the very most important, concerned in the government of the human (and the animal) body. Very many things depend on our seeing it and respecting it, especially the practical conclusion that we should treat recurring illnesses rather during the interval than in the attack, *i.e.*, that we should aim at prevention rather than cure. In fact we usually aim at cure or alleviation rather than at prevention.

According to opinion so generally accepted as that it may be said to be universally so, the functions or uses which food subserves in the human body are three. These are :—

1. Food must be taken into the body in order to repair the waste which the body sustains in doing or performing work. It must also be taken in order to provide the material out of which the growing body is formed. I admit the truth of this proposition in both its forms.

2. Food must, it is said, be taken, in order to provide the source or material from which comes the energy of life. The work done by the body comes, it is said, from the food. There are, however, two views as to how this comes about. Some think that the work comes from the consumption of the bodily tissues themselves; while others think that food oxidation is the source of the work, without the necessity of its first being converted into body-stuff. On both these views, however, the food may be considered as the source of the work of the body, because the body is made from the food. On the former view, the food is the somewhat remote source of the work-energy of the body; on the latter view the food is the immediate source.

3. The third accepted, or almost universally accepted, view, as to the functions of food, and the need of taking it into the human and animal body, is that it is said to be the source of the heat of the body. The food is believed to provide the heat by which the body of a warm-blooded

animal is maintained at a temperature many degrees higher than that of the air (or water or earth) in or on which it lives.

I am sorry to say that I disagree with the belief, the common scientific belief, in the truth of both of these last two opinions. I am perfectly certain that the food is not the cause of the work of the body; either of its intellectual, moral, emotional, or volitional work on the one hand; or of the mechanical work of the body, whether internal, as in the various manifestations of functional activity, or external, as in locomotion, or the doing of what is commonly called work on the other. The food has no relation whatever to these things, other than that very indirect one, which is connected with the first admitted function of food, namely the building up of the bodily structures, so as to fit them to be the means or medium through which energy acts. The body is in my view a medium for the reception, storage, and transmission of energy, but neither it, nor the food out of which it is made, is the source of the energy. Next, I think it is open to very grave question whether the oxidation of food is the cause even of the maintenance of the bodily temperature. Holding these views I proceed to put the reader in possession of the evidence which has satisfied me that on both of these points ordinary views are wrong.

The latest scientific exponents of accepted views (Friedenwald & Rührah: "Diet in Health and Disease," pp. 32 and 33), writing in May, 1906, say: "Food is required for two purposes; to build up the body"—they mean before full growth, during childhood—"and repair tissue-waste and to supply energy and heat." I am separating the supply of work-energy from the supply of heat for purposes of convenience; but am stating the accepted views. Modern science considers energy and heat as fundamentally one. I should prefer the statement that all kinetic (or active) energy is probably warm, to the statement that it is heat. If, however, warmth is not a quality of all kinetic energy whatever, it *is* a quality of all energy animating what are called living things. I should like to be allowed to name Vital energy as Zoo-dynamic, and to say that it manifests two forms: what we may call Zoo-potential, or Zoo-dynatic (in order to avoid the verbal hybridism of Zoo-potential), and Zoo-dynamic. In this respect it corresponds with the forms or phases of electric energy, known as electro-potential and electro-dynamic, and it is convenient to have similar terminology for naming corresponding qualities of sister powers.

The writers named, however, go further than accepted views warrant them, and further, I think, even than they mean themselves, when they say "Every act consumes energy. If a man lifts a pound a foot high, he must reproduce in his body that amount of energy. This energy is obtained from the food." *Consumes?* Energy. Is energy consumed? No; they do not mean this. They mean rather that potential energy in the food has been changed into kinetic energy in the body, providing the material through whose combustion heat and motion have been maintained in the body. But it is a loose expression, unjustified by modern scientific opinion, to speak of energy being consumed. If it were so, there would be less energy now than there was a thousand or a million years ago; and it would follow that in another thousand or million years there will be less energy than there is to-day. But no evidence justifies us in saying either of these things, nor is it in consonance with modern views. The second part of their statement is also expressed with unjustifiable looseness. "He must *reproduce*," they say, "in his body that amount of energy." *Reproduce?* Does a man produce or reproduce energy in his body? What if he *receives* it? I think he receives it. He does not appear to me to produce it or reproduce it, or create it in any way. The body seems to me to produce or create nothing. What it emits it first receives—after elaboration no doubt; but still it must first receive. And then they say "This energy is obtained from the food." Well this is the point I propose to discuss; and I am sorry to be compelled to question the soundness of the view which attributes either the work of the body or even the heat of the body to the food.

As to the work of the body, this is of two great sorts; what may be called mental on the one hand; and mechanical on the other. The reader will understand that by the term "mental," I mean not only intellectual, but also emotional, spiritual, and volitional energy, what I have already termed noetico-dynamic, æsthetico-dynamic, psycho-dynamic, boulo-dynamic, and sebo-dynamic. It is in this sense of the word, I take it, that our writers mean to be understood when they say (p. 35), "But the relation of energy and food to mental labour is a problem that has never been worked out." Now I wish to draw the reader's special attention to this point. In what respects does the work of the human machine differ from that of the machines or bodies of lower animals? Obviously chiefly in that of "mental labour." Yet even the dog is capable of a certain amount of mental power; and all different animal forms show different amounts and powers of mental labour, in accordance with the varying structures, chiefly of their respective nervous systems. Suppose we were to term human mental labour "Anthropino-zoo-dynatic and dynamic," and that of the dog "Canine-zoo-dynatic and dynamic," and to ask ourselves what relations these powers have to one another, and particularly what relations "Canine-zoo-dynatic" and "Canine-zoo-dynamic" bear to the dog's food; is there a single fact known to physiologists which would enable us to equate these two? To correlate them? Who ever heard of any relation whatever being shown to exist between a dog's food and the mode in which he can find his way about? and return home when he wants to? There are no facts known to physiologists by which these mental, or quasi-mental, characteristics can be correlated with the dog's food. And so on through the whole series of animals, fishes, reptiles, birds, and mammals. No relations have ever been shown to exist between Hippo-zoo-dynamic, or Elephanto-zoo-dynamic, and the food of horses or elephants. Many facts of course are known which go to show that natural mental powers of animals work better or worse according as the animal is fed more properly or less properly. No doubt if an animal body is choked up with excess of food-stuff, its powers are all deteriorated, its powers of doing mental labour among the rest;—nor is it denied that the nutrition of the brain, the organ of mental labour, is effected through the food and the blood. But the power of doing mental labour existed at any rate in the potential or dynatic form prior to the taking of any food. And much less has any such relationship ever been determined between the mental powers of men and the food which they ingest into their bodies. Now does not the reader think this is a very curious thing ? Who every heard of the plays of Shakespeare, or the songs of Burns, or the principia of Newton being determined by the food of these respective authors ? Obviously no one ever did, and I venture to believe no one ever will show any direct relation subsisting between these two sets of very different things. I therefore do not propose to make any further reference to the mode of production or to the source of these powers of man, and animals. But inasmuch as it is in respect of his mental characteristics in a wide sense that man's powers enormously transcend those of all other animals, so much so, indeed, as to place him in a class by himself, it is to me, I must say, somewhat curious that the same scientific men, who speak so easily of energy being "produced," and of energy being "consumed," should be obliged to add that the relation between energy and food to mental labour is a problem that has never been worked out. Does not the fact that they are compelled to do so raise the presumption in the reader's mind that probably the mode in which they view the relationship between food and mechanical energy may itself require to be reconsidered ? If they have admittedly failed to show even the slightest relation between the food and the higher powers of the organism, is it not probable that the mode in which they view that relationship to the lower powers may also require reconsideration ?

It may tend somewhat to clarify our ideas if we consider for a little some aspects of this question. It really is a question of materialism or idealism which forces itself on our mind. Theologically there may be three classes of religionists ; the materialists, the immaterialists or idealists, and the agnostics. Even philosophically these three classes may exist or temporarily co-exist; but scientifically, that is to say, viewing man in relation to the facts of life, the agnostic can scarcely find a place for the sole of his foot. We all believe in the existence of one another though we never meet; and therefore we need only consider the materialists and the idealists. Modern science is so wholly materialistic that idealism can scarcely be mentioned without arousing signs of discord and even scorn and contempt. So certain is modern science that thinking is a function of the brain, that the man who hints that the brain, its conformation, its structure, its position, are functions of thinking, has difficulty in finding a hearing. Material monism is so much in evidence that immaterial or idealistic monism is laughed out of court. And yet her position appears to me to have quite as much warrant as the other; indeed I think much more. It is, of course, very difficult, if not impossible, to argue an opponent out of his position. The answer we give in the end almost appears to depend upon feeling rather than upon reason; but the idealistic position which I take up, and which I am compelled to take up, appears to me to be a feeling, if such it is, founded on eminently rational reason, and to be in accord with a process of ratiocination which is concordant with the totality of things as we know them. When structure and function are co-ordinated and correlated, and proportionate one to the other, the one varying as the other varies, and the other as the one, co-ordinately and proportionately and simultaneously, it is not in the nature of things easy to say which is first. Either, however, as has been already observed, the thing was before the thought, as modern science almost universally asserts, or the thought was before the thing, which is the belief of a contemptible minority, among whom, nevertheless, I most emphatically range myself.

About the special phase of the question as it affects the action of the brain and the function of thought; a most remarkable oversight appears to have been committed, to which, although I have already referred to it, another reference is not unnecessary. Unlike all other organs of the body, the circulation of the blood, when it reaches the brain, ceases to be under the government of the heart and its mechanism, and comes under the government either of the respiration, or that portion of the nervous system which governs respiration. That is to say that, whereas circulation in the stomach and liver, and pancreas, and spleen, and kidneys, and even in the membranes of the brain, moves at the rate of 60, 70, 80, or 90 times a minute; that of the brain moves only at the rate of from 13 to 18 times a minute. The muscles are the organs of mechanical work; the brain is the organ of mental work. It has been known for 150 years that the circulation in the brain moves with the respiration, while that in the muscles moves with the blood circulation. How is it that this fact has never been made use of by physiologists? Their refusal to use it, or their blindness as to its meaning, is almost certainly a great part of the reason why the writers above mentioned have been compelled to make the poverty-stricken admission already quoted. How is it possible that the functional actions of the brain could be equated with the nutrition of the organ, when an essential part of its mechanism, although known for a very long time, has been persistently overlooked? The first point which I have to make, then, in the attempt to co-ordinate the work of the body with its food and nutrition, is to emphasise the fact that, according to the admission of the latest authorities, and also in accordance with the facts of the case, no relation between mental labour and the food has ever been worked out. And as this is so, and as the ordinary doctrine entirely fails to explain the relationship between the food and the higher functions of the human machine, so it seems to me that a presumption is raised against the adequacy of the ordinary doctrine to explain the relationship between nutrition and the manifestation of mechanical energy also. I now, therefore, proceed to examine the prevailing opinions of science as to the relations between the food taken into the body, and the manifestations of mechanical energy.

1. Let me, however, say a word or two respecting the power of food to repair the waste of the body, and to provide the material out of which the increase of the body, in infancy, childhood, and adolescence comes. This double function I admit, and I believe this is the only use subserved by food in the body, to repair waste, not to supply the material out of which work (or even heat ?) comes, but only to repair the waste the machine sustains in doing or being the vehicle of the doing of the work. It does not seem to me even that the body does the work ; it is the vehicle of the work, or the instrument through which the work is done, as the strings of a harp or violin are the means through which the tune is played. When work is done by means of any machine, the matter of which the machine is made wastes in the performance of it. The parts of a steam engine waste through the friction of going, through what may be called the internal work of the machine, irrespective, that is, of whether the engine is performing useful mechanical work or not. If, in addition to mere going, the engine is performing

mechanical work, driving machinery for weaving, spinning, or propelling a ship through the water, etc., the engine wastes more. The motor at the bottom of the electric tram-car wastes in the act of going, and the more miles it runs the tram-car, as also the steeper the inclines it has to mount, the more it wastes. Similarly the animal body, or the material of which it is made, wastes in the mere act of doing the internal work of life, of carrying on the internal work of breathing, digesting, the movements of circulation, peristalsis, and so on. If, in addition to these internal motions, the body performs external movements of locomotion or the doing of mechanical work, the body wastes more than when it is doing only internal work. This is so. But if we ask the question, *how much* more does the body waste when performing outside mechanical work than when it is performing only the internal work of living, it is not easy to give an answer to this question. I think the answer is: the body wastes more in doing external work than when doing internal work only, but not so much more as we might be disposed to think. The strings of a violin waste, no doubt, when tunes are being played upon them, but you can get an enormous number of tunes played on the strings before they show much evidence of wear and tear; and further, a high quality of the music does not involve any more wear and tear than a low quality; generally indeed not so much. The amateur's efforts waste the strings more than do those of the expert musician, but the direct effect of the playing of the music in causing wasting of the strings is very difficult to estimate. In the body, the ultimate products of oxidation are urea, uric acid, carbonic acid, water, etc.; and it has been alleged that the quantities of these products eliminated by the body are in direct proportion to the quantities of internal and external work done; but unfortunately this is not true. It cannot be said that they bear no proportion to the work, internal and external, done by the body, but it certainly is the case that the elimination of carbonic acid, urea, and uric acid from the body bears a far more direct and noticeable proportion to the quantities of food ingested into the body than it does to the quantity of work, internal and external, performed by it. The more food is taken into the body the higher is the elimination of carbonic acid, urea, and uric acid from it. Roughly speaking, carbonic-acid-elimination is the measure of the amount of carbo-hydrate and fatty-food ingested (starch, sugar, and fat), while the urea and uric acid eliminated are in proportion to the quantity of proteid food ingested (meat, eggs, fish, cereals, cheese, etc.) No doubt, under excessive exertion continued for a long time, an excess of urea and uric acid has sometimes been known to be eliminated; but in these cases the feverish state has set in, when these products have been the measure, not of the work done by the body, but of the material lost by it owing to the supervention of the feverish state. The problem is no longer one of the natural and healthy relations between the ingestion of food and the work done by the body; but it is one of unnatural and unhealthy conditions arising in disease. No doubt the body of a navvy, or that of a ploughman or other man doing hard work, wastes or loses more substance than does that of a clerk at his desk; but the difference is not so much as is generally supposed.

The favourite analogy of science between the work of the human machine and mechanical power has been to compare the animal body with the steam engine. I suggest that the animal body is in its action much more analogous to the electric motor than it is to the cruder steam engine and boiler. In the latter case the main source of energy is said to be oxidation, and principally of carbon. But even as regards the liberation of heat by the consumption of coal in the furnace below the boiler, which heat converts the water into steam, whose expansion and contraction are used to move the machinery which does the work, too crude ideas seem to prevail. We say that the oxidation of the carbon is the cause of the heat, but this is not a very correct expression. It would be much better to say that the combination of oxygen and carbon to form carbonic acid gas in the fire is the immediate precursor or the constant concomitant of the elimination of heat. The heat itself, however, I presume (and I think this is the form in which modern science, when she attempts to speak accurately, prefers to put her statement) was stored up in the Sun long ago, and is now liberated by chemical action, or by the action of chemical energy between carbon and oxygen. The heat is really liberated through the coal and air by chemico-dynamic, but this is a very different thing from saying that the heat is produced by the coal. If we use the term "cause" in its scientific sense of constant sequence or constant concomitance or necessary precedence, then the Sun is the cause of the heat, while the chemical action between carbon and oxygen is the occasion of the liberation of the heat. The analogy of the electric tramcar to the working of the human machine appears to me to be a much truer one than that of the steam engine, although, as I have shown, the action of the latter is not so crude as is generally supposed. The machine at the bottom of the electric tramcar, which works the car, is worked by electric energy ; as we can easily see if we ask ourselves how long it would continue to work if the trolley were off the wire. For the moment, however, we are occupied with the consideration only of the fact, that the more work the motor does, or more accurately, the more work the motor is made the means or vehicle of doing, the more does the motor waste. The engineer keeps oiling the machine, and by and bye, when it is worn out, pulls it out and puts in a new one. But the body is self-repairing ; and this is the chief difference, it seems to me, between the artificial machine made by man, and a natural machine made by Nature, pro-created, as it appears to be, by zoo-dynamic or vital energy ; which energy is created by or emanates from the Author of Nature. The food, however, is the immediate source from which the waste of the grown body is repaired, the waste which is incurred when the natural machine does internal and external mechanical work ; and so far as I can see this is the sole function subserved by food in the body.

1a. The amount of waste sustained by the body in doing internal and external work.

Of course, as has been said, this waste is less or more according as the body is doing less or more work. A very great deal of labour has been expended in experiments in the attempt to determine the amount of waste sustained by the body of a man when engaged in the mere act of living, as compared with the body of the same man when doing a regulated amount of mechanical work ; such for example as riding a bicycle. The apparatus employed is known as a calorimeter (heat-measurer or calorie-measurer). A calorie is the amount of heat required to raise one kilogram of water through one degree Centigrade in temperature. The results are not very conclusive. I say this because of the occurrence in text books of statements like the following. I quote from Professor W. G. Thompson, of Cornell University, New York. In his "Practical Dietetics" he says :—

> "Metabolism within the body is not alone controlled "by muscular work, but by the nervous energy "expended in its performance. For example, a day "labourer, like an iron-founder, may be stronger, "and do much more mechanical work, than an "oarsman, or football player in time of contest, yet "he expends very little nervous energy in his routine "daily work, and requires less proteid in his diet "than the athlete. In other words, severe muscular "work, performed for a brief time, under conditions "of great mental excitement and nervous tension, "demands an excess of protein" (*i.e.*, food containing "nitrogen) "whereas continued muscular effort "without great fatigue or mental strain is maintained "upon a liberal allowance of food, which may be "varied in composition, if it be easily digestible."

It will be observed how vague these expressions are. What is nervous energy? How is it related to food? Prof. Thompson's statements are made without any proof being offered as to their correctness. I humbly doubt if they are correct. As we shall see, the nervous system, which I imagine to be the organ through which nervous energy acts, or what we may perhaps call zoo-neuro-dynamic, although I do not suggest that the nervous system is the source of that energy—this nervous system is most stable in its constitution; and we shall see later that even under severe and prolonged fasting it scarcely wastes at all. The statement therefore that when severe muscular work is performed under conditions of great mental excitement and nervous tension, excess of protein is demanded, rests, I venture to suggest, on no basis of proof at all. None at least is offered.

Another quotation from the same author may be made, to account for my saying that this whole subject is in a very unsatisfactory condition.

> "It still remains extremely difficult," he says, "in "the case of all foods to trace their finer uses in the "body, and determine with any approach to accur-"acy, what proportions of each furnish respectively, "energy, repair of tissue, and heat, for there are no "more complex chemical processes known than "those of tissue-metabolism."

I do not know that I could have put my own view or my reasons for holding it into better expression than this. Since it is so extremely difficult to determine these things, one is left to wonder still more, on what grounds the previous statement regarding the need for an excess of protein, when severe muscular work is performed under great nervous tension, was made.

THE UNSATISFACTORY RESULTS OF CALORIMETRY.

The results of inquiry into the relations of food-ingestion into the body and heat-production in it are very unsatisfactory. They involve inquiries too technical for exposition in a publication of the present kind. I have discussed them in the introduction to Mr. Hereward Carrington's book on "Vitality, Fasting, and Nutrition"; and to that and to the authoritative views there criticised, readers are referred who wish to go more deeply into this interesting inquiry. But that the results of the inquiry into the mode of heat-production in the body—into calorimetry as it is called—are very unsatisfactory, is a conclusion which must be forced on every mind that considers the question. Nothing practical seems to come of it; or if anything practical is deduced from it the deduction is opposed to the experience of what is good in practical life. One gramme of protein, like meat or egg, for example, is said to contain energy equivalent to 4.1 calories, *i.e.*, sufficient to raise 4.1 c.c. of water through 1° centigrade. One gramme of starch, like arrowroot or sago, has the same equivalent of 4.1 calories. Now as the chief difference between protein and starch consists in this—protein contains nitrogen while starches do not, the conclusion follows that nitrogen takes no part in heat-production in the body. But nitrogen is necessary for the building-up of the substance of muscles; and therefore it seems to follow that muscle-substance may be built up without any change in the heat of the body at all. This would quite agree with my view. But if this is so, why may not starch and the starch part of protein also be assimilated into the body without any change in its heat? Then fat has a much higher calorie-value than protein or starch, according to the accepted views. The value is 9.3 as against 4.1, and alcohol has a calorie-value, it is said, of 7, *i.e.*, one gramme of it when used in the body produces heat sufficient to raise 7 c.c. of water through 1° centigrade. But if these were any more than mere chemical facts, it would seem to follow that the best foods to train athletes on would be fats and alcohol; and further that it is a matter of indifference whether they were trained on proteids, like eggs, meat, and cheese, or on starch, like sago or tapioca or arrowroot. Such conclusions would of course, if carried out in the practical management of the body, be absurd and even damaging in the highest degree. As regards alcohol there are indications that authorities have occasionally not hesitated to carry these theoretical conclusions into practice, with the effect of damaging the body greatly.

It has been held on the other hand that the foods that really matter for the nutrition of the body are the proteid or nitrogenous foods. But if this were so, gelatin and glue ought to have a high nutritive value, for they are both rich in nitrogen. And yet no authority maintains that glue has any nutritive value whatever; while the view held about gelatin (say the extract from cow-heel boiled and cooled) is, that if it has any nutritive value at all, that value is next to nothing. If again the accepted views about heat-production in the body and its relation to food-ingestion were correct, why should we find sugar produced in tropical countries and arrowroot also? and still more difficult is it to explain the abundant production of palm-oil and of ground-nut-oil in the tropics, and of olive oil in the warm temperate regions, if the function of these foods is to produce heat, when they are taken into the body. But if sugar and starch and proteids and fats or oil are necessary foods for man in all countries, and if they are assimilated by the power of life inhabiting his body, and so perfectly that the temperature of that body alters only within the narrow limits of healthy variation during the process, then we can understand how sugar and arrowroot and oil are produced in the tropics for the sustenance of man, and how all the foods necessary for him are also produced in all required varieties on all parts of the earth's surface, hot, temperate, and cold. I think the true reading of this inquiry results in the conclusion that whenever any of the lower forms of energy acts through the body, an increased amount of CO_2 is eliminated from the body, and a correspondingly increased amount of O_2 is required to be ingested into the body, but so long as health is maintained there is no increase of heat of any moment. The quickening of the pulse and respiration which occurs when any lower form of energy acts through the body, should likewise not exceed the limits of health. But the second fact that meets us is this: that whenever any of the lower forms of energy acts through the body, whether it be the energy of doing work (erg-dynamic) or the energy of digesting food (tropho-dynamic), the body wastes, and that that waste has to be made good by food. In fact the elimination of CO_2 may be an indication of the waste of the body which has to be made good by food, or it may be an indication of the action of assimilation or tropho-dynamic, when the CO_2, a product of digestion, is being thrown out by the lungs, which as we have seen are complementary or supplementary digestive organs, and are formed as an outgrowth from the fore-gut. But in neither case, so long as the body is in health, is this elimination of CO_2 accompanied by any increase in heat. In all circumstances, so long as health is not exceeded, *i.e.*, so long as the body is treated as the laws of its nature require, its processes are conducted at its natural temperature of about 98.4°F., with a tendency to a drop of a degree or so on waking in the morning, and to a moderate elevation when fatigue is felt at the end of the day. For the temperature, although more steady than most of the other phenomena of the body, shares with them the quality of variation within somewhat narrow limits, yet remaining normal. I think, for example, that the sub-normal temperature of 96°F., with which many middle-aged persons wake in the morning, is a condition due to the slow blocking up from too much food gradually accumulating as life advances, and that it requires an illness every now and then to clear it off. Or perhaps it may be premonitory of the onset of chronic illness, which no power may be able to cure? Still, we know that the pulse varies in rate within the limits of health, that so does the respiration; and so probably it is with the more stable phenomenon of the temperature.

These considerations, however, all tend to the conclusion that the present doctrine of calorimetry or the relation of food-ingestion to heat-production is in a very unsatisfactory condition, and in particular that no practical rules can be founded on it. This being so, we are glad to try to obtain light from other methods of inquiry, and so we turn to what may be called

TRIBOMETRY.

The question here may be put—How much does the body waste (*τρίβειν* = to waste) when doing mechanical work? If we knew this we should know or we might get to know how much food and of what kinds is required for the replacement of the waste of the body.

The most prodigious feat of strength or of the performance of mechanical work known to me as having been done by man in a short space of time is that described in the following pages.

EXTRACT FROM "PHYSICAL CULTURE," SEPTEMBER, 1903.

A MILLION POUND LIFT.

A MARVELLOUS FEAT OF STRENGTH AND ENDURANCE.

To lift one million pounds in 34 minutes and 35 seconds sounds like a feat almost beyond human endurance, yet it has been done. Mr. Gilman Low, of New York, trained for a demonstration of this feat for two months, giving particular attention to his diet and manner of living, training only with light weights, or none at all. He had previously attempted the feat and utterly failed, reaching only a little over the half million mark in 25 minutes. Then he ended in sore distress and dizziness. He had been eating two meals daily. In the successful lift he was in no way bordering on distress at any time during the demonstration, and came out fresh and strong. One thing especially noticeable was his freedom of lung-power, so very important he says, in accomplishing a lift of this kind; for as soon as one ceases to breathe well, the muscular power fails. At no time in this latter lift was he compelled to breathe through the mouth. He set his jaws in grim determination when the lift was about two-thirds finished, in order to complete the lift in the time he had allotted himself. He figured on accomplishing the feat in 35 minutes, and succeeded with 25 seconds to spare. During his two months training, Mr. Low lived during the first five weeks on only one meal daily, consisting of three eggs, one half loaf of whole wheat bread, fruit, either oranges, grapes, apples or bananas, cereals and nuts, and one glass of milk after the meal; also plenty of cooled distilled water during the day. As an experiment he ate meat twice during the first five weeks, and he found he could do just as well without it. The last three weeks he lived on four meals weekly, consisting of the same diet as the five weeks previous. At ten o'clock in the morning on the day that the lift was made he increased the eggs to six, also somewhat increased the bread; otherwise the meal consisted of the same allowance. A pair of Fairbank's scales with a strong steel platform built above the main platform, supported by stout iron corner posts, was used for the test. The distance between the platform above and the main platform was forty-one inches. First the scales were tested and found to balance exactly; then Mr. Low, the hand stool, and back pad were weighed, and found to amount to just 200 pounds; then 1200 pounds in weighing lifts were placed on the beam, every lift of the beam meant that 1000 dead weight had been raised. This is the amount Mr. Low lifted 1006 times in 34 minutes, 35 seconds, making a total lift of 1,006,000 pounds in that time. The quickest lift was made on the last 50,000, which completed the 800,000 pounds; over 1000 pounds being raised 50 times in 13 seconds flat. This was by the back and arms. The next 50,000 pounds were lifted with the legs alone. This seemed to be the hardest test of all; it naturally would be, as no assistance from the arms favoured him this time. Between the end of the million pound lift and the ton lifts was a 15 minutes rest, during which he lifted 47,000 pounds at intervals to keep him in condition; he then raised the beam, with 2200 pounds attached, 22 times in 19 1–5 seconds (beating his old record of 21 times in 20 seconds), raising at each lift one ton dead weight; an intervening rest, and then again one ton 10 times in 9 4–5 seconds; another rest, and one ton again 12 times in 11 1–5 seconds, or lifting 44 tons in 4 minutes flat.

The total amount of dead weight lifted by Mr. Low in 35 minutes was just 1,141,331¼ pounds. Between each 50,000 pound lift Mr. Low walked continually and did not sit down to rest. Walking, he claims, was the only resource left him, after he once got into the work, to keep his legs and back in proper condition. Only one glass of water was consumed during the whole time, and that by sipping. Even then one half was used principally to rinse and cool his mouth.

You can perhaps have a better idea as to the amount of energy expended when you learn that during the 55 minutes Mr. Low lost in actual weight over 5¾ pounds. The lift was accomplished in Professor Anthony Barker's gymnasium before about 50 witnesses. Prof. Barker acted as referee. On the whole, it was a marvellous exhibition of what proper training and right living can do for a man. Mr. Low has never used tobacco or liquor in any form, and to this fact he lays a great deal of his wonderful strength and endurance.

I have had some difficulty in the attempt to find the true interpretation of this wonderful feat of strength. In the first place the reader will be interested in noting that Mr. Low had eaten only four meals a week for a period of three weeks before the performance of the feat. The ordinary view of this form of dieting would be to call it starvation. Next, the feat was performed some eight or ten hours after the last food had been eaten. This also in common opinion would be considered to be starvation. Thirdly, according to the statement, Mr. Low lost $5\frac{3}{4}$ pounds of his body-weight in raising 1,141,331 pounds in 34 minutes and 35 seconds. But as he sipped a glass of water, say half a pint, or about half a pound weight of water, during the performance, of which one half, *i.e.*, say a quarter of a pound only, was swallowed, the rest being used to rinse out the mouth, the net loss of body weight becomes reduced to $5\frac{1}{2}$ pounds. In order to find out more about this loss I wrote to Mr. Low; but got no answer. The question I asked was, through what height vertical the weight was lifted each time? However, the reply came through another channel to the effect that the weight was lifted each time through a height of about $\frac{3}{4}$ of an inch. I do not know if I can rely sufficiently on this answer to found any reasoning on it, which may afford more than a very rough approximation to accuracy of result. The results of some experiments instituted by myself seem to render this questionable. But taking the statement as I got it, the data of the calculation are that 1,141,331 pounds avoirdupois were lifted through $\frac{3}{4}$ of an inch vertical with the loss of $5\frac{1}{2}$ pounds of body-weight. One pound of body weight therefore represents the lifting of two-elevenths of this or 207,515lb. avoirdupois through the height of

$\frac{3}{4}$ inch. This again equals 12,900 foot-pounds $\left(\frac{207,515}{16}\right)$ of work or erg-dynamic, or as near as possible 5.8 foot tons. That is, according to these statements, each pound of body weight in the case of Mr. Gilman Low represented the doing of work equivalent to the raising of 5.8 tons (nearly) weight through the height of a foot. I am, as I say, inclined somewhat to doubt the value or the accuracy of this result from facts which will be detailed immediately. Mr. Gilman Low's body would, I should think, from the preparation through which he put it, be in a very sound state and one fit to bear without loss or with very little loss a considerable amount of strain. Nevertheless the bodies of men who had undergone no particular training or preparation did not sustain loss of weight to anything like the same extent that Mr. Gilman Low's did. They were not tried, of course, to anything like the same extent as Mr. G. Low, and it is of course possible that his loss of body weight was sustained to a far greater extent at the end of his feat than it was at the beginning of it. However, here are the results of some experiments. A considerable number of experiments were made, and those detailed are only samples, but samples taken without any particular selection. On September 2nd, 1908, three men, J. S., F. W., and A. R., each lifted 5 tons through the height of a foot with the following results. The experiment, which was in each case the same, consisted in lifting a 28-pound weight with each hand from the floor on to a buffet or stool exactly 12 inches high. As 56 pounds was raised at each elevation, obviously 40 elevations would be equivalent to 1 foot ton of erg-dynamic. In each case the pulse-rate and respiration-rate were considerably quickened, as might have been expected.

The following are the results :—

1. After lifting 5 foot-tons J. S., a young man, was found not to have lost any weight at all.
2. F. W.'s weight fell from 10st. $4\frac{7}{8}$lb. to 10st. $4\frac{1}{2}$lb., that is he sustained a loss of $\frac{3}{8}$ pound avoirdupois on performing 5 foot-tons of erg-dynamic. He perspired freely under the task. According to this result 1lb. of body-weight of F. W. would represent 13.3 foot-tons.
3. A. R.'s weight fell from 8st. 12lb. to 8st. $11\frac{7}{8}$lb., that is he sustained a loss of weight of 2oz. or $\frac{1}{8}$lb. According to this result 1lb. of body-weight of A. R. would represent 40 foot-tons of erg-dynamic.

As none of these men were in training for the task it does not seem likely that they would be able to perform the mechanical task by any means as easily as Mr. Gilman Low—unless indeed (which may have been the case) his loss of weight occurred mostly towards the close of the experiment, when a considerable amount of exhaustion must have occurred. None of the three men were exhausted by their efforts, although F. W. was somewhat stiff for some days after his first effort. The weighing machine was one in use in a hospital and weighed with moderate accuracy, but not to very small appreciations, so that no conclusion can be drawn from the result in J. S.'s case, except that he did not lose much weight. It is not credible that he lost none at all, for increase of Tropho-dynamic as shown in heightened respiration and increased pulse-rate as well as increase of erg-dynamic must have the effect of wasting the body ; and yet the scale did not register any loss. (One might play a good deal of violin-music, it may be suggested, without being able to measure the loss of weight sustained by violin-strings or bow-hair. It would require a very fine balance to detect the loss.) If these results are at all trustworthy, it seems as if we might draw from them the inference that the body is so well constructed as to be able to bear the exercise of a very considerable amount of erg-dynamic through or by means of it, without sustaining any loss to speak of. This seems to me to go to show how well the body has been pro-created by anthropino-zoo-dynamic for the manifestation not only of its primary functions of tropho-dynamic but also for that of erg-dynamic. With these observations I leave this part of the subject for the present. Of course there is another view which may be taken of the loss of weight, viz., the one presented by modern science, which would view the body-stuff as the source of the energy emitted. This body-stuff might be in the form of glycogen or in any other form. This view is materialistic to this extent that it views body-stuff as the source of zoo-dynamic, including tropho-dynamic and erg-dynamic. I am anxious to put the other view, viz.,—the idealistic one that energy is the pro-creating cause of body-stuff, in fact that anthropino-zoo-dynamic procreates the human body in order to manifest itself through it. The figures as to the relation between the two work out the same, however, on either view, so that I can imagine some reader saying that it does not matter which view we take. I do not agree with this at all, as the reader will see; and here for the present I must leave the subject.

EFFECTS OF FASTING.

A form of experiment which it has fallen to me to have made in the course of my professional life, appears to me to introduce, if not a better method of inquiry, at least another and corroborative one, into the question how much the body of a man wastes in the mere act of living. In order to cure a man of constant sickness, which had lasted for seven years, I advised him to fast for a period of 35 days. During this time he took only the whey from 2 pints of milk a day. He did not take the curd. During the period of 35 days the man lost $13\frac{1}{4}$ pounds avoirdupois in weight. The average loss during the 35 days was about six ounces a day. Or if there had been two ounces of food in the whey he took (but he did not take the equivalent of two ounces of solid food of any kind) then we may consider that he lost eight ounces of weight a day during the period, and that therefore he would require to take for doing the light work of walking about, and performing little domestic duties, as much food as would suffice to replace this amount of loss. I think the general feeling of readers of this statement will be that the loss is much less than they supposed. Nevertheless it corresponds with other observations of mine, notably one, in which a lady suffering from chronic rheumatism maintained her weight for a considerable period of time on an allowance of eight ounces of food daily. In another case in which the food was frequently weighed, and amounted to seven or eight ounces daily, a lady actually increased her weight by about four pounds avoirdupois in three years. While, therefore, I do not call in question the universal belief that food must be taken into the body in order to repair the waste it sustains in the doing of work, I add that this waste is much less than is commonly supposed. How seriously this estimate differs from authoritative statements as to the amount of food required by the average man or woman, will be evident when it is remembered that the late Dr. King Chambers recommended the nursing mother to take a weight of three pounds avoirdupois of food daily, and that some authorities speak calmly of as much as 76 ounces or nearly five pounds weight of food being consumed. In the writer's view, such amounts of food choke up the bodily machine and prevent its proper and efficient action, much in the same way as a fire may be put out by heaping up too much coal on it.

We come now to consider the two other alleged uses of food, as to both of which I am disposed to question the soundness of the universal, or all but universal, belief. These are :—

(2). That the food is the source of the work of the body ; and

(3). That it is the source of the heat of the body.

2. No doubt the more work the body does, the more digging, walking, running, hauling, etc., the man does, the more his body wastes. So do the strings of a violin, and so does the motor at the bottom of the electric tram-car, in proportion to the number of tunes played, and to the miles run. And yet it is the hand of the player which is the efficient cause of the violin-music and not the strings, although no doubt the tune cannot be played without the strings. And even the hand of the bowman is actuated by his will, so that the really efficient cause of the music is the will or mind of the player, while the

strings and the wood are only the material cause, as the old writers used to express it. And to see how small a part the motor takes in doing the efficient work of the electric tram-car, we have only to ask ourselves how long could the motor work the car if the trolley were off the conducting wire ; or how long it would take to start the car, if, the trolley being on the wire, there were no current passing ? Obviously the motor is the material cause indeed of the movement of the car, and the more miles the car runs, the more does the motor waste and require repair ; but the efficient power of the work is the electric energy, which is conveyed along the wire to the trolly and the motor. Now as the electric tram-car is run by electric energy, or electro-dynamic, the body, I conceive, is run by vital energy, or zoo-dynamic. Like the motor, the more work the body does, or rather, let us say, the more work is done through or by means of the body, the more does the body waste, and the more food therefore must it have to replace this waste ; but the body is only (like the violin or the motor) the material cause of the work done by it or through it, while the efficient cause is vital energy, or zoo-dynamic, or life. I shall be asked, no doubt, what is the source of zoo-dynamic ? We know, it will be said, the source of the electric energy, for we know how it is produced at the nearest generating station, by steam power, or water power, or in some other way ; but we have no such knowledge as to what I am terming vital energy, or zoo-dynamic. What is the source of that ? Well ! if I cannot answer that question, I am no more to be condemned than any one else ; for the man has yet to arise who can explain the origin or source of life, or vital energy, or zoo-dynamic, or even of Power in general.

But I may, perhaps, be permitted to suggest, that while in my view the ultimate source of vital energy is no other than the ultimate source of all other forms of energy, the *immediate* source may be the unlimited stores of energy in which we live, move, and have our being. And I think we draw on those stores according to our needs, not from the dining-room, but specially from or through sleep. It is during sleep, specially, it seems to me, that our bodies charge or are charged with the vital energy or zoo-dynamic, which seems to me to be the immediate efficient cause of the work done through the body.

The critic, however, is supposed to have said that we know the source of the electric energy which works the motor which works the tram-car. Do we ? Does not the same question arise here, as arose when we were considering the cause of the heat of the furnace in the cruder steam engine ? The electro-dynatic becoming electro-dynamic, is produced, says the critic, at the nearest generating station, by steam power or water power. Is it ? Is it produced ? Or is it liberated only, like the heat, which, although we thought it was produced by the coal, we found was not produced by it, but came long ago from the Sun, and was only liberated by chemico-dynamic, or chemical energy, acting between carbon and oxygen. What if electric energy comes from the Sun also, or from the Earth ? And if it does, where or whence did the Sun or the Earth get it ? Or is the power that made the sun and the earth the source of electric energy also ? Do we not see that we are only pushing our difficulties a little back, and not really answering our question at all ? Is it not well for us to attempt to realise how much or how little we really know or do not know about the constitution and course of nature ?

It seems then to me, in considering whether the food supplies the material, whose changes form the work of the body, that the evidence is against this view.

First, the oxidation products Urea, Uric Acid, Carbonic Acid, and Water, are proportional far rather to the quantities of the food ingested, than to the quantity of work done.

Second, while the waste of the body is proportionately greater, when the body is working, than when it is resting (in the conventional sense, of course—the living body never does rest ; it does more work or less work ; if it did none it would be dead), still this fact is quite compatible with the view I advocate, viz. :—That the waste incurred is due to the extra friction and wear and tear of the machine, which is acting as the vehicle of the work, or the means by which the work is being accomplished (as harp strings are the means, though not the cause of the music), although it does not supply the material out of which the work comes. Again, the ordinary view which I am opposing has been held and advocated in ignorance of the facts of fasting, and by persons who have taught that the body would die in about 21 days, if a person is deprived of food, but allowed to take water ; whereas, in point of fact, many persons have fasted for six weeks and longer, not only without dying, but in many instances, have experienced a positive increase of strength from the fast. It is difficult to conceive that the energy stored in the body from the consumption of food, should suffice to supply the power of work for so long a time ; whereas if vital energy, or zoodynamic, is the source of the power, and if it comes into the body, as I suggest, at all times, but specially during sleep, the whole position is easily intelligible.

There is, however, another line of argument to be considered, and it is connected with the facts of fasting. The man I referred to, who fasted for 35 days, lost in weight, at most, what amounted to eight ounces a day, and may have lost only six ounces; but I put it at eight ounces in order to strengthen the argument in favour of my critics and against myself. According to accepted doctrine, even the starving man emits a calorie value of 2000 calories a day in the form of heat loss. Now half-a-pound of best rump steak provides energy, if perfectly oxidised, up to 547 calories. It is not to be assumed (is it?) that a man's general tissues will have a greater calorie value than an equal weight of bovine tissue. But in consuming this amount of tissue, whence came the other three-quarters of the calories required? We have accounted for only 547 out of the 2000 required. If we imagine that the man could have found the other 1500 calories for a day or two, from the stores inside of him, is it likely that he could draw on himself at this rate for 35 days? The thing is incredible. If, however, he was charged with energy of zoo-dynatic, during the night, to be converted into zoo-dynamic during the day, we have an easy means of accounting for the fact of his survival, and also for the other fact that he felt much stronger at the end of his fast than he did at the beginning of it. Besides this, in many cases, persons have fasted for a very much longer period than five weeks, in some cases, for even as long as 16 weeks. Whence came the energy which enabled them to do this? I shall have something more to say on this subject when dealing with the question of heat production in the body. In the meantime, however, let me say that we wake in the morning after refreshing sleep, especially if it has not been disturbed by the labour of digesting a meal taken late on the previous day, like a spring compressed, tightened and braced up, especially in its transverse elements, by the energy or zoo-dynatic accumulated in the machine during the night, and that the spring, as it were, uncoils during the day, liberating zoo-dynamic, which may be converted into the work of the day. In the evening, the machine is therefore uncoiled, slack, dilated, tired, its longitudinal elements contracted, and ready for sleep, during which it is again braced, tightened, compressed, and charged with power to go through the work of another day, or days. It is a very much more beautiful, more subtle, more delicate, more wonderful machine than we imagined. It is a machine for the reception, for the containing or holding or storing, and for the transmission of energy ; and it appears to me to be a gross libel on it to assume, as modern materialistic science does, that it transforms this energy, either out of its own tissues, or out of its food. When its substance is used as the medium of the reception and transmission of energy, the substance wastes a little no doubt, as all material things do, when they act as the medium of Power ; and food is required to repair this waste ; but how little the waste is, the reader now sees. Well might the late Dr. E. H. Dewey put in his book on "The True Science of Living," that while the fat of the body wastes in starvation to as much as 91%, over nine-tenths of it disappearing in the process, while the Spleen wastes 63% and the Liver 56% in starvation, the Muscles 30%, and even the Blood 17%, the Nerve centres waste not at all. These nerve centres, including the brain, are the organ of thinking, of feeling, of willing, and of spiritual apprehension ; and in starvation they do not waste at all. As this statement is quoted from the work of Dr. Burney Yeo, a distinguished physiologist and eminent practitioner of the medical art, Dr. Dewey cannot be accused of drawing on imagination for his facts.

This beautiful and delicately constructed machine receives from its temporary tenants, or occupiers, or users, the coarsest treatment, for which it was never intended, and which it is quite unfitted to bear. And when it breaks down, and, proving itself an unfit house for the habitation of zoo-dynamic, is deserted by that zoo-dynamic, man is apt to blame nature and to speak of cruelty or at least of hardship. But if a machine delicately constructed is subjected to coarse usage, what can we expect but that it should break down ? If we scour its tender mucous surfaces out by drastic purgatives when our wrong habits have blocked and plugged it up, or if in order to obviate an opposite condition we bind it up by the action of strong and contracting astringents, how can we be surprised if it shows signs of suffering under these coarse methods of handling it ? If we treat it by deadening hypnotics because it does not fall asleep, instead of asking what is the cause or what are the causes of the sleeplessness, is it wonderful that the finely constructed machine goes wrong or even breaks down altogether ? I hope that the reader will see the force of this argument, although, to be sure, the reasoning is almost as powerful even if the ordinary views are held as to the relations between food and energy, as if the reader adopts the more delicate and subtler views which I am placing before her.

3. I now come to consider the question whether the food is the source even of the heat of the body. My opinion is that it is not. I do not know that the evidence

which I am able to offer on this point is as strong as that which has led me to the positive opinion, that the food is in no sense the source of the working energy of the body, either mental or mechanical. I can imagine indeed that a reader might be convinced as to the first point, and yet fail to be convinced on the second ; but I wish to put him in possession of the considerations which have on the whole led me to this opinion. No doubt when food enters the body, and when, through the process of digestion, it becomes assimilated in and into the body, heat may be liberated. It is quite possible, of course, that this heat is used in maintaining the bodily heat, with which every infant comes into the world. But it is also possible—and this is my view—that zoo-dynamic itself possesses heat as one of its qualities, and that normal human zoo-dynamic, or what I have called anthropino-zoo-dynamic, that is the special form of zoo-dynamic which animates the human machine, has a pretty constant temperature of 98.4 degrees F., *i.e.*, that in procreating the human body to be a fit house for its habitation it maintains it at that temperature. It is therefore possible that the heat which may be liberated in the processes of digestion is not required to maintain the human temperature, but passes into the body, and out of it again without modifying its temperature, and even without contributing to maintain the heat of life. If it does the former we fever, and this is a mark of disease. In fact I have no doubt that we eat our fevers, that is, that fevers are caused by taking into the body more food, and of a more heating character, than is required for the repair of its waste. But if only a sufficiency of food is taken into the body, and that of a proper quality ; so subtly, so delicately, and in so refined and recondite a way, are the assimilation processes effected that very little heat, if any, is liberated. We can see this very markedly in the action of respiration. Expired air is loaded with carbonic acid gas, as is well known; and as the generation of carbonic acid gas is nearly always in nature accompanied by the liberation of heat, it was for a long time supposed that the lungs, or the blood in the pulmonary veins, which come from the lungs, would show a temperature higher than that of the rest of the blood in the body. The lungs, where the carbonic acid gas was generated, were supposed to be the seat of the fire of the body, or the place where the heat was generated. Physiologists, however, have shown that this is not so, and that the formation of carbonic acid gas there consists simply in the elimination of the carbonic acid gas formed in the venous blood, during the processes of digestion, and its replacement by the oxygen of the inspired air, and that in health there is no increase of heat at all. If there is any increase of heat, the person has fallen into an unhealthy condition—disease has set in. I think the chief cause of this is taking too much food, or food of a too heating character. As to the cause of fevers, I have no doubt that while bad air is a contributory cause, the chief cause is an excess of food. This view I set out and defended before the Sanitary Congress, which met in Bradford in 1903. I do not then see any evidence for the view that the heat liberated (if indeed any heat *is* liberated, when food of a normal amount and kind undergoes natural digestion) increases the bodily heat above 98.4 degrees or so. In fact we do not desire that the heat of the body should rise above this point. When exposed, as in this country it almost always is, to a temperature much below its own, the body no doubt cools, and cools rapidly; but it seems to me that as rapidly as it cools, zoo-dynatic is converted into zoo-dynamic, and maintains the temperature. In winter time, to prevent ourselves from feeling the cold below a point which is comfortable, we put on heat-retaining clothing, non-conducting clothing as the expression is, light fires, shelter ourselves in houses, and eat food. We do the last, as I think, under a false theory, viz.: that the heat of the body comes from the food; and under the same delusion we eat more food in winter and of a more heating character than we do in warmer weather. It is quite possible, however, that this is a mistake. I think it is a mistake, although unfortunately I have myself in former times fallen into what now seems to me to be an error. Hippocrates expressed the very interesting opinion that a man should eat once a day only, "if it were summer time." I thought from this that he meant that a man ought to eat oftener in winter time in order to maintain his temperature. But it is possible that he only meant that in the extreme heat of the Ionian summer, a man's powers of digestion, like all his other powers, were so overtaxed that he was unable to find energy to expend on digestion, and that in the coolness of winter he might not be so overtaxed, and therefore might be able to digest more. In our winter, however, with its darkness, and gloom, and fog, especially when we increase the fog by the black smokiness of our manufacturing towns, it seems to me, that our powers are so reduced, that it is very unwise to tax them with any severe digestive labour, and still more unwise, if we even add to that labour, by increasing the quantity of food we take. And a very curious fact which seems to have a marked bearing on this consideration is, that epidemics of contagious and infectious diseases are apt to occur in spring. The children get their fevers then, their scarlet fever, diphtheria, and so on. The great epidemic of influenza of 1891 was at its height in March and April. May not this fact, as well as the frequent occurrences of inflammatory diseases in spring, be due to our wrong food habits in winter, these habits leading to the retention of quantities of unused material in the body, which unused material is thrown out of the body, when its powers are increased by the returning warmth and light of the sun, and the general re-vivifying influences of spring? Disease is nearly always, if not quite always, the process by which waste, effete material is being thrown out of the body; and these inflammations and fevers of spring are no exception to the rule.

The Registrar-General has shown that the mortality in the first or spring quarters of the years 1838–1906 was at the average rate of 23 per 1000, while that of the second quarter was 20.1, of the third quarter 19, and of the fourth quarter 20.3. This increased mortality in spring, with its excess-of-sickness rate, which has come every year since 1838, and no doubt for thousands of years before that, might all, it seems to me, be easily prevented if we understood or wished to understand nutrition. It is a serious reflection.

One or two other curious facts go in my mind towards strengthening the view that food does not maintain the bodily temperature. I have known, for instance, the bodily temperature elevated by as much as 3 degrees F., from 96 to 99 degrees, and to remain up for an hour or two, by taking a cup of simple hot coffee. It is, of course, physically impossible that half-a-pint of coffee at

110 degrees F. could have raised 120 lbs. of the bodily tissues of a man through two or three degrees, and have maintained it at that level for some hours. As a question of thermal physics this is impossible. How then did the coffee act ? It did not contain any nutrient material in the conventional sense. It is inconceivable that the nutrient material contained in the coffee, if there was any (there was neither sugar nor cream in it), could have directly, by its oxidation, raised the bodily temperature. What it did do, I suppose, was to stimulate the body to use up some of the materials already accumulated in it in excess, and by freeing the body of them, to allow zoo-dynamic or vital energy freer play to raise the temperature. I infer that nutritive material existed in the body in excess at the commencement of the experiment, because the temperature was sub-normal by two degrees or more, the bodily functions being choked or depressed by this cause. I have known a glass of hot water have the same effect in raising the bodily temperature, though not by 2 or 3 degrees. On the occasion to which I refer the temperature rose from 96.8 to 97.9 degrees, or through a degree and a tenth, on taking a glass of hot water. While the experiments do not prove the negative—always so difficult to prove—that food is not by its oxidation a cause of elevating bodily temperature, they do show that it is not *the* cause or *the only* cause, because from them we see the temperature rising without taking food at all. So far as they go, therefore, they seem to render less likely the prevailing scientific assumption that the food is the cause of the maintenance of bodily heat.

But another fact greatly corroborates this conclusion, and I do not know whether the reader may not even feel that it settles the question as against the prevailing view. It certainly goes a long way in my mind towards doing so. On the occasion formerly referred to, when I felt compelled to ask a man to fast, in order that he might be cured of grievous illness, lasting for seven years, one of the signs of the illness was a sub-normal temperature of 95 to 96 degrees F. This was repeatedly verified. On the 28th day of the fast, the temperature rose to natural 98.4 degrees F. and remained there. Here the temperature was elevated, not by taking food, whose oxidation, according to accepted views, is the cause of the maintenance of the body-heat, but by abstaining from food for four weeks! How can we maintain after this that the taking of food is the cause of the maintenance of the body-heat? What is my explanation? My explanation is this. The poor man's body was choked so by unassimilated material that he was in danger of death, and vital energy could not continue to inhabit that machine if the conditions continued or remained unfavourable. To show that this view is correct, I may say that the elevation of temperature to natural was coincident with a large elimination of urates by the kidneys. Nothing is so instructive as observing the processes of nature; and my eyes were widely opened by observing these two facts, of the large deposit of thick yellow urates, and of the elevation of the temperature, after 28 days fasting. I had no idea before that unused stuff from the digestion of food, or rather from its indigestion, could remain in the body for so long a time—for that must have been the source or cause of the urates—nor that fasting might raise a sub-normal temperature. But how are these facts to be explained on the ordinary view? If food-oxidation is the cause of maintenance of bodily heat, the food acting must have been taken over a month previously. But as if to show that this could not be the cause, the body throws out of itself a large quantity of urates! These could not have come from the bodily tissues I think, or there would have been fever. I mean I don't think they had been built into the tissues of the body, but had been, I imagine, somewhat loosely held in the interstices of the connective tissues. We have an analogous distinction in view when we separate in our minds between mechanical mixing of oil and water, which soon separate again, and chemical union say of O and C, when CO_2, a new body, is formed. The urates, it seems to me were lying mixed in the connective tissues of the body, not organically built into it. But vital energy, or zoo-dynamic, is the power which works in the body, and which maintains (I think) its temperature. And so long as the bodily-interstices were choked with the accumulation of unused stuff from former food supplies, the vital energy had no free play, and so the man's temperature remained too low because the vital energy could not raise it up. The clogged machine would not work; the instrument would not play the tune. But when the machine became unclogged on the departure of the urates, vital energy had freer play and was able to warm the body properly, and the temperature rose to natural; the natural harmony of the instrument expressing itself in a general feeling of well-being and health.

As bearing on this view that the animal temperature is maintained by zoo-dynamic or the power of animal life and not by the food, some facts regarding phyto-dynamic, or the power of plant life, are very instructive. A pear has, when just plucked from the tree, a temperature of about 63°F., whatever may be the temperature of the surrounding air ; but if boiled and allowed to cool so as to become devitalised, it appears to take the temperature of the surrounding atmosphere.

If, as I suggest, life or vital energy or zoo-dynamic is the immediate source both of the work of the body and of the heat of the body, we can understand that the body is warmed by the passage of vital energy through it and by its remaining in it. And in this connection I am greatly impressed by the fact that a copper wire conveying an electric current is warmer than a similar and similarly situated wire not conveying such a current. The passage of the electric current warms the wire. May not the passage of the life-current, of the current of vital energy, of zoo-potential converted into zoo-kinetic, warm and quicken the body in a similar way ? Are not electric energy and vital energy sister powers dependent in the last resort on the one and only source of all energy ? And as in the case of all powers, do we not infer their existence from their effects rather than perceive them directly ? As I have already in Conversation I. expressed my views as to the various species or forms of energy manifested in the universe, I need not do more now than refer the reader to that conversation. In short, however, the doctrine concerning food and its use in the body which I wish to put before my fair readers is this.

1. Food restores the waste sustained by the body in the doing of work or in being the means of doing work. Food also furnishes the material out of which the growing body is formed.

2. Food is not the source of the work of the body. That comes from vital energy—a sister power to electric energy or to gravitation. Powers and their existence are (always ?) unseen, unfelt, unheard, unperceived, but

inferred to exist, through the seen, the felt, the heard, the perceived.

3. Food probably takes no part in the process by which the body-heat is maintained; Heat, like work, may be maintained by vital energy. A copper wire which is conveying an electric current is warmed by the current, and the body is warmed by the life-current which dwells in it and animates it. And a subnormal temperatnre may sometimes be raised by prolonged abstinence from food.

ON SLEEP.

As several references have been made to the functions of sleep, this seems a suitable place in which to insert some observations in regard to it. The function of sleep does not seem to be very well understood. There is very little said about it, strange to say, in the text-books of physiology. Some of them indeed say nothing about it, the term not even appearing in the index.

The function of sleep in the animal body seems to be threefold. First, during sleep, unused material and unnecessary material (finding its way into the blood mainly through the digestion) is eliminated from the blood and the body. The kind of evidence for the truth of this statement is that the water excreted from the kidneys during the night and the early morning is heavily loaded with waste matters eliminated from the blood. Those overgrowths of epithelium also, called corns, are more easily peeled off in the morning than at night, being gradually in course of being exfoliated during sleep. They are really gouty over-growths caused by unassimilated food and by an excess of food, although often attributed to too tight boots. Curiously enough, occasionally we hear of their being attributed to wearing too loose boots. But if corns are attributed on the one hand to wearing too tight boots, and on the other, to wearing boots that are too slack, the probabilities are that these accidental circumstances are the occasion only of the occurrence of the alleged effects; and that the real cause is something in the habits of the person affected.

The body has been so beautifully made and it is so responsive to the power of human life that pro-created it, tending always to return to health when disturbed, that it is continually throwing out or exfoliating any material accumulated in it in excess of its requirements. This process is going on always no doubt, as well in the waking as in the sleeping state. But, as after the long quiet time of the latter, we are more able to attend to the differences in our sensations and conditions and to compare them, than during the much shorter intervals of our experiences in the waking state, it seems as if exfoliation went on more noticeably during sleep. In the case of corns we find that these gouty excrescences have been gradually extruded or exfoliated, and so we can peel them off more easily in the morning than in the evening, when the attempt to do so would have made them tear and bleed. A better appreciation of what goes on in the body and a finer perception of the working of its powers would have enabled us to understand it better, and would have allowed us, keeping clear of the fallacy of referring the existence of corns to too tight boots on the one hand or to too slack ones on the other, to attribute them to their true cause, viz.: our own wrong food habits; and it would have enabled us better to appreciate how the self-rectifying powers of life are continually in action both when we wake and when we sleep. The way, however, in which we tend to attribute our corns not to our habits but to the state of our boots, is very like the way in which we attribute various other ailments from which we suffer to the weather. The weather is apt to be cold and so it gives us cold, we say ; or it is too hot, when it equally gives us cold ; or it is too wet or too dry, in both of which cases we take cold ; or is is too windy or too calm. The convenience of being able to attribute this, that, and the other illness to the irresponsible weather rather than to the responsible man or woman is no doubt very great ; and I sometimes wonder how we should ever have got on without it. Still it ought to be much more obvious than it seems to be to the ordinary mind, that if all these contrary conditions of the weather make us ill, the causes are far more likely to be in ourselves than in them ; that these conditions may be the occasion indeed of our illnesses, but that the true causes are in our own state. And it is also much more hopeful to take this view, since nothing we can do seems to have much influence on the weather, while the modification of our own condition is a matter greatly in our own hands. Elimination of waste matter from the blood then and from the body is one of the chief actions that occur in the body during sleep. Some go so far even as to say that sleep is caused by the occurrence of a certain amount of what is called auto-intoxication or self-poisoning. This is closely related to that function of sleep by which the elimination of waste is effected, because the products of auto-intoxication are in this way got rid of. Under the action of the food-habits at present indulged in, no doubt sleep often is induced by auto-intoxication due to the accumulation and retention of waste products accompanying the breaking down of tissue which is associated with the action of all forms of power on the substance of the body and which is so much more noticeable when food has been taken in excess of our requirements. But if no excess of material were ingested, and only the proper amount of food were taken, it is more than doubtful whether there would be any auto-intoxication at all or any dangerous excess of material to be got rid of. We should still sleep from fatigue even if there were no self-poisoning. One of the tests easily made by any of us who fears he may be in this condition is to inquire if we wake tired in the morning, or perhaps aching in some parts of the body or the limbs; or if we wake fresh. If the former, we may be pretty sure there has been an over-ingestion of food material for some time previously, and that, the kidneys having done their best to rid the blood of the waste, some of the remainder of it has been thrown down in the connective tissues of the body, so making us feel tired on waking. As these connective tissues cover muscles, bones, and nerves, and form the ligaments of joints, obviously the whole locomotor system of the body becomes clogged, and so whenever we move we feel tired.

Another test of easy application is the state of the children's breath when a mother kisses them in the early morning. If the breath is fetid, and the mouth clammy when it ought to be sweet and delicously cool, we may be sure that the power of life has not had a fair chance to rid the body of waste during sleep. Still another test of proper nutrition in respect of sleep is found in the answer to the question whether sleep is quiet and calm or restless and tossing. Most cases of the latter in children are caused by too heavy an evening meal and can be easily put right by the simple plan of letting the child have nothing solid after dinner, at one or two o'clock, and letting it have some milk simply at tea-time. In these cases, if attention be directed to them, it will generally be noticed that the restlessness lasts till 2 or 3 or 4 a.m., after which calm sleep ensues. The meaning of this is that it is 2 or 3 or 4 o'clock in the morning before the stomach becomes sufficiently empty to allow of calm sleep occurring. The mother is not up at those times and so, unfortunately, her attention is not directed to the state of things, and in fact very often she does not know about it, seeing only in the early evening restlessness which she cannot account for.

As in other functions of the body, derangement shows itself in four directions in the case of sleep. There may be defect of action, excess of action, irregularity of action, and lastly perversion of action. 1. The person may not fall asleep until 4 or 5 in the morning, and be unfit to get up at 6 or 7 when he ought to be getting out of bed. 2. He may sleep too heavily and too long, and wake unrefreshed. 3. He may fall asleep immediately on going to bed, then wake in a couple of hours, and then be unable to sleep any more for the rest of the night. Or 4. He may keep falling asleep in the day-time, and sometimes on occasions of the most critical nature, when on all accounts it is most important for him or her to be awake. In all cases we should look for a constant or frequently acting cause; and this may nearly always be found in some trophic or nutritional or digestive disturbance. This four-fold aspect of the general question of alteration of function must demand attention later. It is very important and as interesting as it is important. But it may be said here that the proper way to meet any of these disturbances is not to give sedatives or hypnotics to induce sleep, nor yet stimulants to induce wakefulness, but to alter the way of living so that the irritation may be removed.

The second function of sleep is to allow of the inflow into the human body of vital energy. The machine pro-created by zoo-dynamic for the manifestation of the powers of life becomes charged with life-power during sleep. No doubt it is charged at all times with the kosmic energy in which we live and move, but it seems to be specially charged with it during sleep. Strange as it may seem, sleep is not confined to animals or even to plants. Minerals also, and particularly metals, seem to recover their power to conduct impulses better after a period of repose and to wear out less quickly if they are allowed to rest and if they are worked intermittently, than if they are worked continuously or right on without a break. The view that I put of this is that hylo-dynamic and phyto-dynamic and zoo-dynamic flow into the substances and bodies suitable to their reception, and fit them for doing their appropriate work. These different species of energy flow into their respective and suitable receptacles from the unlimited stores of kosmic energy in which we live and move and have our being. In fact these energies procreate each the form of body most suitable for its own reception and manifestation. But when energy acts through substance, whatever be the nature of the substance, whether organised substance like the body of a plant or animal or even unorganised substance like a metal, the substance wastes, small particles from its decomposition accumulating in its substance, and these preventing or at least impeding the further action of energy on or through the substance. During sleep or repose, elimination or clearing takes place by various channels. In the case of the higher animals the kidneys and skin and mucous surfaces eliminate the waste. But even in the case of unorganised bodies like metals some molecular changes take place during sleep which lead to a clearing and renovation of the substance of the body, and hence when a wire has been acting for some time as a conductor, for example, of electric energy, the wire becomes clogged and requires a period of repose in which to recover its conducting power.

In the human brain there seems to be a peculiar modification of the nervous structure called dendritic or tree-like, which seems to act like a dynamo and to become charged with life-energy during sleep. It is related, we may be sure, to that arrangement already referred to, by which the brain circulation is synchronous not with the general circulation, but with the respiration. And during the deep breathing of sleep, no doubt this charging with vital energy takes place. The proof that it is so is found in the fact that after refreshing sleep we wake with a calm, slow pulse and with a lowish temperature, and generally with a high potential, like a spring compressed. We wake therefore shrunk or toned up or braced. The spring gradually uncoils during the day and liberates active or kinetic life-power, which is translated or converted into the business of life, whatever it is. Useful or useless, it is for us to say. Amusement or the service of man—this is at our own option. In the evening, then, our bodies are like a spring uncoiled and are swollen, lax, and tired ; and we are ready for sleep again. We see thus how it is the power of life which is the source of the energy of the body. Anyone who wants to understand a little more of the functions of sleep may do so by looking at her hands and feet in the morning and observing how the veins are empty of blood, *i.e.*, are rather empty, as compared say with their condition at night before retiring, when they are found much fuller. We may understand this better still by recalling what has been said of the metazoic body being formed fundamentally from two layers, and by the modifications which result in this, that the tubular structures of the body are composed of two sets of fibres, one going longitudinally and the other transversely (or as it is often called circularly). In fatigue such as we feel at the end of the day the longitudinal elements are contracted, and so the whole body tends to be shortened, widened, and relaxed. For this reason tired persons are in the evening actually shorter or not so tall as they are in the morning. And for the same reason persons are actually taller in the morning than they are at night. They seem to grow longer during sleep. We may put this in another way, and say that during the day the activities of life exert their power rather through the longitudinal elements of the body whose contraction causes or is coincident with the feeling of fatigue. Sleep on the other hand appears to exert its influence mainly on the transverse elements of the body which, being brought into contraction, cause the tonic, braced, refreshed feeling of the morning. These facts appear to suggest and corroborate the opinion that while both the cerebral and the sympathic systems of nerves control both the longitudinal and the transverse or circular elements under the spheres of their respective governments, the cerebro-spinal system appears rather to exert control over the longitudinal, and the sympathetic system rather over the transverse. During the day the body is under the special government of the cerebro-spinal system of nerves which is essentially the organ of thinking, feeling, willing, and determining voluntary movements. As this ends in overcontraction of the longitudinal elements of the body, as we have seen, it seems evident that the cerebro-spinal system of nerves especially acts through these. Of course, after the longitudinal elements of tissue contract they pause and then lengthen ; but I think the lengthening is mainly effected through the contracting of the transverse, which, as we have now seen, so often has this effect. At the end of the day the overcontraction of the longitudinal elements makes the body relaxed, swollen, tired, sleepy. Voluntary vital energy has wasted and tired the organism, particularly in its longitudinal parts. In sleep, on the other hand, the reverse action occurs. The sympathetic system of nerves, acting on the transverse elements particularly, causes contraction in them ; and this, going on for some hours, has the effect of causing over-contraction of the transverse elements of the body and so of narrowing and lengthening it and of diminishing pulse-rate and temperature, while the prolonged action of the cerebro-spinal system during the day ended in shortening and widening and in increase of pulse-rate and temperature. As with the longitudinal elements, however, so also with the transverse. They also pause after contraction and then dilate ; but I think the dilation or lengthening of the transverse is partly at least obtained through contraction of the longitudinal, just as lengthening of the longitudinal is obtained through contraction of the transverse. It may be unwise to push analogies too far, or attempt to see correspondences in nature which may or may not exist ; but the relation between the longitudinal and transverse fibres suggests an analogy to the opposition of the action of equatorial and axial magnetism, as also to other oppositions as of positive and negative in electricity and to others which, if I do not name them, probably occur to the reader also. But this kind of inquiry brings us also face to face with one of the paradoxes of life, and renders less unintelligible the statements of philosophers who like Heraclitus and Hegel said — the one, "We are and are not"; and the other "To be and not to be is the same thing." From our point of view we see how contraction (of transverse) is lengthening (of longitudinal) and how contraction (of longitudinal) is lengthening (of tranverse) and generally therefore how lengthening is shortening and shortening is lengthening—although had we made such a statement without trying to get the reader to think of what it meant we should or might have been accused of talking nonsense. Perhaps the fair reader thinks so yet? One never knows.

To return: An important consideration arising here is the great importance and the great need for sleep in early life, as children actually grow during sleep. Also of course anything that interferes with sleep is exceptionally bad for them. Besides late eating, which has already been condemned—but indeed adults even ought not to go to bed within less than 5 or 6 hours after eating —late hours and too much excitement tend greatly to interfere with sleep, while proper exercises and proper interests in life encourage it. Children ought to sleep for 9 or 10 hours. These considerations also, it will be seen, agree well with the view that the power to work comes from the power of life, as comes also the power of digestion, or assimilation itself, and not from the food. Assimilation indeed is one of the greatest labours of the body, as it is also the body's primary or fundamental function. It demands the use of much vital energy, inducing the feeling of fatigue 3 or 4 hours after eating, which is often attributed to quite other causes. And also a consideration of these facts shews the unwisdom of taking suppers, which by requiring to be digested after going to bed, put strain and a tax on the organism at the time when it ought to be charging with energy for the work of the next day. And this view, forced on us by a proper consideration of the physiological facts with which we have to deal, falls into line with and corroborates and puts in a new light the opinion of many distinguished physiologists and medical practitioners as to the hurtfulness of suppers and late and heavy meals.

The third function of sleep is to restore the body and give the opportunity for repairing its waste ; but the reader may now think that these functions have been explained in what has been said already. To eliminate waste is not of course the same thing as repairing loss, although they go on together. The restoration of the powers of the body is the only function of sleep usually recognised by the public. Of course the food supplies the material out of which the wastage of the body is made good ; as also the material out of which the increasing bodies of growing children are made and formed, but the time during which many of the processes occur is during sleep ; and the subtlety and refinement and adaptation of the machinery by which they are effected is brought more and more into prominence by examination.

CONVERSATION IV.

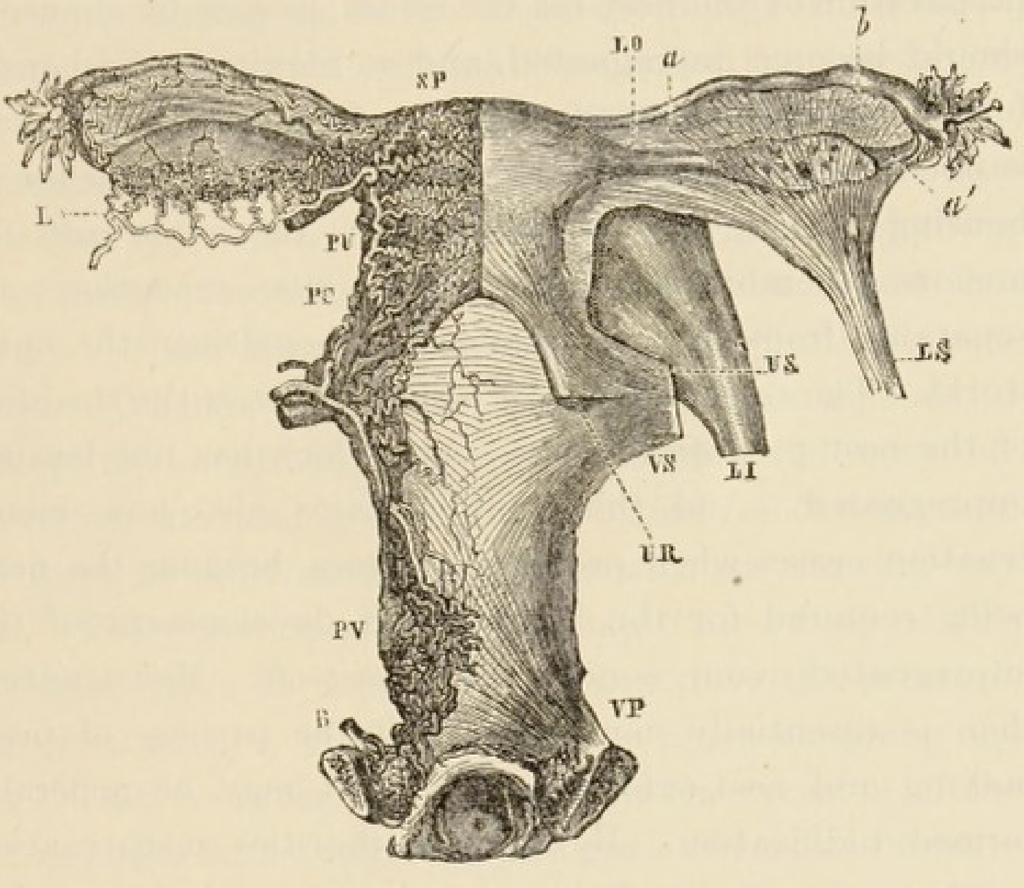
THE SPECIAL AILMENTS OF WOMEN.

We have now dealt with the preliminary considerations regarding women's illnesses, or as many of them as it seemed necessary to consider. We have also considered the facts of digestion and assimilation in reference thereto. And in the last conversation we have come to the conclusion that the sole function of food is to restore the waste which the bodily machine sustains in being made the medium of the conveyance of energy, but that it is not the source either of the energy or of the heat of the body. And we have dealt also with the function of sleep in the body.

We now come to consider the special ailments of women. But, of course, we cannot, in view of all that has preceded, fail to recognise that these special ailments and their occurrence are determined by the same general principles that determine general ailments in women and also general ailments among men and children. There are even a large number of theoretical considerations with a very practical, too often a grimly practical bearing which still demand attention ; but I prefer to allow these to suggest themselves for consideration, as from time to time they will inevitably do, rather than delay any longer coming to close quarters with the special diseases of the sex. Of course the special aspects of these diseases, the consideration that they are local marks of general conditions, and particularly of general nutritional or digestive or assimilative conditions—this general consideration must be assumed and kept in mind always. If the body is, as is certainly the case, a machine pro-created by the human power of life for the manifestation of the various forms of energy such as doing work (erg-dynamic), thinking (noetico-dynamic), and feeling (æsthetico-dynamic) willing (boulo-dynamic), and worship (sebo-dynamic, σέβομαι = I worship), it is enabled to manifest these forms of energy better if the assimilating power (tropho-dynamic) is manifested through a machine or organism in good order. The manifestation of tropho-dynamic is the primary function or power of the human body, while the other manifestations of power are secondary. A phase or form, however, of the power of life (of zoo-dynamic) closely allied to the nutritional, is the reproductive power (what we may term toko-dynamic) with some consideration of which we must now continue.

By the much appreciated courtesy of Messrs. J. and A. Churchill, and of Dr. Agnes McLaren I am able to insert here a copper-plate engraving of the uterus from the work of Professor Courty of Montpelier. For this and for the further liberty to use the very beautiful plate of the pelvic organs and their relations to one another, on page 164, I am glad to return my hearty thanks.

It is well known that from the age of puberty, an indefinite time occurring anywhere between the ages of 12 and 15 years, though sometimes earlier and sometimes later, young girls begin to menstruate, as it is termed, and that they go on doing this at intervals of a month of 28 days until the age of 45 or so. And just as the time of commencement is indefinite (mere infants, though rarely, have been known to menstruate) so is that of cessation, which may occur at any time between 40 and 50 years of age, and has been known to occur both earlier and later than these limits. The function of menstruation lasts on each occasion for about 3, 4, or 5 days. From its occurrence once in 28 days (27 to 29 days sometimes, for no feature of the function is perfectly definite) the function receives its name of menstruation from μὴν= a month. What is the essential characteristic of this function? Much speculation and much discussion has



General view of the vascular formation of the internal genital organs. P.V.—Semi-circular enlargement of the vaginal plexus. P.C.—Cervico-uterine plexus. S.P.—Helicine arteries of the body of the uterus. L.—Helicine arteries of the hilum of the ovary.

taken place on this question, but I think there can be little doubt that the special characteristic of it is denudation or exfoliation from the uterine surface of some of the mucous membrane, the membrane which lines the interior of the uterus. What purpose does this denudation or exfoliation subserve? To understand this we must realise that coincidently with the liberation of an ovum or of ova in the ovaries each month, there occurs a thickening of the mucous membrane lining the interior of the uterus or womb. This thickening takes the form of a velvety increase of the substance of the mucous membrane at the upper part of the womb, and is in fact a preparation of the nest for the ovum, in case by chance it should become impregnated, and so require to be housed for a considerable period of time. If, however, the ovum is not impregnated, and if there is no special need for its housing; then, as a matter of fact, the ovum and the mucous membrane prepared for its reception are separated from the uterus and are passed into the outer world. The essence, then, of menstruation is the shedding of the nest prepared for an ovum which has not become impregnated. And this view explains also how menstruation ceases when pregnancy ensues, because the nest, being required for the housing and development of the impregnated ovum, is not shed or cast off. Menstruation then is essentially connected with the process of nest-making and nest-exfoliation, or what may be generally termed nidification. By some authorities menstruation has been thought to be connected with ovulation, and it has been thought that an ovum or perhaps several ova were thrown out of the ovary once a month. Very likely this function of the ovaries is periodic in this way and at this interval of time, but it is now thought to be more than likely that the ovaries are always throwing off ova independently of the occurrence of the menstrual period. If one ovum were specially maturated and exfoliated, or shed once a month, we should rather expect to find a series of ova at progressive stages in the ovaries on those occasions when we might accidentally have the opportunity of examining them, as we do eggs in the oviduct of the hen. Nothing, however, of the kind has been observed. Some again have thought that human menstruation was analogous to the oestrus or rut of animals; but this is certainly not the case. If, then, menstruation is not specially connected with ovulation; if it is not analogous to the occurence of rut in animals; and if it is connected with nidification or the exfoliation of the nest prepared for the reception of a possibly impregnated ovum, is there anything else which we can say about it? Is the occurrence of hæmorrhage or bleeding an essential characteristic of the exfoliative condition? Hardly. Exfoliation is constantly occurring in the human body. When we wash our hands, a certain amount of skin epithelium, dead, condensed, done with, and incapable of further functioning comes away by insensible degrees in the form of scurf, and disappears without showing any sign. The presence of corns is simply an excess of this epithelial tissue hardened and thickened by the pressure, it is often alleged, of tight boots, too much confining the feet. This, however, while it may be the occasion of the occurrence of corns, cannot be the cause of corns. Pressure of tight boots ought really to thin the skin, not to thicken it, and it becomes thickened only, or at least mainly, because patients suffering from corns and from general rheumatism and goutiness of the feet have persistently ingested into their economies more food than they needed and more than they could assimilate. In such circumstances, the defence of the organism against the pressure becomes excessive, and in place of mere hyperaemia, or increased vascularity leading to repair, gouty thickening occurs, and corns more or less thick form. These overgrowths or thickening of the epithelium may even become dangerous, many persons known to the writer having suffered from inflammation of the feet on attempting to trim their corns, and one or two having lost their lives through the occurrence of inflammation starting at a wound in the corn, and spreading in a deep-red crimson congestion up the leg, and causing actual death of a portion of the limb and poisoning of the whole system. Hæmorrhage, it is true, does not occur in these conditions, because the inflammatory congestion and exudation blocks up the small vessels and their surrounding connective tissue. But it is quite obvious that had not the gouty condition preceded the corn and the inflammation, and had not the gouty condition been induced by the persistent ingestion for a long time previously of too much food (and perhaps drink also in some cases) into the body, no inflammation and no pain ought to have been experienced when mere exfoliation was taking place. And this consideration leads me to suggest that while exfoliation of denuded mucous membrane is the essence of menstruation, exfoliation should not be accompanied by hæmorrhage, or at least should not be accompanied by any appreciable amount of hæmorrhage. There is a good deal of evidence for the truth of this view, strange perhaps as it may appear. In the first place, impregnation may occur in the condition of amenorrhœa, as it is called, that is when for months previously no visible menstruation has occurred. And when impregnation occurs in such conditions it will be apparent how difficult it may be to forecast the time of parturition, since there is nothing to count from. But there is no evidence in these cases that ovulation has ceased, or that denudation of the mucous membrane of the upper part of the uterus (for the mucous membrane of the cervix or neck of the womb does not take part in the process) has failed to occur. In fact the occurrence of pregnancy shows that ovulation must have being going on before impregnation occurred, and, this being so, some amount of denudation must most probably have been going on also.

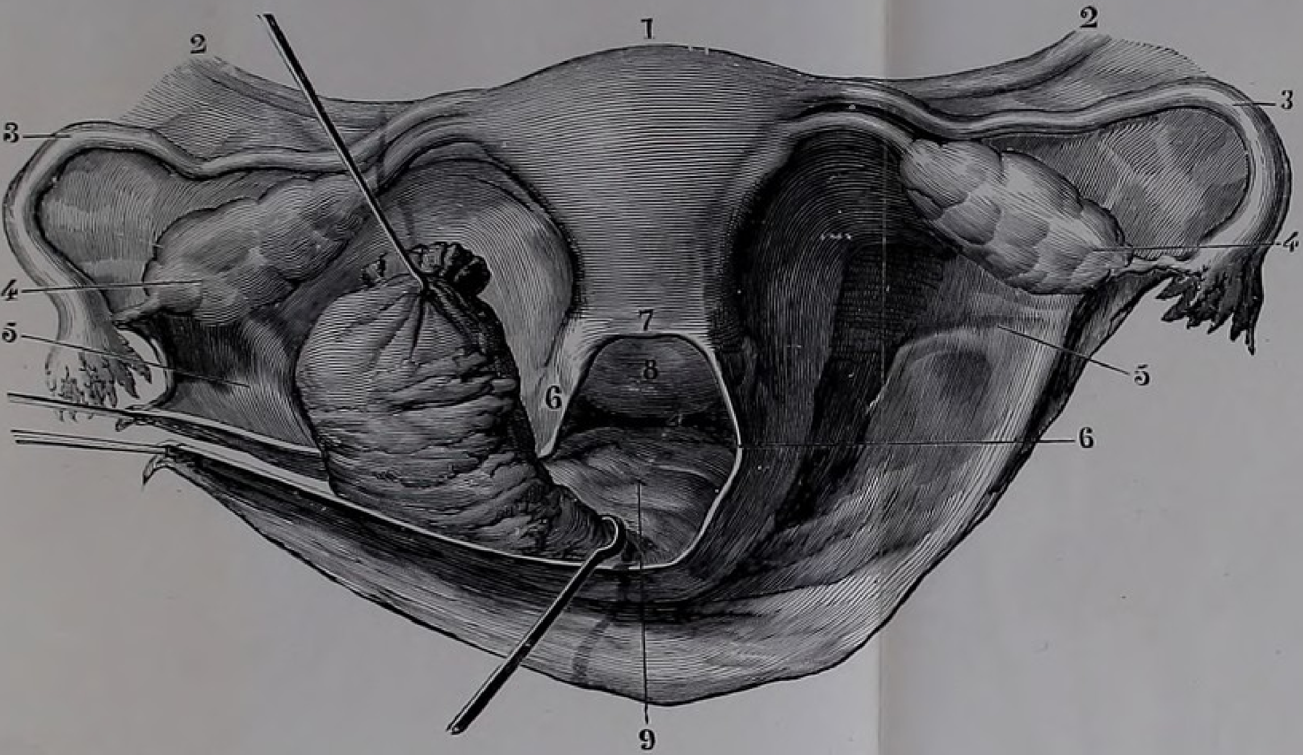
The process of nidification conducted by means of denudation and exfoliation of the thickened mucous lining of the uterus is confined to the upper portion of the womb, the body and fundus, as they are called, the parts above the cervix or neck of the organ. The mouth and neck of the womb take no part in nidification or nest making. That they are congressional organs only is shown by the remarkable fact that the longitudinal elements of their structure are situated inside the transverse or circular fibres, and not outside, as in all the other tubular structures of the body. The usual arrangement obtains in the fallopian tubes and in the fundus and body of the womb itself, whose function plainly is therefore to pass the ovum on from above down till it reaches the uterine cavity, where its progress is arrested by the thickened velvety bed of mucous membrane prepared to receive and house it. And if there it meets with its companion element, brought in from the outside by structures specially adapted to the purpose, impregnation occurs; and the nest duly prepared is used as a house for the developing ovum during the appointed time. And it is surely a further fact, not without profound significance, that in most cases where disease occurs in the womb it begins in the congressional mouth and neck and not in the nidifying body and fundus. And we can further see if we wish to, how, if the impulse from without is too strong, the centripetal action may even be carried so far as to overcome the centrifugal action of the fundus and fallopian tubes, and by introducing the spermatozoon into the body-cavity lined by peritoneum give rise to impregnation outside of the womb altogether or to extra-uterine gestation as it is called. Each reader for herself must ponder well the moral significance of these profoundly moving facts and hear, as she will do if she listens for them, the voices which the dumb forces of nature address to her on the subject of self-government and self-control and the dignity and spirituality of the body. And members of both sexes may hear, if they listen for them, the dumb voices, which, through the felt if unheard suggestions of nature, cry aloud to both of us alike. Toko-dynamic like Tropho-dynamic, shouts aloud with no uncertain voice that if we do not keep the body under it will assuredly keep us under and even destroy us. In this domain also, as in all others appertaining to the actions of the body, not only may abnormality be shown by excess of function, by defect of function, and by irregularity of function, but even by perversion of function. And if excess of function is generally caused by over-stimulation and over-nutrition of the longitudinal elements of structure ; if defect of function is generally caused by over-stimulation and over-nutrition of the transverse elements ; and if irregularity of function is generally due to over-stimulation and over-nutrition first of one and then of the other, how important is it that these processes should be rectified before complete perversion of function shall set in. If I were to prosecute this subject further I should be transcending my province by entering the spiritual region ; but a physiologist may not unreasonably be allowed to point out where and how the one domain marches with and forms the frontier line, to transcend which involves crossing over into the other. The highest interests of unborn generations are most deeply bound up with a proper regard for these considerations, and there I must for the present leave them to the judgment, conscience, and imagination of my readers.

But if, so far as we have yet considered the subject, it seems reasonable to conclude that hæmorrhage or bleeding need not form an essential feature in menstruation, the next consideration that strikes us in our attempt to understand the nidifying or nest-making function is this. In treating young women for long-continued indigestion, the menstrual flow often ceases for a time, as it likewise often does in anæmia. Yet there is no evidence that either ovulation or some amount of exfoliation ceases. The fact which seems conclusively to prove the truth of this view is that when young women in this condition marry they become mothers just as readily as their more regular sisters. The treatment of the amenorrhœa in such cases may generally be left alone, since patients generally recover ; and if the treatment of the dyspepsia has been effective, when they do menstruate they either see scarcely any hæmorrhage, or if they do, there is no pain at the menstrual period. It is a happy thing for a woman when all the evidence she has of the occurrence of menstruation is a mere staining of the linen and no pain at all. Alteration of the diet in these cases, which is necessary to cure the dyspepsia, has coincidently made all the parts and functions of the body healthier, and such women lose their menstrual pain. The view then which I would put for the consideration of my readers is that denudation or exfoliation of the mucous membrane of the uterus and not hæmorrhage is the essential feature of human menstruation. If there is any hæmorrhage it should be the merest staining, and there should be no pain. Any hæmorrhage beyond this very small amount is pathological, and requires treatment, just as hæmorrhage occurring anywhere else in the body requires it. Now to say this is equivalent to saying that a large proportion of women from 15 to 45 years of age are unhealthy, which is a serious thing to say—but is it not true? When one gets to know much about them, is it not true that, besides suffering much misery at the periods, they also suffer in a large number of cases from indigestion, anæmia, colds, influenzas, headaches, neuralgias, backaches, fatigue without adequate cause, and other ailments? If it should be said—well, do not men suffer also from a large number of ailments? The answer to this is: men suffer also no doubt from many things, though hardly to the same extent as women. But even if they did, two wrongs would not make a right; and we have Mrs. Poyser's authority for the statement that the women were made to match the men. Men and women are all unfortunately much less healthy than they ought to be. From the physiological, no less than from the spiritual point of view, it is too true that we may say "there is no health in us." And the anæmic (catatribæmic or triphthæmic?) woman and the neurotic woman generally aches in every part of her body, from the crown of her head and the back of her neck right down the small of her back to her ankles, while her breast bone and the articulations of the ribs thereto ache so obscurely that she cannot walk or breathe without pain, and so constantly that she often bursts into tears because she is so unintelligibly and inscrutably and unspeakably miserable that she does not know what else to do. And then perhaps she is told that she is hysterical, instead of being told what she ails and how to get rid of it. It is worth our while to attempt to understand this too frequently occurring condition in women. As is well known, it is often called hysteria and it is more than hinted that the ailment is not real at all but only imaginary. In proof of this it is pointed out that the women suffering in this way are quite well, laughing and perfectly happy at one time, while shortly afterwards they may be depressed, crying, and utterly miserable, and that this state may be speedily followed by one in which they feel quite well again. No doubt in many of these cases moral control is more to be depended on than medical treatment, and the most hopeful appeal is one to the better nature of the sufferer. But there are other cases, and especially among older women, where the sufferers are really ill, and where they ought to be treated accordingly with tact and kindliness and insight. I believe that in conditions such as we are now considering there is congestion of the connective tissue, that tissue which connects one part of the body with another, and every part of the body with every other. I have suggested that it should be known under the name of Initis (from ἴς = *vis* = strength), because it seems to me to be an affection, usually congestion and sometimes inflammation, of the strong or connective tissues of the body. The names by which it is known are so many and various that this fact alone is sufficient to raise in our minds the question whether it is properly undertsood. Besides the general name hysteria (from ὕστερον = the uterus or womb), the name given to the affection because it was thought that in some obscure manner it was connected with derangements of that organ, numerous other names have been given to it. It is often called anæmia from the pallor usually accompanying it, as also because menstruation often ceases when it sets in. Sometimes it is accompanied by various neuralgias, as of the supra-orbital and infra-orbital or other nerves about the face and head, and then it may be termed neuralgia or sometimes rheumatic neuralgia, and sometimes again neuralgic rheumatism. Again, because it is often accompanied by severe headaches manifesting themselves at intervals, it is often called megrim, or perhaps sick headache, or nervous headache. And because not infrequently the women are sick and actually vomit during the attacks, they term them bilious attacks. Not infrequently the slightest knock or bruise, as from knocking against a piece of furniture in passing, causes black and blue marks in a day or two afterwards; or the same affect may be produced by a hand-grasp, the finger-marks appearing next day or the day after, even although no violence has been offered. This condition is called peliosis or pelidnosis (πελιὸς = blue), because persons in this condition so easily become black and blue. The connective tissue is in fact so friable and weak that on being subjected to the slightest strain it tears or ruptures; and, as very fine capillary blood-vessels are ruptured at the same time and fine hæmorrhages take place under the skin, we have the dark blue colour accounted for, which afterwards becomes yellow as some of the colouring matter of the blood is absorbed, and then green before absorption. In some cases designing women have shown these marks as proofs of cruelty or violence, when they were proof only of excessive weakness and tearing of the connective tissues of the body such as might have occurred if they had hurried slightly to catch a train or for other purposes. Signs and symptoms of this affection are mingled in almost inextricable confusion; signs such as peliosis, vomiting, or pallor, or laughing and crying in alternation, which can be observed by others; and symptoms, such as fatigue without adequate cause, feeling of sinking, and general and indescribable misery, headache, backache, and general ache felt only by the sufferer herself. As to the name hysteria connecting the affection with the uterus or womb, it is quite improper, because the affection, although far commoner among women, is not unknown among men. The name initis, by which I suggest that it should be called, is perhaps now the best that can be given to it. Properly speaking the name ought to be syndesmitis (from σύνδεσμος = a band), but syndesmitis has already been applied to inflammation of the ligaments of joints; and it is hopeless, or at least most difficult, to apply even to a better use a name already appropriated to another. The term initis would direct our attention to the fact that the connective tissue is congested in many places in the body —sometimes it would even seem as if it were so in all. And the importance of this condition and its gravity is shown not only in the fact that the women suffering from it are tender wherever they may be pressed anywhere in the body, in the back of the head and neck, in the back, over nerves, muscles, bones, and joints, anywhere and everywhere in the body; but in the further fact that most grave and even sometimes incurable conditions arise at a subsequent stage of life, which start from the basis of this general congestion of connective tissue.

The following plate is also inserted by the permission of Messrs. J. &. A. Churchill, and of Dr. Agnes McLaren, from Professor Courty's Diseases of the Uterus, &c. It displays very well the general appearances and the general relations of the reproductive organs concerned. The view is from behind.

From this general view it will appear that three organs are mainly involved in the facts which we are now engaged in studying. These are :—

I. The ovaries (4.4.) lying on each side of the pelvic cavity or lowest part of the abdomen. These produce or liberate the ova which are passed, one or more at each menstrual period, if not at other times also by means (II.) of the fallopian tubes (3.3.) to (III.) the uterus or womb or nest (1). The ovaries may be considered as the generators or at least as the liberators of ova ; the fallopian tubes as the conveyors of ova ; and the uterus or womb as the nest of the ova, the place where they lie, become attached, and are maturated or ripened. The ovaries and fallopian tubes are loosely fixed in the lower abdominal or pelvic cavity by means of what are called the broad ligaments and their prolongations, the whole being made of layers of peritoneum, and being prolongations of the general peritoneal membrane which lines the whole of the abdominal cavity and forms a covering for all the abdominal and pelvic viscera. Besides the peritoneal covering forming the broad ligament, the ovaries are covered with a fibrous coat, inside which ova are formed. The ova rise to the surface of the ovary, and from this point are passed into the fallopian tubes. As will be seen from the plate, these are tubes between three and four inches in length which pass to the uterus. They enter the substance of the latter organ at each upper *cornu* or horn of it, as it is called ; but the other or ovarian end of the tube has a peculiar relation to the ovary. It is not in anatomical continuity with it, but loosely embraces the ovary, having a dilated end (called fimbriated) which on being congested swells out and embraces the ovary and receives, if there be one separated, an ovum



1. The Fundus or top of the uterus.
2.2. The round ligaments.
3.3. The Fallopian tubes.
4.4. The ovaries.
5.5. The posterior folds of the broad ligaments.
6.6. The continuity of the posterior folds with the peritonial folds called Douglas's ligaments.

7. The utero-sacral or utero-lumbar ligaments, the principal means of suspension of the organ contained in these peritoneal folds, passing off from the upper third of the cervix to the bony pelvis.

8. The vagino-rectal *cul de sac* formed between Douglas's ligaments by the reflection of the peritoneum from the posterior side of the cervix; and

9. Of the vagina to the anterior side of the rectum or lowest part of the bowel.

or ova from the ovary. Once in the fallopian tube, the ovum easily passes into the uterus, although various accidents may occur, in the passage of the ovum to the womb, owing to the structure and relations of the ovaries, fallopian tubes, and uterus to one another, with which I need not trouble the reader. One or two features, however, connected with the structure of the fallopian tubes should be mentioned, as they bear on remarks already made in previous conversations. The fallopian tubes are constructed, as we have already seen to be the case, with other tubular structures of the body, of two sets of fibres or structural elements, a longitudinal and a transverse or circular. Obviously, contraction of the former will shorten and widen the tube and allow of the easy passage of an ovum along. On the other hand, contraction of the transverse or circular structures of the tube will narrow and lengthen it and make it more difficult for an ovum to get along. Now as congestion of all the parts concerned occurs at menstruation or denudation time, and as congestion is coincident with increased functional activity, it is easy to see that over contraction of the circular elements of the fallopian tube may so narrow the tube as to allow the ovum to pass with much difficulty; and pain may be caused through too tight contraction of the circular or transverse elements of the tube, causing even sometimes a kind of cramp or muscular spasm in it. As, coincidently, the transverse elements of the uterine tissue are also thrown into contraction we have the anatomical and physiological conditions which lead to painful menstruation or dysmenorrhœa, as it often called. From what has before been said in Conversation I. the reader will see how over-contraction and over-congestion of those transverse elements is connected with the general nutrition, and will therefore bear in mind its connection with digestion and assimilation, and with dietetic habits which might not seem at first sight to have had much influence on it. But in treating the ailment, obviously one of the most important factors must be dealing with the general nutritional causes. Dysmenorrhœa, or painful, and perhaps somewhat scanty menstruation, being thus accounted for by over-contraction of the transverse or circular elements of the tubes and womb, what will happen if over-contraction of the longitudinal elements occurs ? Obviously the tubes will be shortened and widened, and the ovum will be hurried along the tube. But coincidently with over-stimulation and over- contraction of the longitudinal elements of the fallopian tubes, contraction of the longitudinal elements of the uterus also occurs, the fallopian tubes being really prolongations of the uterus. The effect of this must be to aid in widening the uterine vessels, and blood will be thrown out of them to a greater extent than natural. This condition is called menorrhagia or excessive loss of blood at the period. In some cases it amounts to flooding or very excessive loss ; and may even become dangerous. We thus connect dysmenorrhœa or scanty or painful menstruation with over action and often over growth of transverse elements of structure in fallopian tubes and uterus ; and on the other hand we learn to associate excessive loss of blood and flooding, with over-stimulation and over-contraction, and over-growth of the longitudinal elements. These are just the same conditions as we saw before when considering the occurrence of constipation and diarrhœa in the intestine, or pallor and blushing in the vessels of the face ; and we see how the same proximate causes underlie all these functional disturbances. And of course my chief reason for referring to them is to emphasise the great importance of so managing the general nutrition as that there shall be no excess of growth and no excess of stimulation either to the transverse or to the longitudinal elements of structure. Also perhaps the reader may be induced to see what is so plain to me, viz.: that nothing in the functional changes of our wonderful bodies happens by chance or at haphazard, but everything in relation to law and plan and purpose and adaptation. By stimulation of transverse or longitudinal elements we see how any function may be altered. The *property* of contraction (or, as I prefer to say, the need for contraction, in the purposes of life leading to the insertion of the structures fit for its performance) connected with the constitution of the elements translates itself differently in accordance with the *connections* of the structures; and so we find alterations effected in the most interesting ways.

The uterus itself, like the larger hollow viscera of the body generally, is made up of transverse, longitudinal and oblique elements; and their action is just the same as in those other parts, regard being had to the different functions which each part serves to perform. The mucous membrane lining the uterus, however, is remarkable for the large number and for the arrangement of its muscular fibres. There is a great hypertrophy of it. It is called the *muscularis mucosæ*, or the muscular layer of the mucous membrane, and it is it which forms the greater part of the thickness of the uterine wall. These muscular structures consist of bands of fibres disposed with comparative regularity in its upper part, being arranged there in numerous concentric rings round the openings of the two fallopian tubes, the widest series of the two circles meeting from opposite sides in the middle of the womb. Lower down they form the so called sphincters of the inner and outer mouth of the womb. At the neck, however, there are also longitudinal fibres within the tranverse, the reason and meaning of which we have already seen. We have now, however, to realise a further reason for the arrangement of the longitudinal fibres within the transverse and a highly important one it is. At parturition the first step in the expulsive process by which the living child is ushered into the world is opening up of the mouth and neck of the womb. The portion of it between the outer os or mouth and the inner os, that is the cervix or neck of the womb, opens up so completely as to disappear. Now the mechanism by which this is effected is the very arrangement of the longitudinal fibres within the tranverse which has been described. When the longitudinal fibres contract in response to the first impulse in the parturition process, obviously the effect must be to open up and to make to disappear that portion of the mechanism known as the cervix or neck of the womb. This process is known by the name of the development of the cervix, although as good a name or even better might have been the temporary annihilation of the cervix. If the longitudinal fibres had been outside, and the circular fibres inside, as in other tubular structures of the body, this development or temporary annihilation of the cervix either would not have occurred at all, or would have occurred with much more difficulty; and so the preparations for parturition would not have been so complete and perfect as they are. But that form or aspect of zoo-dynamic or the power of animal life which we may term toko-dynamic so arranges things, so builds the structures, as that the way shall be prepared for parturition when the fulness of the time shall come. If zoo-dynamic and toko-dynamic are blind and unconscious, who can fail to see that they are blind and unconscious instruments directed by a power that knows and foresees and adapts? It may be said—Yes; but how easily are these provisions and adaptations upset. Truly: they may be interfered with by mal-nutrition; but if nutrition is under the government of the power of life, and if the person does not exercise the lofty function of self-government, and if, at parturition pain and laceration follow in place of gentle and intermittent dilating and stretching—well, who is at fault? If the user of the machine, if the tenant of the well adapted house, misuses and mismanages her house—well, who is to blame when things go wrong? Let us at least be quite sure that we have done all that in us lay before we lay blame elsewhere, and talk, as we are so apt to do, of the cruelty of nature. This arrangement of the longitudinal fibres within the circular in the cervix uteri in place of the reverse arrangement which obtains in other tubular structures in the body, turns out when examined to be of the most extreme importance in reference to the purposes for which it is adapted.

At each menstruation remarkable changes take place in the mucous membrane lining the womb, a complete removal of its superficial part occurring by a process of softening and molecular disintegration. This commences, as also does the menstrual discharge, close to the neck of the womb, and advances progressively towards the top or fundus of the organ (unfortunately fundus means bottom in Latin, so that there is apt to be a little confusion here—but it is the rounded part with the two horns receiving the fallopian tubes which is meant by top or *fundus*). This goes on during the normal time, three or four or five days of the flow. At this time there is a considerable increase of vascularity or what may be called congestion, the mucous membrane becoming a good deal thicker than usual. The flow of blood ought to be very slight and quite painless, but such as it is, it is the direct consequence of the open condition and of the destruction of the small vessels. And on the other hand the restoration of the mucous membrane, which begins even before the cessation of the menstrual flow, proceeds in the same order, from the lower end upwards to the top. The restoration consists essentially in a very rapid proliferation of the cells and nuclei which occupy the interstices of the inner muscular fibres. The mucous membrane lining the neck of the womb does not take part in the changes described. In gestation, as may be readily imagined, great changes occur in the womb. How great these are may be more readily appreciated if we consider that in order to form a fitting nest for the growing living contents, the womb has to increase from a weight of about one ounce to from two to three pounds, and from a length of three or four inches to from thirteen to fifteen. The muscular structures competent to expel these living contents when the fulness of the time shall come, increase coincidently, and in due time perform the purpose for which they were so markedly developed. Still, do transverse, longitudinal and oblique fibres grow and enlarge, fitted as in other parts of the body, and in various forms of animal life and development and evolution, for the purpose they have to fulfil. The arteries are made curly or helicine as appears in the plate on p. 153, in order that it may be possible for them to lengthen, as the enlargement of the structures occurs in pregnancy. Even those—and they seem to form the large majority of scientific men—who admit no plan or purpose, speak of the adaptation of these means to the end, and admit the similarity of the means to the achievement of the ends throughout the various forms of the animal kingdom.

Supposing now that pregnancy does not occur and that it is a question of the existence of menstruation simply, the longitudinal elements of the fallopian tubes go into contraction simultaneously with the longitudinal elements of the uterus itself, while the transverse elements of both work simultaneously when their turn comes. And of course the longitudinal elements of both act alternately with the transverse elements, so that we are again reminded of the rhythmic and peristaltic and intermittent action that we saw before in considering the movements of the earthworm. In normal circumstances these changes occur naturally and painlessly, and we know nothing about them, except from the occurrence of events which we cannot overlook. But when pain accompanies these events, I hope the reader, when considering the occurrence of this discomfort in herself or any of her sisters, will be stirred to connect them with over-stimulation either of the longitudinal or of the transverse elements of the tissues of the parts affected, and I hope that she may be further stimulated to inquire how it was that this over-stimulation and over-contraction should occur. When we have connected in our minds over-stimulation with over-nutrition then we see the true nexus of events. And as nutrition is closely connected with digestion, we see that relief from pain and discomfort in these and other parts is to be obtained as much or even more from efforts to set the general nutrition right, than from topical and local applications, whose employment however may be useful as means contributory to that end.

THE GENERAL LAW OF DISTURBED FUNCTION IN THE BODY.

It is now, however, time to state the most general law as it appears to me to be, of disease or disturbance in the human body. It is this : Physiological disturbance takes the form of

(*a*) defect of action ;
(*b*) excess of action ; and
(*c*) irregularity of action ; to which must be added
(*d*) perversion of action.

Defect of action usually coincides with over-stimulation and over-contraction of transverse elements of structure. Excess of action coincides with over stimulation and over-contraction of longitudinal elements of structure ; while irregularity of action coincides with the alternate over-stimulation and over-contraction, now of the one and then of the other. These changes occur or may occur in any and in all of the structures related to all the various functions of the body. They are immediately related to the general nutrition of the transverse and longitudinal elements and therefore are intimately dependent on the changes that occur in what we have already considered in Conversation I. when discussing the proximate causes of disease. And as these changes are effected by changes in the blood-supply, which changes are intimately connected with nutrition, we are again compelled to bear in mind their connection with the great functions of assimilation and digestion. Stimuli to transverse and longitudinal elements are no doubt conveyed along the nerves that are in relation to them ; but those nerves act properly or improperly mainly as they are well or ill-nourished by blood, so that from all points of view we are compelled to keep in mind the importance of the nutritive function ; which is the primary function of the body. It will be well to take some illustrations of these different disturbances. I have already instanced constipation and diarrhœa as being coincident, the former with over-contraction of the transverse elements of the intestine which is in consequence so narrowed that it with difficulty allows anything to pass. Diarrhœa, on the other hand, is coincident with over-contraction of the longitudinal elements. As the effect of this is to widen and shorten the bowel, the contents are hurried along, and we have diarrhœa. And when there is alternate contraction in excess, of transverse and longitudinal elements, we have irregularity of action, and an alternation of constipation and diarrhœa.

In anæmia again (better perhaps called triphthæmia or catatribæmia from τρίβειν to waste or rub, because the blood is loaded with waste matters from the digestion) usually associated with pallor and constipation, we find the condition coincident with over-contraction of the transverse elements of the blood-vessels and of the intestines. The whole connective tissue also is contracted or shrunk, but it is not possible to distinguish here between the condition of the transverse and longitudinal elements of the connective tissues, because the meshes of the connective tissues and the strands that form them go in all directions simultaneously. In obesity, on the other hand, usually, though not by any means always, associated with more colour than anæmia, even with a florid colour sometimes, and generally easy action of the bowels, we can attribute these conditions to over-contraction of the longitudinal elements of the vessels and of the intestine, and probably, if we had the means of isolating them, of the longitudinal elements of the connective tissues also. When pallor and anæmia and constipation alternate too rapidly with obesity, floridness and ease of bowel-action, or with diarrhœa, these conditions can be accounted for by over-action alternately of the transverse and of the longitudinal elements of the tissues concerned. Here, therefore, we find three states, defect of action, excess of action, and irregularity of action. Perversion of action occurs when an action that ought to be centrifugal becomes centripetal ; or *vice versa*, when an action that ought to be centripetal becomes centrifugal. In the former condition the body absorbs when it ought to eliminate ; in the latter it eliminates when it ought to absorb. As perversion of absorption usually takes the form of absorption by the body of its own excreta, it may be dimly felt what a horrible state this is. And as the elimination of what ought to be absorbed wastes the means of life, or the means through which life is manifested, it will be seen that this also is a very serious condition. And yet even then in both of these conditions, there may still be hope because *e.g.* fœcal vomiting and also hæmorrhage may be steps, if painful and trying ones, towards cure.

Take as another illustration the changes that occur in the rate of the circulation of the blood and in the heart's action. Over-contraction of the transverse elements in the heart and vessels leads to the production of a slow pulse down to fifty or forty a minute, or occasionlly even a slower rate (even twenty sometimes). The state of inhibition may be so great as to threaten to put a stop altogether to the heart's action. On the other hand, over-contraction of the longitudinal elements of the heart and vessels leads to too rapid a rate of the circulation ; while over-stimulation alternately of the transverse and of the longitudinal elements leads to a too slow pulse rate, alternating with a too rapid rate, which, being translated, is the chief form of irregularity of circulation.

I hope the reader is not tired of these illustrations from various functions, of excess of action, defect of action, and irregularity of action, and of their being associated with over-stimulation and over-action of longitudinal and of transverse elements, and of over-action affecting the two alternately. As I have a highly practical aim in view, I shall venture to give one or two others which are at once very common and very interesting in themselves. In the case of the kidneys also we may have scanty and high-coloured excretion, coinciding with over-contraction of transverse elements in the renal vessels and renal tubules. And on the other hand we may have excess of excretion, coinciding with over-contraction of the longitudinal elements, and these conditions may be followed by irregularity, when alternate over-contraction of transverse and longitudinal elements occurs, periods of scanty high-coloured urination alternating with periods of more free and abundant and generally lighter-coloured excretion. In perversion of renal action, the contraction of transverse and longitudinal elements, in place of occurring from centre to periphery, from the kidney to the ureter and bladder, takes place in the opposite direction, from periphery to centre ; and so, material being absorbed which ought to be expelled from the body, poisoning occurs, too often ending in convulsions and death. The corresponding perversion of intestinal action may be observed in cases of obstruction of the bowels, where contents that ought to be expelled from the intestines in the natural way find their way out through the mouth, a horrible condition that, unless immediately relieved, speedily proves fatal also.

Or take the function of respiration. This may be too rapid, as in the feverish state, or too slow, as it often is in states of depression; or it may be irregular, as in what is known as Cheyne-Stokes respiration, when a succession of short, shallow, and somewhat rapid inspirations is followed by a long pause, after which the same disturbed round re-commences. As the pathological state accompanying the occurrence of the physiological change is over-distension of the air-cells or emphysæma, and as this state essentially depends on over-contraction of the transverse elements of the lung-tissue, the law of the action can be plainly seen and the similarity of its action in this and other parts of the body made out. Cheyne-Stokes respiration is frequently a precursor of death. In the disturbance of respiration known as asthma, undoubtedly we find over-stimulation and over-growth of the transverse elements of the bronchial tubes and of the air-cells preponderating, because the pathological condition found is one of over-distension of the air-cells. The air gets in through inspiration which is increased in strength and frequency, but from over-growth and over-contraction of the transverse elements it is prevented from getting out easily, and, the longitudinal elements giving way, in time the air-cells become over-distended in the asthmatic condition. It is rather a curious thing—but the explanation is what has just been described—that the asthmatic thinks he cannot get breath, while in point of fact what happens is that he cannot easily get rid of it; and so the air remains in his air-cells loaded with carbonic-acid gas and actually poisoning him. Slow and deliberate expiration frequently repeated will often succeed in stopping an asthmatic paroxysm.

As regards disturbances of function sustained by the nerves, we note again the three changes of defect of function when the nerves are numb and dulled in sensibility; of excess of function when they are painful, or when we feel too acutely by means of them; of irregularity of function when they are alternately numb and painful, or when as sometimes seems to happen, they seem paradoxically to be both numb and painful at the same time. In this connection I should like to put before the reader the view that while knowledge of perception is largely attained by us through the functioning of the nervous system, sensibility or response belongs to all tissues, and in particular that the connective tissues act as the organ of common sensibility. The connective tissues are so called because they connect all parts with all parts, and the response of the connective tissue, with its ubiquitous strands, probably is the means by which we realise organic unity and feel that our bodies with all their parts form each one organic whole. While knowledge of this feeling is attained through the action of the nervous system, the feeling itself comes to us through the response of the connective tissues. The sensibility of the connective tissues also, may, like that of all other structures, be altered in the direction of defect or numbing of the feeling; of over-sensitiveness or increase of it; and of irregularity of response, the connective tissues being at some times too little responsive or numb, and at other times too acute or sensitive or even painful. The part played by the connective tissues in the working of the body has not received anything like the attention which it merits. Universally distributed throughout the body; covering muscles, bones, nerves, and joints, and forming the coverings of viscera, not only is it the organ of common sensibility or response, but it is the organ through which we experience the feeling of being well or ill. Feeling of general well-being arises when the connective tissues are in good order. Feeling of backache, headache, and aching of the limbs, and of malaise generally, arises when the connective tissues are congested. And it is these tissues which are mainly the seat of rheumatism. Rheumatism is in fact congestion of connective tissue somewhere in the body; and often enough it is inflammation of connective tissue. Sometimes suppuration and death or necrosis of portions of connective tissue occurs, as when death of sub-cutaneous tissue takes place, or death of portions of tendons or ligaments occurs. When the dead parts are thrown out (usually with severe and very painful inflammations of the surrounding parts) the contraction that afterwards takes place leaves gaps and puckerings and depressions that are never filled up. Erysipelas of the skin very often accompanies or is indeed part and parcel of connective - tissue - inflammation, or initis as I propose to term it. In rheumatism, influenza, and anæmia this tissue is affected par excellence, and it is through it that the anæmic girl aches—as does also the so called hysterical girl very often from the crown of her head and the back of her neck and her back down to her ankles. It, like other tissues, may suffer from defect of function, from excess of function, and from irregularity of function. And apparently it may suffer from perversion of function, as in those cases where, in place of separating the lymph from the blood and carrying it into the lymph ducts to the lymphatic glands, the lymph seems to be re-absorbed again into the connective tissues, and the patient shrinks down into a lethargic shrunk state with a yellowy-green-grey colour of skin indicative of the most profound alteration of the blood itself and of the gravest illness, from which there is generally no recovery.

THE COMMON DISEASE: MORBUS VULGARIS.

This is the fittest place to describe a condition of body that human beings and especially women are apt to get into and which affects a large number of persons. So common is it, that I think nine out of ten women who come to the consulting room suffer from it to a greater or less extent, as also do those who present themselves for treatment in hospitals. So frequent is it that I have come to note it as the common disease. It consists in a large variety of symptoms generally known as "neurotic." Women will say that they feel generally ill. They are tired without adequate cause. They are irritable. The least noise grates upon them and puts them about. Various mental symptoms disturb them also. They will say that they hear and understand what is said to them but that it seems to make no impression on them. They cannot brace themselves to do things which they know they ought to do. And so on. There is a large number of indefinite symptoms. Some of these women become black and blue without sufficient cause. Besides the peliosis, whose explanation has already been given, various other symptoms appear, and among them various mental perversions also occur in this state, exaggerations of trifles on the one hand and perhaps minimising of important things on the other. A certain want of scale and of sense of proportion is manifest, often flightiness and uncertainty of character. Such women often parade their black and blue marks as proofs of ill-treatment, for some of them seem to glory in finding grievances, and seem indeed to be unhappy unless they have them. As we have seen, various names have been given to the condition. A few sufferers actually become insane and have to be sent to asylums, and some commit suicide. It is these cases of course which justify the common term neurotic as applied to the condition; and I do not say that the nerves are not affected, because often enough they are. But if we examine these women we find them tender everywhere. In fact we can hardly touch without hurting them. Their limbs are sore to touch, the back, the back of the neck, particularly the back of the head, which is often both numb and tender at the same time, indicating the co-existence of two states more or less incompatible with one another. Then the jaws are tender, so that the women ache when they eat and sometimes even when they talk. Also the breast-bone and the ribs are sore, as also are the joints between the ribs and the breast-bone, particularly the fourth, fifth, sixth, and seventh left. The back of the breast-bone (if we could reach it) is also congested and tender. From it two bands of connective tissue, the *trabeculæ cordis*, pass backwards to the *pericardium* or *fibro-serous-sac* in which the heart is contained, and as these are also congested and softened, the pericardium becomes affected and in time even the heart itself. And as coincidently the sympathetic ganglia which govern the heart's action are affected, as well as the sheaths of the branches of the pneumo-gastric nerve, the heart's action is disturbed and palpitation sets in. Evidently the conditions are serious. It is all very well to say that they are functional and not organic. This may be so, and no doubt is so at first. But by-and-bye the functional disturbance becomes organic disease, and slowly, persons who have been assured that their hearts were sound find that they are not so. The heart may be pronounced to be diseased by a strange doctor whom they have been induced to consult, and the information comes on them as a surprise, perhaps to the detriment of their own medical attendant. But both statements are true. The heart was not "affected" some years ago; and it is affected now. The affection has come on insidiously through long-continued malnutrition.

Women finding themselves in this miserable condition, with the obscure pain and aching described, unable to walk or work, naturally from time to time burst out crying, so wretched do they feel, especially as they are unable to locate their ailments and indeed often are unaware until it has been pointed out to them that they do ache so universally, and are so tender in so many parts of the body. The tissues specially affected are the connective tissues, forming the coverings of nerves, bones, joints, and muscles, which parts, it may be observed, form the locomotor system of the body, which aches therefore with every movement, however slight. But the connective tissues got into this congested state through long continued indigestion, accompanied generally by constipation, flatulence, and decay of the teeth, many women even in early life having lost their teeth and requiring to wear artificial ones. If the history is inquired into, it often transpires that such women have been fond of tea and bread and butter, and of sweets, and of cakes which they have interpolated between their meals, or even may have made their meals of, only smiling perhaps when attention was directed to their habits, and warnings suggested to them as to the ill-health that was impending. The two great remedies for this wretched and slow and long-continued stage of things are restriction of the diet and gentle exercises—but unfortunately these remedies are often violently or indignantly set aside, and expensive journeys abroad with constant change of scene and air are resorted to instead. I may add that the diagnosis reached in this way clinically and from experience is not easy to verify pathologically, but there are two good and sufficient reasons for this; first, death is rare and therefore we have no opportunity of examining the parts. Second, as the changes are mainly in the lymph-circulation, they are very evanescent and variable, rather similar to those occurring in the synovial structures of joints which, though they cause most acute pain, often leave no pathological trace in the comparatively rare cases in which they have been pathologically examined after death. That it is not often possible to verify the diagnosis pathologically with the microscope after death does not prevent our yielding our judgment to the overwhelming mass of clinical evidence which leads to the diagnosis of congestion and friability and degeneration of connective tissues and to the affixing of the name *initis*.

The fourfold alterations that occur in sleep have already been dealt with, and nothing more need be said here than to remind the reader that excess of sleep, defect of sleep, irregularity of sleep, and perversion of sleep characterise disease in this function of the body, as they do disease in other functions. And as the changes are similar and the causes the same, so the treatment must be similar and must be effected mainly through the nutrition.

For the explanation and treatment of Cheynes-Stokes respiration (where it is tractable, for unfortunately this form of respiration is too frequently a precursor of death) the same principles apply, although the mode of their application is not so easy to see.

The stimulations and contractions of transverse and longitudinal elements of the structures of the body and their alternations with one another, are carried on co-incidently with the stimulation of the nerves that go to them. These nerves are composed of two sets of elements or strands, coming respectively from the cerebro-spinal system in the brain and spinal cord, and from the ganglionic or sympathetic system of nerves collected in ganglionic masses or aggregations in the neck, chest, and abdomen and pelvis particularly. Strands of nerves going to muscular and other structures are thus mixed nerves, containing both cerebro-spinal and sympathetic elements or parts. The former are connected with the exercise of the voluntary and knowing and willing functions, while the latter act automatically as it is called, and often unconsciously, governing actions like digestion, circulation, respiration, &c. As the nerves are mixed, it is not easy to separate the special distribution of the different parts of the nerves to different parts of bodily tissues. Very likely, both sets of the nerves, both the cerebro-spinal parts and the sympathetic parts, are distributed to both the transverse and the longitudinal elements of the structures. But there is reason to believe, nevertheless, that if both parts are supplied by both, still the distribution of the cerebro-spinal parts of the nervous structures is rather to the longitudinal elements of structures, while the distribution of the sympathetic portions of the nerves is rather to the transverse. And the chief reasons for this opinion are that at the end of the day, when fatigue has come on after the exercise for several hours of the voluntary functions of the body, and when therefore the voluntary parts of the nerves have been long in action, the longitudinal elements are contracted, the vessels widened, and the whole body shortened. Prolonged exercise of the voluntary functions results at the end of the day in shortening and widening both of the hollow parts of the body and of the solid parts. This is compatible with the view that the cerebro-spinal portions of the nerves, through which the voluntary functions are carried on, are distributed to the longitudinal elements especially, and it can in fact be accounted for in that way. On the other hand, there is reason to think that while nerves are mixed, as has been said, the sympathetic parts of the nerves go specially to the transverse elements of the body, because after sleep, on waking in the morning and when for some hours the voluntary parts have been in abeyance, we wake with the vessels contracted and with the whole body in fact slightly longer and narrower than it was when at night we went to bed tired, and with our bodies shortened and widened. As prolonged functioning of the voluntary powers during the day results thus in over-contraction of the longitudinal elements of the body, it seems probable that the cerebro-spinal nerves through which these voluntary powers are exercised go preponderatingly to the longitudinal elements of bodily structures. And as, on the other hand, prolonged absence of function of the cerebro-spinal nerves in sleep results in narrowing and lengthening of bodily structures, during which time the sympathetic system of nerves acts as the medium through which the vital powers mainly function, it is probable that these sympathetic fibres mainly go to the transverse elements of the body, since they are in tonic contraction when we wake. In the morning the body is like a spring compressed, the pulse and respiration slowish, the temperature lowish, the potential or dynatic energy of the body rather great, and ready to be liberated during the day by conversion into kinetic energy, to result again in shortening and widening of the bodily structures at the end of the day, when the same or a similar round of changes has again to be gone through. The results of physiological experiments and investigations into which I need not enter are in keeping with this view also—some of the phenomena and questions arose in the discussions of sleep in the last Conversation—so that it is probably true that on the whole the cerebro-spinal portions of the nerves are specially associated with the longitudinal elements of the body and the sympathetic with the transverse. The terms voluntary and involuntary, conscious and unconscious, remind us again of the way in which apparently opposite functions merge into one another by gradations so insensible that it is difficult to say where one leaves off and where the other begins. A stimulus conveyed by a centripetal nerve-strand to a cerebro-spinal centre results in a conscious action of will, conveyed say to a muscle by means of a centrifugal nerve. A stimulus conveyed to a sympathetic centre by a centripetal nerve coming from one of the digestive viscera results in an unconscious or automatic action conveyed to the muscular coat of a blood-vessel and inducing contraction of the same. But it is plain that centripetal nerve-strands, centres to be affected and impulses to be carried along centrifugal nerve-strands are common to both these sets of actions, so that if we cannot quite say that the sympathetic centre has a will of its own, we yet see quite well that the will-apparatus is an automatic apparatus, and so, that between simple reflex action governing the trophic action of viscera, and voluntary action, it is almost impossible to draw a dividing line. The difference is in function or physiology, or feeling or psychology, rather than in anatomy.

Before I pass to the practical measures of treatment for the different conditions, I think I ought to mention a somewhat interesting fact about them. Over-stimulation of the transverse structural elements connected with one physiological function no doubt is generally associated with over-stimulation of the corresponding elements connected with another physiological function. But this association or correspondence is not by any means invariable, for over-stimulation of the transverse elements of one function may be associated with over-stimulation of the longitudinal elements of another function. Pallor, which is caused by stimulation of the transverse elements of the vessels, is generally associated with constipation, which is caused by over-stimulation of the transverse elements of the intestine, and is usually found to accompany anæmia or triphthæmia. But anæmia *may* be accompanied by diarrhœa, which is primarily due to over-stimulation of the longitudinal elements of the intestine. Similarly anæmia is generally accompanied by dysmenorrhœa or amenorrhœa, *i.e.*, by painful menstruation or by the absence of menstruation, which are associated with over-contraction and over-stimulation of the transverse elements of the fallopian and uterine structures ;

but anæmia may be accompanied by menorraghia, which is associated with over-contraction and over-stimulation of the longitudinal elements. In the sphere of treatment therefore we may have to set before us the aim of reducing irritation to one set of structural elements belonging to one function, along with the aim of reducing irritation to the opposite set of elements belonging to another function, so that the practical problem is often rather complicated.

TREATMENT OF ABNORMAL FUNCTION.

I said that I had a highly practical aim in view as regards these disturbed functional conditions ; and I come now to its exposition. As all these conditions are due to over-stimulation and over-action of the longitudinal or the transverse elements of tissues (and of the oblique where they exist), they must all be treated by diminution of the stimulation, and as this over-stimulation most frequently depends on errors in diet (sometimes of course on an excess of alcohol or tea, and sometimes on other causes), the one remedial measure paramount in them all is alteration and restriction of the diet. Sometimes, no doubt, the diet has been wrong in quality. An excess of tea or coffee is sometimes the chief cause of these various disturbances, and of course where this is so, the error must be rectified. But it has to be admitted that in the large majority of cases the cause has been excess of diet, and therefore the chief remedy consists in restricting or diminishing it. The asthmatic whose sleep has been disturbed in some of the ways mentioned can nearly always be cured both of his sleeplessness and his asthma if he will follow the advice to eat nothing after mid-day dinner, say not later than 2 o'clock or 3. He may if he likes have a hot drink, as of Plasmon Cocoa, or Allen and Hanbury's Food, or Benger's Food, or milk and barley water equal parts, or of Hygiama about 7 in the evening ; but he should not eat anything after dinner time ; and he will usually sleep in a fortnight or three weeks from the commencement of the treatment and have his asthma much improved also. As to functional irregularities of intestinal action, I have come to believe that we cannot cure diarrhœa by astringents, nor constipation by the use of aperients, but that the only way to cure both (I speak of course of long-continued or chronic forms of these complaints) is to restrict the diet. Generally speaking, taking two meals a day with an eight hours' interval between, will succeed in curing both constipation and diarrhœa in a few months. But if not, having recourse to one daily meal will almost always be effective. Sometimes the quality of the diet requires to be altered also. (For the explanation of the reason why constipation and diarrhœa are both to be treated in the same way, by restriction of the diet, the reader is referred to "Air, Food, and Exercises.")

To shew, however, that this theoretic conclusion has a highly practical bearing on treatment, I may mention here the case of a married couple about sixty years of age who consulted me simultaneously. They had both lived for over thirty years on a diet of four meals a day ; and the man suffered from inveterate constipation, while the wife suffered from chronic diarrhœa. In the man the transverse elements of the bowel were over-stimulated and over-grown, while in the wife the longitudinal elements were over-stimulated and over-grown. I advised them both to reduce their meals to two a day ;

and in six months, both were cured, he of his constipation, she of her diarrhœa. So intensely practical is the application of this theoretic principle. I may add that had the wrong dietary been allowed to go on, the man would soon have suffered from cancer, while the wife would have had tuberculosis of the bowels. The treatment, I believe, therefore prevented the onset of both of these incurable ailments.

As regards the treatment of disturbances of the circulation, restriction of the diet is admittedly the sheet-anchor of treatment in the feverish state when the pulse is too quick ; and I can only say that it is the best treatment also for both a too slow pulse and for an irregular one. The labouring heart can often be made to recover wonderfully when, through lightening of the diet, it is relieved of the labour of having to pump blood either too thick or in too great quantity ; and many diseased hearts have been enabled to go on for many additional years by this simple device. The same principles hold good in management of affections of the renal organs. With affections of the respiration it is the same. Both too quick respiration and too slow respiration have usually to be treated in the same way, viz :—by restriction of the diet. In the Cheyne-Stokes condition, unfortunately, the patient is usually in such a condition that no treatment can do him any good ; but in accidental cases of this kind, restriction of the diet is the most efficacious means of treatment. With sleeplessness I have already dealt. As to the treatment of nerves which are either numb or dulled in perception, or tender and painful when they feel too acutely, or we feel too acutely through them, or which may alternately be too numb at some times and too tender or painful at others, the same principle of treatment is much the best and indeed the only one, if we are in search of cure and not of mere palliation. Besides topical applications, change of air and so on, the treatment ought to inculcate some restriction of the diet as to quantity, quality, and frequency, if it is to be really successful.

Disturbances of the mental equilibrium show themselves also in the four main ways that we are now so familiar with. Patients in this condition are either too excited, or they are too depressed, or they suffer from an alternation of excitement and depression, while perversions not infrequently break out in unnatural crimes. It is difficult to follow out the conditions existing in the brain-circulation in disturbance of mental equilibrium which correspond with over-stimulation of longitudinal and transverse elements in other structures and organs of the body. The existence of some corresponding conditions, however, cannot be doubted in view of the fact that we find here also present, defect of action, excess of action, and marked irregularity and flightiness with perversion of action. But the beneficial effects of restriction of the diet are of remarkable power in many of these conditions. Strangely enough, one phase of insanity frequently takes the form of refusing all food for a time ; and many insane persons have fasted themselves into sanity when they have not been prevented from doing so, and when nourishment has not been forced on them by the well-meant but often ill-advised interference of friends. Of course careful watching is necessary in order that the delusion may not be carried too far, but the beneficial effects of restriction of the diet are often unmistakable. In all these various conditions, therefore, shown by disturbances of these various functions and organs, restriction of the diet is of the utmost benefit, because defect of action is most commonly caused by over-stimulation and over-nutrition of the transverse elements affected; because excess of function is most commonly caused by over-stimulation and over-contraction of the longitudinal elements; because irregularity of function is most commonly caused by the alternate over-stimulation and over-contraction and over-nutrition, now of the transverse and then of the longitudinal elements of the parts affected; and because perversion of function ensues when centripetal action becomes centrifugal or when centrifugal becomes centripetal. In the former case the means of life are wasted, since what ought to have been absorbed is excreted from the body unused; and in the latter case excreta which ought to have been expelled from the body are re-absorbed into it. Now as the chief way (not the only one, it is true, but the chief one) in which this over-stimulation, over-contraction, and over-nutrition is effected is by the ingestion of too much food and by its too frequent ingestion, it is advisable in all these cases to restrict the diet, so that, the cause of the over-stimulation being removed or diminished, the patient may have the opportunity of recovering.

TREATMENT OF MENSTRUAL DISORDERS.

These things being so, and the same general law being seen to hold as regards disturbance of all these various functions, the same treatment being required for them all, so soon as their relations to the general nutrition have been seen, the same principles hold good as to the causation and also as to the treatment of dysmenorrhœa, and amenorrhœa, and irregularity of the menstrual functions.

Hot abdominal applications are very grateful, as also are hot applications to the back, and of course rest when it can be obtained. But these palliative measures are greatly aided, and indeed in many cases rendered unnecessary, by such an alteration of the diet as shall remove the over-stimulation and over-growth of the longitudinal and transverse elements of structure respectively. In this function also a proper blood supply, proper both as regards its quantity and its quality, greatly aids in enabling the function to be painlessly conducted. But the function of digestion being to make blood, while it is the function of blood to nourish the various parts of the body properly, the great importance of obtaining a sound condition of the digestion rises into greater and greater prominence in the mind of the observer. This is felt even more when it is realised that the women suffering in these ways experience often an almost irresistible desire to allay the aching and misery and that feeling of gnawing and emptiness and depression from which they suffer by taking cups of tea, and bread and butter, and sweets, and sometimes even alcohol in repeated if small doses. Some would-be advisers indeed encourage them to do so. A woman should have a cup of tea and bread and butter, say some of these advisers, when she goes down town shopping in the forenoon ; or she should do the same if she goes a railway journey. But what advice can be worse for her ? No doubt she gets a little temporary relief from these measures, but at how great a consequent cost ? As to the use of alcohol to combat this form of misery, it cannot be too strongly condemned. Not that it does not relieve. It does relieve for the time in many cases by taking the spasm off the transverse elements of the structures involved and by directly stimulating the longitudinal. But obviously this is not going to the root of the evil, which is the painful dyspepsia accompanied sometimes by an inordinate liking for sweets which has led to bad blood-formation, and therefore to mal-nutrition to the parts involved. To put this right is the only way to reach the malady at its source, and to avoid the need for increasing the doses and multiplying the administration of stimulants whether as tea or as alcohol, the craving for which is so apt to grow on women suffering in these ways. It is trying no doubt to women to be told that they must control their desires in these ways if they want to be well. But this is the problem of life in all directions; and no honest adviser can refrain from pointing out that if we do not attempt to keep the body under, it will undoubtedly keep us under ; and that so we shall become the slaves and servants when we ought to be and when we were intended to be the masters and the mistresses. Not that asceticism arises out of this. On the contrary, a far larger measure of happiness and healthfulness and cheerfulness is enjoyed than in any other way. Nature sets no embargo on joy and happiness. On the contrary she enjoins it, pointing quite unmistakably to the fact that her processes are performed much more efficiently and healthily when the disposition is cheerful than when it is morose or sour or pessimistic. But she equally plainly points out that it is very unwise and always eventuates badly to purchase present ease at the cost of further discomfort ; and that is just what those women do who resort to small and frequently interpolated meals or to sweets or to stimulants to allay and reduce cravings which would not exist if the general nutrition and digestion had been properly attended to and regulated. Here again two daily meals with an eight hours' interval, or three at the most, slow mastication and a proper selection as to quantity and quality of food will point the easiest way to health and happiness. As to quantity, the amount of the waste of the body is the measure of that. It does not amount at the most to more than an ounce a day for every ten pounds of body weight. And as to the quality, the reflection that when in the fulness of time man appeared on this planet, his food also was prepared for him, and that this food is offered to him in great variety, will serve to keep us right. As nature does not restrict us to any one sort of food, why should we restrict ourselves or deprive ourselves of variety? No doubt it will be wise for us, seeing that nature provides some sorts of food specially in summer, the green vegetables for instance, and in the autumn the fruits and nuts, it will be wise for us to follow her indications and modify our dietary in the directions in which she points at those seasons. But at all seasons a diet mixed according to natural suggestions is indicated. If on the other hand nature fixes somewhat strict and narrow bounds as to moderation both in amount and frequency, can we hope for impunity if we transcend them? I hope at least that now the relation between the occurrence and the healthy and painless performance of these functions and the general bodily nutrition has been thoroughly established in the mind of the reader, and that she will be able to attain for herself and her family health and happiness by considering it and acting accordingly.

It will be well if at this point we attempt to summarise some of the general principles which seem to emerge from a study of the facts so far as we have considered them. We may call them the Laws of Animal Life, and particularly of Human animal life (anthropino- zoo- dynamic).

The human body appears to be pro-created by the human power of life for the manifestation of all the qualities of anthropino-zoo-dynamic. The function of the doctor is that, being familar with the physiology (or the healthy state) of the body, he should strive to maintain that, and ward off disease or pathological states ; and also when these have supervened to combat them, and strive for the restoration of health. The processes of anthropino-zoo-dynamic are many and complicated and varied ; but the primary series of processes are those of nutrition or assimilation or tropho-dynamic. When these are in order, the higher powers of anthropino-zoo-dynamic, toko-dynamic or reproduction, erg-dynamic or the doing of mechanical work, knowing, willing, feeling and worship, or, as we may term them, noetico-dynamic, boulo-dynamic, æsthetico-dynamic, and sebo-dynamic, are more easily and efficiently performed than when the processes of assimilation are out of order.

The view here put as to the relation of the human body to energy is in keeping with the general view of the relations of energy to the rest of the known world of things which has forced itself on the mind of the writer. It may be well to re-state this shortly in the form of the following propositions :—

1. All material things, inorganic or organic, inanimate —so called—and animate, are the incarnation or manifestation of different phases or forms of energy which is pro-creative of them ; and is infinite, eternal, omnipotent and omnipresent (because it emanates from an infinite, eternal, omnipotent and omnipresent source).

2. The manifestations of this universal energy are the different things with which the different sciences, so-called, are concerned, and the most fundamental characteristic of

this energy is that when two or more phases or forms of it are present, action at once begins between greater and less degrees or amounts of it, and goes on until equalisation takes place. Complete equalisation, however, hardly ever takes place, although an approximation to it is constantly occurring, It is the approximation to equality, it seems to me, which gives energy its apparently intermittent character. One would be disposed *a priori* to imagine that infinite, eternal, and omnipresent energy would act continuously. So it does, probably. But the response of things to energy is intermittent. An illustration will best explain what is meant. If we take two bodies unequally heated like the earth and the sun, we see that the side of the earth turned to the sun becomes more heated and also more attracted than the side turned from the sun. But this very inequality tends to make the earth turn the other side to the sun in order to attain for it an approximation to the more heated condition of the opposite side. When this has happened the former side again tends to turn to the sun to equalise the inequality, and so we have rotation of the smaller and cooler body round the larger and hotter one. But as gravitation acts in an exactly similar way, we not only have rotation accounted for, but we have rotation accompanied by an alternate advance and recession of the smaller body to and from the larger one, out of which arises the apparent intermission of energetic action, while energy may be really acting always and continuously. I must not go further with this, but probably the succession of the seasons and the alternately quicker and slower movements of the planets in their orbits round the sun, as likewise the inclination of the planes of the ecliptics to their equators, may be accounted for in this simple way. And if, perhaps, our sun with his system of satellites revolves, along with others of the so-called fixed stars, around a sun infinitely more distant, infinitely hotter, and infinitely larger than themselves, this simple explanation or suggestion of an explanation in the tendency of energy to distribute itself equally, always giving of itself up to the measure of the capacity of the recipients, might suffice to make the method clear.*

3. All forms or phases of this energy, as they proceed from a common source, must work similarly, any opposition between different forms of energy being apparent only and not real.

4. We cannot therefore hope to combat the effects of one form of energy by invoking the power of another, although of course one form of energy may transcend the power of another. But each form of energy is supreme in its own domain.

5. Recapitulating the material forms pro-created by various phases of energy we have—

α. Hylo-dynamic, or the power of material substance, whose law is gravitation or attraction. This may be positive, as when bodies move towards each other; or negative, as when they move apart from one another; the same law which makes the earth in some circumstances move towards the sun compelling it in other circumstances to recede from it.

β. Hydro-dynamic, or the power manifesting itself through water. (Hydrostatics. Hydro-dynamics).

γ. Crystallo-dynamic, or the powers and forms of crystallisation.

ε. Aero-dynamic, or the powers of gases.

δ. Chemico-dynamic, or the power of chemical combination or attraction, as also of apparent repulsion.

* See Singer and Berens on "Some unrecognised Laws of Nature."

ζ. Electro-dynamic, or the electric power with its positive and negative phases.

η. Bio-dynamic, or the combined power of plant life and animal life (" Life " is of course a relative term, for all nature is alive more or less with energy—the difference is a matter of degree).

Bio-dynamic is divisible into

θ. Phyto-dynamic, or the power of plant life, and

ι. Zoo-dynamic, or the power of animal life. Now zoo-dynamic manifests itself in an immense variety of forms or qualities. We may call the lowest of these the power of

I. Response, or apameibo-dynamic, which zoo-dynamic shares with all the lower forms of things. This power acts through all the tissues, but in the higher animals it appears to be specially located, or a special form of it is located, in the connective tissues. (To obviate misunderstanding it ought to be said here that the appreciation of response, or the power of appreciation of response, acts through the nervous system. And to explain how inextricably the two powers of (*a*) response, and (*b*) appreciation of response, are bound up with one another, it has to be remembered that connective tissue forms the covering of the nervous system. It is very easy therefore to mix up the having of a feeling—apameibo-dynamic—with the knowledge thereof—noetico-dynamic). The connective tissue or organ of common response or common sensibility is the organ or general structure through which the feeling of the unity of the animal organism is manifested, the organ through which we recognise that a hand or a limb is a part of the body, and that the body in all its parts is one. It is probably also the organ through which we have the feeling of being well or ill, and through which we feel comfortable or uncomfortable, through which we feel pain or pleasure, and through which probably we feel warm or cold. As the lymphatic circulation rises in the lymph-spaces of the connective tissue, we ought to look on the connective tissue as the largest secreting gland in the body. The importance of this, as it affects nutrition, can hardly be over-estimated, and does not seem to have received anything like the consideration which it deserves.

The appreciation of all these facts and feelings, and even localisation, or at any rate the knowledge of localisation, is obtained through the action of the nervous system.

II. The next way in which zoo-dynamic manifests itself is through the power of assimilation, or tropho-dynamic. This is, of course, most complex in the higher animals, requiring a lifetime, or even several lifetimes, for its understanding.

III. Toko-dynamic, or the power of reproduction.

IV. Erg-dynamic, or the power of doing mechanical work.

V. Noetico-dynamic, or the power of appreciation of response, and of doing intellectual work.

VI. Æsthetico-dynamic, or special appreciation of simple feelings and artistic appreciation of beauty, suitability, harmony, appropriateness, &c. Under this head would probably be classified the positive form love, with the negative form dislike, or the perverted form hate.

VII. Boulo-dynamic, or the power of will (βούλη = will).

VIII. Sebo-dynamic, or the power of worship (σέβομαι = I worship).

IX. Powers of the special senses, as touch, taste, smell, hearing, vision, &c.

The organs through which the lowest manifestations of the powers of animal life are exhibited, as apameibo-dynamic, tropho-dynamic, erg-dynamic, and toko-dynamic, are already known. The highest manifestations on the other hand, beyond the fact that they are exhibited through the brain and spinal cord and nerve-centres, have not yet been definitely referred to any special parts of these centres. The fact that they have not been so is at once a suggestion of the direction that the immediate inquiries of the future ought to take, and an anticipation of the route they probably will follow. And it may be added that any new powers which may yet be discovered as manifesting through the human organism (heuretico-dynamic, *e.g.*, or the finding power) will naturally fall into their proper place when careful inquiry shall have told us what they are. And perhaps it may be possible soon to relegate the functioning of all the highest powers each to its proper part of the nervous and cerebro-spinal systems.

Now, besides the fact already mentioned in Conversation I., that the lower phases of the higher forms of all these gradations of energy are always lower than the higher forms of lower grades, another peculiarity ought to be mentioned. It is perhaps only another way of putting the same property, but it frequently leads to much confusion in study, and it is this—that natural powers merge into one another by gradations so insensible that we cannot say where one ends and the other begins. Otherwise this may be expressed by saying that the universe is full of contraries (while there is only one pair of general contradictories), for the definition of contraries is that the contrary merges into its contrary by gradations so insensible that we cannot say where one ends and the other begins. The definition of the contradictory, on the other hand, is that the contradictory is exclusive of its contradictory for ever. Motion and rest would be contradictories, since rest equals non-motion, if there were such a condition as rest in the universe, but there is not; for all things, being manifestations of power, heave and throb and move with all the motion and emotion of the power that makes them be, and which maintains them; or they would cease to be. There is nothing catastrophic in nature; and creation, which may be sudden to the onlooker, is ever-present to the Doer, and what appears as succession to the finite observer is eternal *now* in the infinite. Reflection on this, even for a short time, shows us the futility and naïve childishness of the definition of a species as all the descendants of a common pair. What was the age of the common pair? To take birds, were they eggs, chicks, adolescents, mature, or old? And if so, why should they have appeared at one age rather than another, and why should the power of bird-life (ornitho-zoo-dynamic), springing from an infinite source, be limited to any one age, and not include all ages, when the fulness of the time for its manifestation had arrived; that is, when the environment was ready for it? Who are we, that we should limit the powers that have made species and have made us?

Familiar examples of contraries, besides the general manifestations of energy already mentioned, are dry and moist, hot and cold, light and dark, day and night, heavy and light, deep and shallow, right and wrong, simple and malignant, simple and compound, acute and mild, chronic and short or long and short, fever and depression,

&c., &c. Curable and incurable would on the other hand be examples of contradictories, if it were possible, which it is not, to say what affections were curable and what were not. The examples of contraries given merge into one another by gradations so insensible that we cannot say where one ends and where the other begins. The one pair of contradictories which exist in nature may be put in three forms—the scientific, the philosophical, and the spiritual. The scientifie contradiction is faced when we discuss the question whether material substance is the cause of energy, or whether energy is the cause of material substance. (This is, properly speaking, a philosophical question, although always treated as a scientific one, science having quietly assumed that the former alternative is the true one. By assuming as a fact what is only a theoretical deduction from facts, science has been able to get her position admitted almost universally, but obviously the other alternative is an equally good or better explanation.) The philosophical position is faced when we ask ourselves whether structure is the cause of function, or function, *i.e.*, the necessity to function, is the cause of the production of the structure through which the function shall be performed. Are (to take an instance) the lungs the cause of respiration ? or did the necessity to rid the body of CO_2, a product of digestion, and to admit O_2 in its place, lead to the formation of the lungs ? This question as we have put it is a philosophical one, or rather it involves a philosophical interpretation of the physiological question, just as the discussion regarding substance and energy involves the philosophical interpretation of the physical question. And lastly the spiritual phase of the question has to be faced when we come to inquire whether the universe is the manifestation of the divine power or whether it came and comes of and from itself.

If, now, we view the human body as the highest manifestation of the powers of animal life up to the present time, those powers which, through higher and lower forms, move and heave and throb throughout the universe, and if we attempt to understand the relation of the medical adviser to this noble structure pro-created in all its varieties of form and age when the long preparation for its appearance had fully matured, we find that his sphere is confined almost entirely to advising as to nutrition or assimilation. It must indeed be so, because as the primary step in embryological development in the human and other metazoal animals is the turning inwards of the outer layer of the embryo to form a body cavity, and as this is essentially the beginning of the digestive tract, it follows that the primary function of the body is assimilation or nutrition. I do not deal with accidents which probably occur to the reader as happening quite independently of nutrition. But even in this domain of medical experience, recovery from the effects of accidents is largely influenced by the state, sound or otherwise, that a person is in at the time that he sustains an accidental injury; and this state is determined by his nutrition. Recovery from the effects of accident is directly proportional to the soundness of the person who sustains it; that is, it is directly proportional to the state of his nutrition and inversely as the severity of the injury. While then even the bone-setter's art is not independent of the general nutrition of the patient, to advise as to nutrition or assimilation is the main sphere of the medical adviser. "There are very few diseases which are not in some sense alimentary." Even those diseases due to the breathing of vitiated air may be comprehended in this category, because the lungs, arising as a diverticulum from the foregut, are complementary digestive organs, and if they inhale vitiated air they cannot so readily rid the body of CO_2 on the one hand, nor can they so easily obtain the needed supplies of O_2 from vitiated air on the other.

In Conversation I. some attention was given to the arrangement of longitudinal and transverse elements in the structure of hollow viscera like the intestines, and it was shown how peristalsis was effected through this arrangement. We saw also how blushing and pallor were induced by contraction of longitudinal elements in the coats of vessels on the one hand and of transverse on the other, the halting intermittent movement of the earth worm, and even the thrusting or putting out of the tongue being effected by the action of a mechanism constructed in the same way. We further saw that increase of functional activity coincided specially with over-stimulation (sometimes accompanied by hypertrophy or over-growth) of longitudinal elements, because when these are stimulated, the tubes whose coats they help to form are shortened and widened, the tubes over-filled, and the contents hurried along. Contraction and over-stimulation of the transverse elements (with or without hypertrophy) on the other hand, as we saw, diminished functional activity, because by their contraction hollow viscera were narrowed and lengthened and their contents more or less impeded or hindered from passing. Now the chief reason for that description in Conversation I., and the reason for further reference to it here, is because an exactly similar mechanism leading to exactly corresponding results exists in the fallopian tubes and in the uterus or womb. In the womb, oblique fibres have been added because the functions of the organ require the addition. But the menstrual flow goes through exactly similar abnormal changes when menstruation becomes unhealthy,, and we can now understand how excessive loss of blood at the catamenial periods is associated with over-stimulation and over-growth, specially of the longitudinal elements of the fallopian tubes and uterus. This is called menorrhagia (literally a breaking out of blood at the monthly time (ῥήγνυμι = I break out or break off, μὴν = a month and ρέειν = to flow). Too scanty flow on the other hand, often accompanied by pain at that time, is caused mainly by excessive contraction or stimulation, often accompanied by over-growth of the transverse elements of the structures of the fallopian tubes and uterus. This is called amenorrhœa or absence of menstrual flow (ἀ privative, μὴν = a month and ρέειν). It is generally not absence but diminution of the flow which is observed, and oligo-menorrhœa (ὅλιγος = small and μὴν) would be a better name than amenorrhœa. From the pain experienced in the small of the back, in the abdomen and lower limbs, the condition is often named dysmenorrhœa (δὺς = with difficulty μὴν and ρέειν), which means pain at the period. We thus account for excess of function by over-stimulation of the longitudinal elements of structure and for defect of function by over-stimulation of the transverse, while irregularity of function, when it is at one time too much and at another too little, is accounted for by over-stimulation of the longitudinal elements at one time and by over-stimulation of the transverse at another. In this way defect, excess, and irregularity of this function falls into line with defect, excess, and irregularity of all other functions in the body, and their relation to the general nutrition is demonstrated, since it is through over-nutrition that structures become over-stimulated and over-grown, the over-stimulation and over-growth leading on to the changes in function under consideration. Dysmenorrhœa and oligo-menorrhœa, inasmuch as they are accompanied by a kind of cramp or spasm of the transverse elements, might be otherwise considered as the marks and the proof of the existence of a sort of inhibition, as it is called, of those elements. Inhibition is a too long-continued contraction of muscular elements, and is always (?) applied to over-action of the transverse elements. Its termination is in spasm, cramp, slowing of function, and angina. Too long-continued and too severe contraction of the longitudinal elements, on the other hand, might be termed inhibition of these elements, and its termination is in increase of function, a rapid running pulse, and collapse. (This is what the Latin medical writers meant when they divided functions into *strictura et solutio*, instead of, as they ought to have done, (1) into *strictura et dilatio* or *dilatatio*; and (2) into *strictura transversarum fibrarum et strictura longitudinalium*, ending in *spamus* on the one hand and in *inanitio* on the other. It is intensely interesting, because they appear to have seen obscurely, though without understanding it, that one sort of over-stimulation ended in cramp and the other in its opposite, *solutio*, or, as it were, being dissolved and melting away in helpless weakness.)

Perversion of function I have already mentioned. It must be explained by such an excess of action of the longitudinal fibres of the os and cervix uteri causing so strong a centripetal action, that it overcomes the natural centrifugal action of the fallopian and uterine structures and, sending ova and spermatozoa into the body cavity causes extra-uterine gestation, a condition which must generally be interfered with by surgery if the unhappy sufferer from it is to escape with her life. Sometimes nature, or the power of life, interferes to cause rupture of such a gestation at an early stage, in which case a sharp attack of pain and peritonitis may put an end to all further trouble by devitalising the ovum and causing absorption of it in the peritoneal cavity. But the over-stimulation and over-growth of the longitudinal fibres of the os and cervix which immediately led to the existence of the condition, being caused by their over-nutrition, emphasises once more the great importance of that function and the necessity of our understanding it if we are to manage the condition properly and prevent its recurrence. Such an occurrence is full of danger. Such a perversion as that the body should devour its own progeny strikes us as unnatural indeed, although so merciful and life preserving is zoo-dynamic that from time to time she interferes in this way in order to save the life of the mother, as happens when an ovum, becoming impregnated within the peritoneal cavity, is absorbed by the peritoneum, just as from time to time the peritoneum absorbs or digests other adventitious products. Had the peritoneum not thus performed the function, the surgeon would have had to interfere.

Of course the general advice that we should strive to understand causes, applies to all conditions of disease in any and all organs. In bringing the diseases of the organs of reproduction and parturition under the domain of the general laws of nutrition I am not saying anything new in principle, although it does seem as if one were saying something new in detail. In order to see better the classification of these diseases I call the powers of reproduction by the name of toko-dynamic (τόκος = birth. τίκτω = I bring forth; also I beget), just as I have called the power to assimilate food by the name of tropho-dynamic and the power of thinking, noetico-dynamic. Unhappily the simplification of ideas which comes of such a generalisation is not so common as it ought to be either in the minds of the experts who treat the diseases of the organs of reproduction or toko-dynamic, or in the minds of the portion of the general public who suffer from them. Both of these parties are too apt to assume that the diseases of the organs of reproduction form a field separate and apart from all others, and by implication to think that no common principles underlie them. This attitude of mind is in fact far too common among specialists of all sorts, who are apt therefore to overlook the great fact that all diseases of special organs are the local expressions of general states dependent on disturbances of the nutrition of these organs, since the same blood which goes to the eye, the ear, the brain, the muscles, the nerves, and other parts also goes to the ovaries, womb, and fallopian tubes for the nutrition of these parts. I hope that in course of time the general dependence of the health of all parts of the body on the state of the blood which goes to them all to minister to their several needs will come to have more influence on the minds of us all, advisers and sufferers alike, so that, our ideas on these subjects being simplified, we may be the better able to combat this class of disease. It is not for the general good that it should come to be considered either necessary or desirable that women should march across the stage of humanity, generation after generation, in order to furnish work for a corresponding procession of successive physicians and surgeons who are waiting to relieve them. At least this attitude cannot be considered for the general good if it can be shown, as to the writer is so plainly evident, that a very large proportion of such abnormalities can be prevented, and that the energies of the operators might therefore be set free for more positively useful work. These considerations apply of course not only to inflammatory affections of the parts in question but also to such affections as tumours and new growths of the womb or ovaries.

Each natural structure, when it becomes hypertrophied or over-grown, manifests still its own special conformation. Hence, while uterine over growths tend to be large, solid, elastic, and fibroid, the womb structure being normally constructed of these materials, tumours of the ovaries tend to be sac-like or cystic. The sacs or cysts exist normally in the ovaries but are of a very small size. When the ovary takes on over growth, these sacs or cysts, one or more of them, tend to expand and to become filled with fluid of lighter or darker colour and of watery or gelatinous character. Sometimes they are little more (either in the ovary or in the neighbouring broad ligaments) than large thin sacs filled with what is very little different from pure water or serum. In this case the blood of the patient is purer, or at least purer than in many other examples of similar sac-like tumours, only an excess of more or less watery fluid being present to show how the general nutrition has gone wrong. Perhaps even at birth one of these cysts may have been a little larger than usual, since variations arise, we do not know how, although the suggestion that the powers of life or zoo-dynamic are infinitely varied seems to me to offer an adequate explanation of variation, and of the fact that no two animal forms ever are found to be identical with one another. Such a slightly larger cyst may easily be believed, through over-nutrition, to increase in size and go on doing this until it attains large dimensions. And it may readily be believed, on the other hand, that had there been no over-nutrition, the original over-growth or the congenitally-larger-than-usual cysts would never have have gone on increasing. Nutrition, digestion, or assimilation is as a fact the natural means by which animal forms do grow, so that this suggestion is natural and not fanciful. And it is, further, adequate to account for the facts. In the uterus similarly, the natural muscular and fibrous tissue may in places be congenitally found in excess. Where this is so it may easily be understood that in the processes of nutrition a nodule thus congenitally larger than usual may go on growing until it forms what is called a tumour, solid throughout or solid at some places and cystic at others, and may require removal by the surgeon. But, on the other hand, had nutrition been maintained just at its proper level, neither too much nor too little food being ingested, the original nodule might never have taken on increased growth, and the owner might have remained in the happy ignorance of its existence. When we consider how much variation is allowed by nature to each animal form, and that small excesses of food-ingestion may go on for a very long time and yet the body may show such resistance to these causes as that no noticeable changes are seen to occur, we realise better how as a rule there may have been slow and long-continued but insidious violations of the power of assimilation or tropho-dynamic before such growths attained large size. In point of fact this is no doubt the case as a rule, and the double delusion that the strength of the body and its heat both come from the food is the immediate cause of the ingestion of too much food so as to lead to the formation of those large cysts and large solid and cystic growths, which are so continually requiring to be interfered with; and which from time to time, when their nutritional or assimilative causes have been still longer at work, go on to the formation of cancer by the change of simple into malignant growths. Normal structures thus become abnormal, and we see again how increase of normal structure existing perhaps originally in slight excess through variation, comes to shew perversion of structure by growing into something quite unnatural and abnormal, or heterologous as it is sometimes called, to the bodily structures. But between simple and malignant growths, between growths that do not tend to return after removal and those that do, between growths that conform to natural bodily structures and those that are unnatural and abnormal, there is no hard and fast dividing line, any more than between dry and moist, or hot and cold, or any of the other numerous contraries of nature. And as the modes in which these abnormalities increase and force themselves on our attention is through alterations of nutrition, once again we are brought face to face with the supreme importance of this function, and the necessity of not only having clear ideas concerning it but also attempting to carry them into conduct.

And another consideration of the utmost importance rises to the mind, too apt to be overlooked, regarding the treatment of growths or tumours of these sorts. I infer, at least, that it is apt to be overlooked because one hears so little about it. Suppose that such a growth is discovered or that it becomes so large that no one can help discovering it or having it forced on her attention; and suppose that quite proper advice is offered to the sufferer that she ought to have the growth removed—what then ? What about the future ? Will there be a return of the growth or a similar formation in future somewhere else in the body ? Well, the usual answer to this question is that simple growths do not tend to return, while malignant or cancerous ones do. But we have seen that between simple and malignant growths there is no dividing line, since they merge or pass into one another by slow and insensible gradations, the causes of simple growths being, when longer continued, the causes of cancerous growths. The usual answer is therefore no satisfactory answer at all. It involves, indeed, a process of circular reasoning, since we unconsciously argue that a growth is simple because it does not return, and also that it does not return because it is simple; and similarly we argue that a growth is malignant because it does return, and also that it returns because it is malignant. All this is very unsatisfactory, and particularly so when we reflect that a little consideration would shew us that if growths of any kind occur through over-nutrition and that, if after removal of them, the same causes are allowed to continue to act on the body, either a recurrence of tumour or some other abnormality or disease of the body will be likely to take place. We are compelled therefore to press our advice that even after the removal of simple tumours, which are not expected to return, the patient should alter her habits, and particularly the food habits, which led to the original formation of the growth. And this advice it seems to me ought to be still more earnestly offered to patients after the removal of cancerous growths, since it is futile to expect that patients can continue to remain well after operation if the causes which led to the necessity of that operation continue to act after it has been performed. Perhaps an example may render this more clear, especially as the nutritional causes of the condition appeared evident on inquiry into the history. Mrs. X, aged 30, suffering from a large solid and cystic ovarian tumour came to me in 1902. I thought it well to prepare her for operation by putting her to bed and feeding her on a spare diet, and this because I found that the patient, a pale, thin, and anæmic, or as I prefer to call it, triphthæmic, woman, had suffered for years from heartburn, indigestion, and constipation. In addition she had had periodic attacks of headache and of vomiting, which she termed "bilious attacks." She might have had one of these as often, sometimes, as once a week. She had been in the habit of taking four meals a day—breakfast, dinner, tea, and supper, at 8.30 a.m., 12.30 p.m., 5 p.m., and 8.30. pm., of ordinary mixed diet. Thinking that her bilious attacks, which very much annoyed her, might be due to her food habits, she had made various changes in her diet ; stopping, among other things, the bacon and eggs which she had been accustomed to take at breakfast time; but did not perceive much benefit from this change, perhaps a little. For about a year her bilious attacks had been fewer and her headaches perhaps a little less severe than formerly. No doubt this was due to the fact that the excess of material ingested into the body by her four daily meals, over and above what was required for the effectual and sufficient nourishment and enrichment of the blood, was attracted to the tumour and went to feed that. The tumour-growth, in fact, was the method adopted by nature to find a use for the surplus material being ingested into the blood, and was, therefore, like all nature's methods, salutary, so far as it went. This being so, the connective tissue of the body, and particularly that about the head (she had general *initis*, or connective tissue lymph-congestion, as nearly all anæmic or triphthæmic women have) was less overfed than before, and so the general disturbance of nutrition was less.

The operation was performed on July 2nd, 1902. The tumour of solid and fluid contents was somewhat large, and might weigh about 25lbs., but there were no adhesions and no more difficulties in removal than a little care and manipulation easily overcame. The preparation of the skin and the general arrangements of the operation were the usual ones, and do not call for any particular remark. Neither does the subsequent recovery, except that it was very slow. Catheterisation was required till July 7th, but after the silkworm gut sutures had been removed and an aperient administered, control of the bladder was recovered. The abdominal wound, or, at least, its outer part, took on a grey, somewhat sloughy appearance and was not healed till the beginning of September; but at no time did the condition cause me much anxiety, for although the temperature rose to 101.5°, the pulse was never above 106 (on the third day), and was generally below 100, and at the end of a week was between 80 and 90. The wound smelt rather faint and somewhat of fermentation, notwithstanding the constant use of antiseptics, boric acid, biniodide of mercury, &c. I attributed that not to any failure in antiseptic applications, but to the long continued indigestion from which the patient had suffered previously to the operation. This indigestion, and particularly her four daily meals, the tetrasiteism to which she had so long subjected herself, a new meal being continually ingested before the previous one was digested, appeared to me to have induced a certain amount of sapræmia, and to have rendered her tissues less capable of sustaining the effects of a surgical operation and less capable of healing afterwards than they ought to have been, and than I think they would have been, had her digestion and blood-making processes been in a better state. Even after the operation, and although the patient was fed on a very spare and fluid diet, she suffered a good deal from indigestion from time to time. Whatever she took seemed to disagree with her, so that occasionally she would abstain from all food but water for a day or so at a time. I recommended various changes in the diet in order to rectify these disturbances, trying two daily meals for some time, and again recommending one. She seemed to do best on the last or monositeous plan ; and so I recommended her to keep to that, with a cup of tea morning and evening, and nothing to eat at those times.

Throughout the time during which I was seeing the patient, the question of the causation of the tumour was frequently referred to. I pointed out to her that mere removal of the tumour was not in itself a very momentous matter, if the causes which led to its formation were allowed to continue unchecked. If this were so, although the tumour had been removed and could not recur, still other things might occur and must occur in the body if the causes which led to its formation were suffered to continue. A tumour of the other ovary, for example, might occur. And here I ought to say what I omitted when mentioning the operation—that I then found the left ovary cystic, and, withdrawing it from the abdomen, incised the cysts, letting the fluid escape ; and, stitching the openings up with catgut, returned the ovary to the abdomen. Occurrence of a left ovarian tumour was not, therefore, a very unlikely event. The initial steps to this had, indeed, been already taken. In fact I have seen an ovary sacrificed at an operation for no more cause than I found in my patient's left organ. Or the stump of the removed tumour might take on malignant action, unless we could deal with the causes which led to the formation of the tumour. I have known this to occur in my own practice, a woman from whom I removed a very large ovarian tumour, which appeared to be quite simple (but how heterologous ovarian tumours are, albeit we are accustomed to consider them simple !) dying some years afterwards in the Bradford Cancer Hospital of a malignant growth springing from the stump of the removed ovary. And, of course, it is well known that simple ovarian tumours are apt to be followed after some years by malignant growths. (I infer from these facts, I may say, that there is no difference in principle between the causes of simple growths and those of malignant. The causes of the one appear to me to be the same as the causes of the other. The chief difference between them is the difference in the length of time during which the causes have been in action.) Or other things might happen in the life history of the woman, the occurrence of rheumatism or gout, for instance, or an attack of influenza and pneumonia, or a great variety of possibilities might overtake her, unless we could get to know and to understand what were the causes which led to the formation of the tumour in the first instance. For although it is not necessary to know causes in order to treat effects, and although this statement is particularly true of surgical treatment, in which we frequently, or even as a rule, combat effects without making the slightest reference to causes ; still, causation and to know causes is of paramount importance in preventive medicine, and also, I may say, in preventive surgery. If, therefore, the patient was to have a healthy life in future, it was absolutely necessary to get to know the causes of her illness, and a very poor thing to blow and brag about the progress of surgery, which had made such an operation possible—as is too often done. My patient was as anxious on this point as I was myself. But the causes of her tumour were patent. The tumour had no doubt come from the blood, or, rather, the excess of material laid down in the tumour, the fluid and solid material infiltrating and enormously hypertrophying the natural ovarian structure, came from the blood. But, of course, the blood got it from the food, the function of food being to make blood, and the function of blood being to nourish the body. And it was quite plain from the history of the long-continued indigestion and constipation and of the recurring headaches and bilious attacks, that for a long time the blood had been improperly made, and no doubt loaded with large quantities of ill-assimilated material, out of which the tumour had been formed. In plain English, the woman had been taking too much food ; and I advised her for the future to take less. She had been taking too many meals, and I advised her to take fewer. There had not been sufficiently long intervals allowed to occur between her meals, and I advised longer intervals, so that one meal should have time allowed it for complete digestion before the next was taken. I tried her with two meals, but she still had headaches ; whereupon I recommended her to be monositeous, that is, to eat once daily. She asked me if I thought this would be sufficient for her, as she had to do her own work, as they were not able to afford a servant. I said I thought it would. The following letters speak for themselves. Mrs. X. left Bradford on September 19th or 20th. On October 12th, Mr. X. wrote to me : " I have not forgotten my promise to write you respecting Mrs. X., but thought it best to wait awhile before doing so. She still continues to live on one meal a day, and finds it quite sufficient for her. On two occasions she tried two meals, but felt sorry for it afterwards. She has not had a bilious attack since she came home, and only one very slight headache. She is much stronger and gaining flesh. She weighed 6st. 9lbs. when she returned, but has not been weighed since." On October 27th he wrote again : " Mrs. X. has been weighed to-day and finds she has gained 5lb. during the six weeks she has been at home. On September 15th she weighed 6st. 9lb., and now weighs 7st. She still keeps to one meal a day. She keeps free from bilious attacks."

Such was the after medical treatment recommended and carried out in a case where it was necessary to remove an ovarian tumour surgically. The reasoning which has led to its recommendation on my part, and to its adoption on the part of the patient, has convinced me of two things besides. (1) If I had simply removed the tumour, saying nothing about the causes which led to its formation, I believe I should have done the woman harm and not good, because I should have removed, so to say, the ash-pit of the body without seeing to it that the excess of ash formation and collection was put an end to. The skin, bowels, lungs, and kidneys were evidently incompetent to do the scavengering required, and I should not have taken any steps to lighten their work. Proving unequal to it before, they would have proved unequal to it again, and some other calamity must have happened to the woman. (2) Had this woman been advised, say, two years ago to live in this way, I believe she would not have had the tumour, and would not have required any surgical operation for its removal. And how many cases of this kind and of many other kinds are now quietly and insidiously preparing themselves for operations which would be quite unnecessary if the patients were now being advised to live differently from the ways they are pursuing, I leave to the imagination and to the reflection of my readers. Obviously the same reasoning applies to the after medical treatment of cases treated surgically for the removal of a vast number of growths, hypertrophies, formations, &c.—a number so vast that it is quite impossible to do more than hint at them now. From this point of view, many surgical diseases are preventible as well as medical ones ; and many surgical operations, now absolutely necessary owing to the existing states of patients, might be obviated.

December 24th, 1902.—This patient having come over to Bradford to spend Christmas with her relatives, I have had an opportunity of seeing her. Things continue to go on well with her. She has no indigestion, no headaches, or only the slightest suggestion of headaches, now, and no bilious attacks at all. Her constipation is much less, and she never takes aperients. Her weight is about the same. She thinks she may have lost a pound. She does all her her own house-work, except the very hardest parts of it. She tells me that some of her friends have of their own accord begun to follow a dissiteous *régime*, and that a friend of hers, who suffered from frequently recurring bilious attacks, and who thought to cure them by taking exercises but without altering her diet, continues to have her headaches just the same.

The account of this case has been taken from the *Medical Press and Circular* of 19th January, 1903 ; and I may say that the patient still keeps up her monositeous habits and remains clear of headaches and constipation, has a much better colour than before her operation over seven years ago, and has not had a day's illness since that time.

THE HEREDITY OF DISEASE.

Consideration of the possible presence of congenital irregularities of structure in uterus or ovaries or other parts to which reference was made some time ago, and the subsequent nutritional changes which they may undergo, insensibly raises another set of questions. How do the congenital abnormalities come into existence ? Are they inherited ? Is there an inheritance of disease ? Is disease hereditary ? The presence of nodules in the uterus or of small cysts in the ovary at birth is of course abnormal, and they must be looked upon as diseased structures. The presence of such nodules prevents us from saying that disease is never hereditary. I suppose their existence is in some way due to the habits of the ancestors. This leads me to say what I think is inherited. Diseases like bronchitis, pneumonia, pleurisy, tuberculosis, gout, rheumatism, cancer, &c., do not appear to me to be inherited. I quite admit that some persons show greater resistance to the causes of these diseases than others ; they have less predisposition to them, as the expression has it ; and such resistance may be the organic expression of the habits of our ancestors. They may or may not. I do not know. But the diseases themselves do not seem to me to be inherited, or hardly so. In at least nineteen cases out of twenty, or even in forty-nine out of fifty, they are acquired. And when disease is inherited, as for example if such a nodule as has been referred to is found in the uterine structure, what seems to me to be the law of heredity is this. We inherit not our ancestors' diseases but something much more subtle ; *we inherit*, it seems to me, *constitutions adapted to our ancestors' habits when these habits have persisted for three or four generations.* If our ancestors have over ingested nutriment into their bodies in excess of their requirements and that for three or four generations, then we may come into the world with some over-developed nodule ; such as has been referred to. It is the same or may be the same with the appendix vermiformis before referred to. If the ancestors of a child have so over-fed their organisms that, say the great-grandmother had tuberculosis from the ingestion of too many meals; that the grandmother had gout from the same cause in her generation ; that the mother had frequent but varied illnesses from the same cause, and perhaps the father rheumatism from the same cause—then the child's organism may be born with an appendix vermiformis six inches long, instead of the three inches or less which it ought to measure. It is as if we heard the organism or the in-dwelling life saying to itself—my ancestors for three generations have over-fed their organisms—I must enlarge my digestive capacity in order to cope with the increased labour thrown on it for all that length of time ; and so it enlarges a structure which has been preserved, so far as we can see, by anthropino-zoo-dynamic or the power of human life in its process through many generations in order that we may see how the power of life has been working, through which we have been pro-created. It is much in the same way as an architect may see in looking at a building the period of its design, and seeing this, may understand it better. Or, much as a student looking at a painting may be able to declare what must have been the period of its production, and sometimes even to name the painter. The appendix has been shown to be a portion of the large bowel ; and it has been left for the purpose of showing this and of showing further that alterations of nutritional and digestive functions will be likely to be the chief means through which pathological changes will be made in it, such as congestion, inflammation, suppuration, gangrene, and the like. They very much undervalue, it seems to me, their own instruction and the significance which the various phases of organisation may have for us, who speak of the appendix vermiformis as a useless and obsolete structure. It *may* be atrophying and it may be possible that the pursuit of proper food habits for a succession of generations will be a cause for its atrophy, just as indulgence in improper nutrition may be a cause for its over growth. But it is perfectly certain that it will never disappear so long as anthropino-zoo-dynamic or the power of human life continues to pro-create man. We may hinder and we may hasten the long, slow, orderly processes of nature, but we can neither prevent nor achieve her purposes. The immense length of time during which man has persisted on the earth, and in which the appendix has persisted with him, might have been sufficient to prove this to us. Why have the little tubercles on the back of the upper eye-teeth not disappeared in the course of ages ? Or the smaller tubercles on the backs of the upper lateral incisors, or the thickening still perceptible with the tongue when we touch the backs of the roots of the upper central incisors ? Why should all these facts of organisation still persist after all the generations during which we know that men have been upon the earth if any of his structural arrangements were about to disappear ? But if persistence in wrong food habits for a succession of generations may be a cause of great overgrowth of the appendix in the way suggested, what ought to be the indication to sensible men and women ? Ought we to alter our food habits ? Or is the indication that we should send for a surgeon to remove the appendix in every case ? But even if we do have recourse to the latter alternative, for how many generations is it likelv that this course of behaviour will suffice to preserve us ? Will the time not be likely soon to arrive when no surgeon can save us and when that strain or family will die out and disappear ? Humanity will not be any the worse for their disappearance ; but, relieved of its encumbrances, will go on to pursue its destiny and carry out its purposes. The purposes of life are deep, profound, awful, persistent. They cannot be controverted or subverted. Within the limits of the law we have an infinity of freedom. Without the limits of the law none at all. In a corridor train travelling at sixty miles an hour we may change our seats in our carriage, or converse with our friends as often as we please, but if we jump out of the train it is almost certain that we shall be killed.

And yet—look at this. Even with a much enlarged appendix, if we live properly, if we do not over tax our digestive capacity such as it is, we may still live our life. No surgeon need interfere if we live properly. The woman even who has a hypertrophied nodule in her womb need not convert that nodule into a tumour. It will not overgrow into a tumour unless in turn she over feeds it, notwithstanding the fact that no doubt her ancestors for three or four generations broke the laws of nature, so causing that congenital nodule to exist. No doubt a less amount of over feeding than would be necessary in a perfectly sound woman will be apt to convert that nodule into a tumour. We cannot go on for ever disregarding the laws of nature without being called upon to pay the penalty. But long before the death penalty is inflicted, long before the strain or family is destroyed, so merciful is nature, that we have warning after warning in illness after illness, unmistakable if we could only be got to listen to it, that it is still possible for us in our day and generation to return to obedience to natural law, and so to begin to lay again the foundation of a renewed life. And if we do this, and our successors after us, who shall say that it is impossible to overcome inherited disease or even say to what height it may be possible for us to rise in physiological improvement ? Admiral Togo in the last war telegraphed that his victories over the Russians were due to the virtues of the Mikado, accumulated through his ancestors. And we Western peoples smiled a self-complacent and contemptuous smile. But were we so wise as we thought when we smiled ? If deterioration of a strain is possible, is elevation, is improvement impossible ? And if my ancestors and I myself have broken persistently the laws of nature over three or four generations, is it likely that I shall be able to compete with you whose ancestors for a like or a larger number of generations have as persistently attempted to keep them ? Or vice versa ? And is the imagination not stirred by the reflection that if three or four generations are sufficient to destroy a strain which persistently, for generation after generation, disregards the action of natural law, so that humanity is left free to go on its appointed way after destruction of the law-breakers—is the imagination not stirred by the inquiry what is likely to happen if for three or four or more generations humanity could somehow be induced to attempt to obey those laws which it has shewn such facility in attempting to disobey ? Sooner or later disobedience ends in death—which brings relief to the rest. But what limit is to be assigned to the elevation of the race which shall begin and continue to obey, and which shall strive to attain its highest physiological good ? Truly it hath not yet appeared what we shall be. The law of heredity in disease appears to me to be summed up in what I have said ; and in this—which seems to account for the fallacy of assuming that because several generations have in succession manifested this, that, or the other disease, therefore such disease is hereditary—that like causes acting on like organisms in successive generations induce like effects. Disease may indeed in some few cases be hereditary—I think occasionally it is—but in the vast majority of instances it is acquired. I do not know how this will affect my readers, but to me it suggests law, design, power, and mercy.

PREGNANCY AND PARTURITION.

The views expounded hitherto will no doubt have prepared the reader for the statement of the opinion that pregnancy and parturition are natural states from which no danger need be apprehended, if women are living in a generally healthy state. What that generally healthy state is, hardly requires any further statement, so much having been already said on the question. I think I ought to draw special attention to this; that while it is in accordance with the dictates of common sense and good feeling that an expectant mother should be rather better fed than usual, it is not generally realised, because attention has not been drawn to it, how little is the extra food which is required. I think I cannot do better than insert here an account of parturition which ended fatally, as attention is then drawn to this question among others, and it is shewn that as the whole product of parturition, baby and after-birth included, weighs only about nine pounds avoirdupois, the extra amount of ponderable substance produced during the normal nine months of pregnancy is only about half-an-ounce a day. At the very most therefore the extra amount of food required cannot be more than say two ounces of food daily. As is well known, much more than this is recommended as a rule, and very much more is taken. The fermentation in the digestion, in the blood, and in the tissues which is set up by imperfectly assimilated food forms the most suitable soil for the growth of the septic micro-organisms which are found in these cases when they go wrong, so that the imperfect food-assimilation rather than the micro-organisms is the prepotent factor in the case, If, in addition, the expectant mother interpolates sweets and things of that kind between her meals, as was unhappily the case in the instance described below, is it any wonder that the results are so disastrous and so unspeakably sad? But let us insert here the account of the case as it was detailed to a medical society.

A case of Puerperal Fever fatal on the twelfth day after confinement.

A young woman, five feet four inches high, and weighing eleven stones, was married at twenty-three years of age, and, being confined at twenty-four, died on the twelfth day after the birth of the child. She had never been ill in her life before, except with the usual (?) illnesses of childhood, and except that she had had several attacks of influenza. She had manifested an unusual love of sweets which she gratified freely. The baby was a fine, well formed boy. The confinement took place on a Friday. As labour had lasted long, and made little progress, although it began on the Thursday, and was accompanied by severe labour pains during the Friday, forceps were applied on Friday afternoon. There was some laceration of the perineum which did not extend into the bowel, and stitches were applied in the usual way with strict antiseptic precautions before the patient came out of the anæsthetic, to bring the parts together. The site of the laceration, however, became covered with a membraneous formation, soft, grey, diphtheritic-looking, the soft formation easily peeling off and leaving bleeding edges where the peeling occurred. The temperature and pulse rose. Although the discharges were not fetid, the attending doctor, in order that nothing should be left undone, ordered antiseptic intra-uterine douches to be used, and gave medicine to combat any septic condition that might be present. The temperature was not reduced by these measures; and he therefore administered anti-streptococcic serum on the Wednesday after the confinement—sixth day. On the seventh day I saw her. Temperature then was 102.5°F., and pulse 124; the outer parts covered with grey diphtheritic looking membrane. Hot intra-uterine douches were continued morning and evening, and the medicine continued, replaced afterwards by ammoniated quinine. On the Thursday, seventh day, Friday, eighth day, and on Saturday, ninth day, the conditions did not improve, got worse even ; and when I saw her on the Monday the temperature and pulse were higher, and the pulse rose to 180 on the Tuesday, becoming quicker and quicker and weaker and weaker, till the patient died exhausted on that day, the twelfth after the confinement. She suffered from diarrhœa on the last two days of her life.

Nothing in the whole history and experience of medical practice is more trying to all concerned, to the relatives, to the attending doctor, and to the friends than an occurence of this sort. An occasion universally considered to be one for general rejoicing becomes converted into one of general mourning. Besides that, in the present state of public opinion, blame is almost always attached to the attending doctor, to whom want of proper antiseptic precautions is apt to be attributed. In this case there is no justification for such a suggestion. The doctor had confined hundreds of women with perhaps less than the usual mortality, certainly with no less success than usual ; and neither in the state of his hands nor instruments was there any justification for the suggestion that any antiseptic or other precautions were omitted. What, then, was the cause of the fatality ? Or what were the causes of it, since causes are always multiple ? I believe that the causes were in the young mother's own state, and that the death was attributable to that condition, and not to the attendant doctor. She was stout, somewhat flabby, and was too heavy for her height, although in a state which might by the ordinary person be called well nourished and in good health. Still in any proper use of these terms I do not think she should be described as well nourished, but ought to have been called over-nourished ; and the four or five daily meals she had been in the habit of taking, with the fondness for interpolated sweets which she gratified too freely had caused her tissues and blood to be in a less healthy condition than natural. This shewed itself in susceptibility to colds and to frequent attacks of influenza. It seems to me that if there had been no confinement at all, the patient was ready for an attack of influenza or broncho-pneumonia from the loading of her blood and tissues with imperfectly assimilated materials. Or if she had been exposed to severe exertion or fatigue or some exceptional strain, she would probably have suffered from some illness of which the strain would have been the occasion though not the cause, just as a man knocked down by a bicycle accident might suffer from an attack of gout, as I have known to happen. The accident is the occasion no doubt of the attack of gout, but the cause is the patient's own condition due to his life-habits, without the concurrence of which the accident would have passed off with the occurrence and recovery from a few bruises and without the supervention of any gouty condition. So it seems to me to be in cases like the very distressing one I am considering. If the young mother had been in a healthier condition, in plain English, in a less over-nourished condition, her tissues less flabby and better toned, and her blood in a healthier state, this calamity would not I think have occurred. But when the long strain of the confinement occurred, terminating in the instrumental delivery after several hours of severe labour, and causing some laceration of the strained and inelastic, because nutritionally choked, tissues—during the course of this long struggle, exudation had taken place from the over-laden blood into the lymph-spaces and into the congested tissues, and inflammatory action had occurred, with the free production of various septic organisms finding a too suitable soil in the unhealthy tissues. Of this state the grey, soft, diphtheritic membrane was at once the effect and the proof. It is a somewhat curious fact that both the patient and the nurse who attended her, as also the aunt who had to come to take charge of the house during the illness, were all total abstainers from alcohol, so that alcohol, at least, can be excluded as a cause leading to the fatal result.

It may perhaps be asked why the medical attendants did not curette out the interior of the uterus ? Well, this question was discussed, but on the whole there seemed no justification for such a measure. There was no fetor of the lochial discharges, and the diphtheritic condition of the lacerations seemed the chief local mark of the general septic condition. And as soon as that was peeled off, the dark crimson lacerations became covered again with a new and similar formation. Curetting of the interior of the uterus, it seemed quite likely, would probably be followed by the formation of some similar grey membranous deposit there, and would not be likely to do any good. I say this because recently authorities seem to be espousing the view that free curetting of the interior of the uterus so as to remove what is believed to be the cause of the diseased state, viz., some broken down or unremoved placental tissue is the only measure to be relied on. If this were so, no doubt the conclusion would follow; and it cannot be doubted that in many cases excellent results have followed on this method of treatment. But there appeared to be no reason for such interference in the case described. Neither was there any abscess to be felt in either fornix or in the broad ligament, or it would have been opened.

I am tempted here to compare this case with another one which I saw the day after confinement and which came into the Royal Infirmary the same day, where curettage was done in the evening, and where, notwithstanding, the patient died during the night. The authorities may be right in maintaining that such treatment is the only one holding out the prospect of recovery in such cases, but unfortunately it does not always succeed. I cannot help thinking that too much importance is apt to be attached in the minds of the attendants to the local conditions, and too little attention on the other hand paid to the general state of the lying-in-woman. That the general state is more affected by the habits of life of the expectant mother before her confinement than by any other cause, or than by all other causes combined, seems certain, and it appears to me that far too little attention has been paid to it. In fact the attention that has been given to it appears to have taken a wrong direction ; for under the advice that " you must eat for two my dear " given on all hands to the expectant mother, far more nutritive material is poured into the blood than is required, and the consequences at the accouchement are apt to be disastrous. If common sense were exercised in this matter, it would be seen that as the whole product of a birth, baby and placenta included, is about 9lb. avoirdupois, and as this product takes about nine months to bring to maturity, the whole extra growth of pregnancy is only about half-an-ounce a day. And it would also be seen that not more at the most than a couple of ounces of extra food are required daily by the expectant mother, instead of the half-pound extra which it is often suggested to her that she should take three times a day to meet her condition. What wonder, if in this over fed, unhealthy condition, with tissues and blood laden with unassimilated and badly assimilated food-products, disasters such as this should have to be detailed. No doubt retained placenta is a fruitful source of disaster after confinement ; and that ought to be dealt with by prompt removal before it has time to set up general putrefaction. No doubt also dirty hands and dirty instruments are a possible source of contamination, and I hope no one will imagine that I underestimate the great importance of attending to these matters because I draw attention to the general state of the patient. But I nevertheless think that the general condition of the lying-in-woman is by far the most important factor in the puerperal state, and that this general condition is to be made healthy by the same temperance in general nutrition which leads to a sound condition of life and health in general.

We, the members of the medical profession, have much in our power in the opportunities we have afforded to us of giving sound advice as to the means of obtaining and maintaining health in the pregnant and puerperal state. No doubt in many cases our clients refuse to take our advice. They refuse to contemplate the self-restraint necessary, or to subject themselves to what they consider its annoyance, and they are apt to prefer the advice of those who advise them differently. As, happily, a large proportion of mothers come through the physiological ordeal of parturition unscathed, the state of the lying-in-woman and the influence of her previous habits on that state are apt to escape attention ; and so we go on, not learning as we might do, the lessons that life is capable of conveying to us. Still, those of us who think these matters important will continue, even at the risk of losing the reputation of being "such a nice man," to try to impress their import on the clients who may consult them.

Some remarks on the history of opinion in these questions followed, in which the general reader would not be much interested, as also some references to the opinions and practice of various obstetric authorities; but these would also be unsuitable to be repeated in this place. One important fact may be mentioned as it is of general interest, viz.: that there has been little or no diminution in the mortality from puerperalism during the last twenty years in England and Wales notwithstanding all the attention that has been paid to external antiseptics, even when these are carried to the questionable length of wearing rubber gloves and wearing operating jackets and overalls during attendance on confinements. Thus in 1888–1890 the mortality from all sorts of puerperalism in England and Wales was 65 per million inhabitants per annum. In the three years ending in 1907 it was 61, a slight fall. But when it is remembered that during that time the birth-rate, *i.e.*, the rate at which women could possibly suffer from puerperalism has fallen from 30.8 to 26.8 per 1000, it is plain that the fall in the puerperal rate has scarcely kept pace with the fall in the birth-rate. In my opinion there will be no marked fall until women have better advice offered to them regarding the nutrition proper to this condition, and until they attempt to follow it. And on the other hand, I feel convinced that if they understood the principles of nutrition and carried them out, the state of pregnancy and parturition might become the natural physiological one which it ought to be, with practically no attendant risk whatever.

In the discussion on this case, different opinions were expressed by different speakers. One said he thought the cause of death was diphtheria. The reply was: the diphtheria bacillus might have been present, but the cause of diphtheria is not the bacillus, but the state of the body which harbours it. The real question was why the poor mother's body absorbed instead of eliminating; and the true reason was that she was suffering from such long continued and profound malnutrition that the functions had become positively perverted; she absorbed what she ought to have expelled—and she died. Alas!!

In this connection I should like to refer to a recent work by Dr. Abramowski, of Mildura, Victoria, Australia, entitled "Eating for Health." Dr. Abramowski is a medical man of experience, whose opinion is the more valuable because, having been ill himself, he discovered that he was so owing to wrong food habits, and that when he rectified those wrong habits he became well. He is greatly in favour of a diet of fruits and vegetables as being the natural food of man. At pages 59-60 of his book he says "If we are what we eat, then the babies are what their mothers eat; and my experience proves that the fruit-babies are not only more normal-sized, but more vigorous and healthy, do not lose weight in the first weeks, thrive better, and develope better bones and teeth than the bread-and-meat-babies. At the same time their natural diet (the mother's milk) is, under this diet, not only of sufficient quantity, but of the best quality, so that these babies have a much better chance to live than others, 45 per cent. of whom, according to statistics, die before they are five years old. Our own baby stands as a proof for the above assertion. But I have a number of other instances, of which I like to quote a few later cases:—

"Mrs. F.: First child; engaged my services about two months before the event. Advised exclusive raw fruit diet up to the time. Result: labour of three hours, baby six-and-a-half pounds, born naturally and with very little pain,"

"Mrs. R.: First child; got my advice *re* fruit diet, only about five weeks before the event. Result: Labour four hours, baby seven pounds, born naturally and with very little pain."

"Mrs. S.: Rather small and delicate; has had two children, the first of nine pounds and the other of twelve pounds, the latter was still-born. Confinement in both cases very protracted and difficult, labour lasted eighteen hours and nine hours respectively, and could never have finished without chloroform and instruments. The third baby, under fruit-diet, was seven-and-a-half pounds, labour four hours, confinement easy; could have finished spontaneously, if the mother had shown a little more patience and confidence in her powers. As it was, a very little artificial help proved sufficient, The happiness and the gratitude of the mother was touching in the extreme, and she is a convert to the fruit-diet for life. The baby is healthy and vigorous, and never lost an ounce but grew heavier from the first day."

"In connection with these facts, I must not forget to mention that in a case of a still-born baby, or the baby dying, I have never seen such an agreeable and sure remedy to prevent any complications through the rush of milk, as a fruit-fast. In every case where it was tried it has reduced the milk production in a few days without any disagreeable symptoms."

THE FRUIT-FAST.

"I . . . allow my patients a limited quantity of raw fruit, such as from two to four oranges or bananas in a day, or a similarly reduced quantity of other fruit, but with the absolute exclusion of any nitrogenous food such as nuts or milk. I call this modified fast the 'Fruit-Fast,' and I have seen the most happy and beneficial effects of it."—Eating for Health, p. 42.

The spirit in which these statements of Dr. Abramowski are conceived, entirely agrees with the views to which I have come, and I have great pleasure in quoting them. Neither of us has quoted from the other, as we are quite unknown to one another. The fruit-diet appears to me to be more or less of an accident. We have not in England so considerable a supply of fruit as they have in Victoria. No doubt a much larger amount might be grown, and I hope and believe will be grown in the future, than has been grown in the past. And coincidently it is to be hoped and expected that a considerable movement will be made towards a more refined dietary and away from those somewhat coarse habits which (probably because we have never been encouraged to think about them) still dominate too much the habits of the majority of our population, men and women alike. But as regards the need for keeping the body under, if it is not to be allowed to keep us under, there is no difference between Dr. Abramowski and the writer of these Conversations. Another point which I wish to mention is also of much importance. Dr. Abramowski's logical argument embraces the two heads of agreement and difference. First as to the proof from the method of agreement. Mrs. F., Mrs. R., and Mrs. S., agree in having easy confinements when they have a (restricted) fruit-diet. Fruit, I may mention, contains about ninety per cent. of water and only about ten per cent. of solid constituents. It is therefore in itself a restricted diet, since in an equal weight of it there is far less solid stuff than in an equal weight of bread and meat or the mixed diet of English life. Restriction therefore of the diet so as not choke up the tissues is the principle which is common to Dr. Abramowski and to me.

But, second, Dr. Abramowski not content with employing the method of agreement in his cases, employs also the logical method of difference, for he shows that on ordinary diet the small delicate Mrs. S. had terrible confinements—long, slow, and painful—requiring instrumental delivery, and resulting in the death of at least one of the babies. When, on the other hand, she alters her food habits she has a much easier delivery, which would have terminated naturally, had not the memory of her former dreadful experiences deprived her of her natural courage and patience and compelled her to clamour for interference, to which the doctor rather unwillingly yielded. The proof in its two divisions of the methods of agreement and difference is complete. (1) Those women who have the lighter and more restricted diet during pregnancy have easier times, and (2) a woman who had fearful times under the heavier diet has a much easier time under the lighter diet. If this experience is repeated in other cases, as no doubt it will be, the proof will become absolutely irresistible—to all those at least who are willing to be convinced by the evidence which is set before them.

The inflammatory disorders of the special organs under consideration need not detain us long. We have seen right through these Conversations that all diseases are due to alterations in the nutrition of the body and its parts ; and the diseases of the special organs in question form no exception to this general principle. All the measures therefore suited to the treatment of inflammations in general are applicable in the treatment of these diseases. But just as particular adaptations must be made of the measures suitable to the treatment of local organs like the eye, the ear, the throat, &c., so here, special douches, warm and cool baths, frictions, sitz-baths, and graduated exercises must be adapted to the treatment of the various inflammatory affections to which these organs are subject. But here also, as in all other affections, while the remedies referred to are measures contributory to the return to health, the main and most important, as it must always be the most powerful, means for attaining this end must be a proper regulation of the diet and regimen, so that, neither too much nor too little material going into the blood, the organs concerned shall be properly nourished and so rendered fit for their purposes in the continuance and reproduction of the race.

CONVERSATION V.

ON SOME AILMENTS COMMON AMONG WOMEN, THOUGH NOT PECULIAR TO THEM.

In this conversation I propose to deal with some ailments which, though not peculiar to women, are nevertheless more often manifested by them than by men. The inquiry will also incidentally illuminate the causation of some of the diseases of women not yet alluded to. While neither sex enjoys the health it might exhibit, it is yet matter of common knowledge that women suffer, less or more severely, from a variety of recurring ailments to a greater extent than men. Examples of such are headaches, neuralgias, backaches, general lassitude, and a general feeling of being out of sorts, &c., and these discomforts are almost always aggravated or are apt to be aggravated at the menstrual periods. Besides these, they suffer from ailments peculiar to themselves, as from whites as well as from various tumours and overgrowths in the organs peculiar to the sex. As to the former, or whites, or *fluor albus* as it has been called, it is a catarrhal or running or discharging affection of the mouth and neck and interior of the womb, mostly of its mucous membrane, and may be likened to the occurrence or recurrence of a running cold in the head, to which many people of both sexes are too prone, and which is so very annoying. The principles of its treatment are exactly the same as for a cold in the head ; and as the chief element in the causation of this affection is excess of food, and particularly an excess of starchy and sugary elements in the diet, no treatment can be effectual which does not limit or restrict these. Besides the use of topical applications, as various astringent injections, *e.g.*, of boric acid, alum, Condy's fluid, salt, &c.; treatment, to be efficacious, must combine restriction of the diet. In the matter of recurring colds in the head and in the chest, this has long been with me a dogma or principle, the practical application of which has become most efficacious; so that when people can be induced to follow advice, there are hardly any recurring colds which cannot be got rid of by patience and perserverance in treatment. I know now a large number of persons of both sexes who, having suffered for many years, in some cases over thirty and more, from recurring colds in the head and chest, have been entirely cured. Such persons now never take cold, or if they do, are so well able to trace its causes, that they feel ashamed when they take cold, feeling that the causes are in their own habits and not in the weather or the climate. That is, of course, that while the weather may be the exciting cause or the occasion, the habits of life form the predisposing conditions or cause, and that without the cooperation of the latter, the former would have been powerless to hurt them. Such persons can go out in the rain and fog, and do so, without any fear of taking cold or suffering in any way, except, of course, from the discomfort of unpleasant surroundings.

Some of the experiences which might be detailed as to the cure of ailments of very long standing when one gets to understand the causes of them and to persuade patients to take the same view and to act upon it, are really very striking. These are, of course, independent of sex, although in the case of women they almost invariably allege that their recurring ailments, of whatever sort they may be, are always worse at the menstrual periods. That is, as we have put it, the menstrual periods are the occasion indeed of an aggravation of the recurring malady, but the causes are further back and really are to be found in the patient's habits. I will mention here two striking cases of the cure of maladies of very long standing, one in a woman and the other in a man, although the cure of the latter led on to the cure of a young woman in a like condition by the application of the same principles. A woman whom I know very well, and who is now sixty-five years of age, has suffered all her life, or for as long back as she can remember, from recurring attacks of bronchitis or bronchial catarrh. Even as long ago as when she was seven years old she suffered from severe colds. Some ten years ago she had a casual conversation with me in the house of a third party regarding the causes of recurring maladies in general, and regarding the causes of recurring bronchitic attacks in particular ; and since that time her colds have left her, and now she never takes cold. The conversation turned on the causes of bronchitis, and I pointed out how colds were due to an excess of food, and almost always to an excess of starchy and sugary food in the diet, and how they might therefore almost always be relieved and cured, and subsequent attacks prevented, by a restriction of the diet, and particularly by the restriction of bread, potatoes, puddings, sugar, and cakes. The practical advice was given her that she should eat once a day and once a day only, and when she followed this advice she was cured and has no more colds. That this happy consummation should be reached after fifty years of age, when the attacks had persisted during the whole of the previous life, is really most striking, and ought to encourage us to institute right treatment for ailments of however long standing and of whatever severity. Nor is this woman a valetudinarian. If she has occasion to go out, she is not prevented from doing so by any state of the weather, neither cold nor heat, nor rain nor fog affecting her, nor frost nor snow (except for their discomfort of course), for she knows now that these are not the causes of her illnesses, although they used to be the occasions of them.

The next case is that of a young man, twenty-five years of age, who for twenty-three out of those twenty-five years had suffered from recurring attacks of bronchial asthma, and this to such an extent that he had not been able to learn any trade or any profession. Of course he was not always ill, but he used to have an attack lasting for two or three or more weeks, after which he would recover and be able to be about for some weeks, when he would be laid up again with another attack. One peculiarity he noticed, viz., that for a long time past, even when well, he could not lie with his head low, but required even when at his best, three or four pillows to support his head, During the attacks he could not lie down at all. Under the simple advice that he should eat once a day and once only, and then not later than one or two p.m., with the addition of a basin of Benger's Food in the evening, this young man has made a complete and perfect recovery and has joined his father in business. I met him out in a fog about a year ago, a fog so dense that we could not see across half the street, and he told me it did not affect him and gave him no cold. Such an experience would have been quite impossible to him on his former food habits. He can now lie down with one pillow under his head and sleep through the night like any one else. An interesting corollary of this case is that a layman (that is, a gentleman not a doctor) who read the account of the cure of this case has been able to effect the cure of a young asthmatic woman, with a history similar to that of the young man, by persuading her to adopt a similiar method of living. He has also been able to effect the cure of several persons suffering from chronic bronchitis by the same means. Of course the law, the physiological or pathological law, is independent of the adviser, and exerts its effects on all cases within its sphere, so that, once the law has been declared, its application is within the powers of all persons whether lay or medical who choose to apply it. All that the adviser can do is to declare the law which he does not make, and which all may regard and obey or disregard and disobey, at their option, showing in their health or illnesses the consequences in either case.

As to the external conditions which lead to the occurrence of catarrhal affections of the breathing organs, or to catarrhal affections of internal organs, peculiar to women, much depends on our behaviour, much more than we think, until we begin to reflect more on the question. If, for example, we were to electrify our factory power and to use electric heat instead of coal heat for warming purposes and for cooking—if we were to appeal to electro-dynamic instead of appealing to chemico-dynamic for the satisfaction of our daily wants, how much pleasanter and cleaner would not our towns become and how much healthier our lives. And if we were to pour less soot into the atmosphere from coal combustion and imperfect coal combustion, there would be much less necessity for nature to precipitate the smoke in fogs and in grease on the pavements, and so we should be able to improve our climate instead of making it worse as we do now. And when electric power was liberated through oxidation of coal or by water power at central stations it would be possible to arrange for smoke consumption far more effectually than can be done now when smoke is being vomited from innumerable chimneys in every town. And so it is with these catarrhal affections peculiar to women. Topical applications combined with regulation of the diet, almost always taking the form of reducing the diet, are quite efficacious in the treatment and cure of these annoying affections. And in fact, so much does the general treatment preponderate over the topical or local, that alteration of the diet and regimen alone without any topical applications at all, is often sufficient to cure the disease.

As to cure perhaps a word ought to be said. By cure I mean cessation of an ailment without recurrence. All ailments, and especially all the recurring and chronic ailments, go through stages or periods. They are now better and then worse. There are intervals between the attacks. In the beginning of disease these intervals are so long that they are often unnoticed, or we forget that we have had a previous attack. If the previous attack occurred in spring, for example, and the next attack not till the following spring, and the next attack not till the spring after, it might be some years before we discovered that we were suffering from a recurring illness. But when the intervals between successive attacks become shortened, and when, instead of a year or six months, there are only three months between two attacks, and still more, if the intervals shorten to eight weeks or six weeks or a month, or a fortnight or a week, then we cannot fail to be struck by the recurrence ; and we begin to ask whether something cannot be done to prevent them. Recurrence, I may say, is still less noticeable if, as sometimes happens, it is not a succession of illnesses of the same kind which we suffer from, but a succession of attacks of different sorts, and called by different names. A succession of attacks of cold in the head ending with cough and expectoration may force upon us the inquiry whether they may not be due to something unknown in our way of living and whether therefore something may be done to prevent them; but when we have influenza at one time and quinsy at another, then a cold in the head, then an attack of pleurisy, then headache, lumbago, and neuralgia, and so on, it is not so easy to see the connection; and so we fall into the general conclusion that we are very "delicate," which indeed in such circumstances we plainly are. From this it is easy to fall into the belief that we are as we have been made at birth, and that we shall never be different, forgetting the while, or failing to realise, that our habits and manner of living have far more effect in making us well or ill than any primary inheritance of strength or weakness. We inherit organisation and humanity through our parents no doubt (not from them, but through them from the power of life); but we are constantly altering this inheritance by the way in which we live and mismanage the bodily machine confided to our trust.

Another case, also in its way rather striking, since treatment has resulted in complete cure and also in cessation of the recurring illness, may be mentioned here. A lady who is still nominally on the list of my patients, although she never requires my services, nor, so far as I know, those of any other medical man, used to suffer from a recurring illness every spring. This had occurred so often that she came to notice it. She used to be laid up for three or four weeks with an attack of broncho-pneumonia, or sometimes with influenza and pneumonia, each year about March or April. We talked the question over, and I dwelt upon the fact that causes acting at short intervals of time in the human economy translated themselves into effects occurring at longer intervals of time, and that these causes were almost certainly in the lady's diet. The fact that the illnesses occurred in spring also corroborated the view I had come to on general grounds, that we are under a delusion as to the need for more food in winter than in summer, whereas the indication really was and is that we ought to take less in dark, gloomy weather than in brighter weather. The patient was a teetotaler, and had been so all her life, so that alcohol did not enter into the causation of the recurring illnesses. Under a restriction of the diet to two meals a day, this patient has got rid of her recurring spring illnesses and has not had a return for many years. She takes a cup of tea in the afternoon, but does not eat with it, on the ground that it is unwise to interpolate a meal, however small, between two others, lunch and dinner.

By cure, then, I mean cessation of illnesses without the recurrence of another attack of the same kind; and not only so, but even also, without the occurrence of illnesses of different sorts, since disease is one, and it is quite as much a proof, or at least it is quite as much a suggestion, that we are mismanaging ourselves if we find ourselves suffering from a succession of illnesses of different sorts and called by different names, as if we were suffering from a succession of attacks of disease of the same sort. In case, however, that this view should present itself to the reader as utopian and that to get rid of all illnesses, whether called by the same or by different names, should seem impossible of accomplishment, I will confine our consideration to the cure of recurring ailments of a given kind. And in respect of this it is certain that far and away the chief agent in the cure of this kind of disease is alteration of the diet, and usually restriction of it. Take for example the case of a person who suffers from recurring headaches, or bilious attacks, as they are often called. Such Cases occur in both sexes. I do not know whether they occur more frequently in women than in men. Perhaps recurring neuralgia is commoner among women. But in either case and in both sexes, far the most important agent in cure is restriction of the diet. Generally speaking, reduction of the diet to two daily meals instead of three or four, is sufficient to rid patients of ailments of this kind. Sometimes stoppage of supper is sufficient. But in other cases even further reduction of food is necessary. and sometimes it is necessary (just as in bad cases of asthma) to restrict the patient to one daily meal. Nor do patients necessarily lose weight on this management. In one case of which I had the management, the patient, a woman of forty-six years of age, gained weight from twelve stones to twelve stones twelve pounds in a week after she had begun to eat once a day only. In a few weeks she lost the extra weight ; but a year afterwards during which she had eaten once a day only, and had during that time also got rid of headaches of nine years' duration, she still weighed about twelve stones, two or three pounds. The weight of the body, while of course mainly dependent on the food consumed, is not dependent on this cause altogether, nor even so much as, without previous thought and experience, we might be disposed to imagine. The truth seems to be that we attain to our natural weight and maintain it (the weight varying for each individual, although conforming to a general average proportionate to height) whatever our food habits may be, and whether we habitually eat two, three, or four times a day or even in those cases where we are recommended to do so, once only. At any rate, the stout and heavy woman in question, after gaining at first, hardly lost any weight afterwards on adopting the monositeous regime. I have known other cases in which the same experience was obtained when persons reduced their diet from three or four daily meals to two. And I have experience also of cases in which the bodily weight was permanently increased on one daily meal. It seems as if each of us, besides having personal peculiarities as to colour of eyes and hair, as to height and gait, and other characteristics, also tends to an individual weight which for a long time is maintained at about a level, whatever our food habits may be. Of course, and as everyone knows, persons are often under fed and over fed, becoming thin or stout accordingly; but on the other hand they are often stout on little food, and often enough, on the other hand, seem to be thin on much. Doubtless an increase of bodily weight tends to be obtained as time goes on in most people, caused chiefly by taking more food than is necessary for nutrition; but it is often a long time before this condition is noticed. It is generally also a mark not of improvement, but of the reverse, in health, and is a sign that ought not to be overlooked or treated too lightly; and chiefly for the following reason. If the weight is increasing because the connective tissues of the body are slowly filling out and becoming slightly overgrown and the interstices between filled up with the products of nutrition, it becomes very probable that the internal organs, the stomach, the liver, the lungs, &c., are slowly becoming congested also; and attention ought to be given to this before it may be too late. The great remedy of course is restriction of the diet.

Here one ought to mention a cause of congestion of the internal viscera which affects women exclusively, and which cannot be considered as being without importance, viz., the wearing of stays or corsets. So far as these articles of clothing exert any influence, it must be in the direction of circumscribing and limiting the space in which the stomach, liver, intestines, and spleen (not to mention the pelvic organs also) as well as the heart and lungs expand and contract and rise and fall; so that by this means congestions are either initiated, or, when already begun, are aggravated in all these organs. How hurtful to the right working of the bodily parts this must be needs very little emphasis; and yet the use of these cramping articles of apparel is far too common. Even when not at all tight, corsets are of no use, or, at any rate, of no use that could not as easily be attained by an undervest on to which the skirts can be fastened by buttons and tapes; and when stays are tight, as has been often shown, they do much damage to health.

The recurring ailments which we are considering, afflict persons often for a great number of years, so many that we tend to imagine that they are part and parcel of our bodily organisation, and that their continuance need not disturb our equanimity or cause any apprehension as to our health. But this is an unwarrantable assumption. They invariably go on to induce more serious conditions, and very often incurable ones. Recurring neuralgias or sick headaches, as they are usually gouty or rheumatic in their character, not infrequently end in general gout or in crippling rheumatism; while other terminations are apoplexy, Bright's disease and cancer. I have seen recurring headaches, and neuralgias, and megrims, after coming and going for many years, terminate in all these forms of fatal illnesses, so that one is led by this kind of evidence to the general conclusion that disease is one (as Hippocrates said, and many others of the ancient writers on medicine), and not only so, but we are compelled to recognise how important it is to treat these affections before they eventuate in conditions for which there is no cure.

The backaches which women suffer from to a much greater extent than men are very frequently associated with inflammatory affections of the interior of the womb. They are often said to be caused by them, though this view is hardly correct. It is nearer the truth to say that the backache and the womb-inflammation are both effects of a common cause, viz., the malnutrition due to prolonged malassimilation of food and to dyspepsia, than to say that they are cause and effect of one another. The backache and the womb-inflammation or endometritis (ἔνδον = within and μήτρα = womb) ought much rather to be viewed as concomitant or successive effects of a common cause than as cause and effect of one another. Failure to make this distinction leads into a very common fallacy in medicine, perhaps more common than any other, much more common than the *post hoc ergo propter hoc* fallacy. In this last form of fallacy a condition (recovery for example) is apt to be attributed to one cause, say the taking of a remedy, when in fact it was due to another. But in the fallacy under consideration, concomitant conditions like backache and endometritis or inflammation of the interior of the womb are supposed to be cause and effect of one another ; and the practical effects of this fallacy are often serious. A woman may be told that, the state of her womb being the cause of her backache, an operation on the womb will cure the backache. She submits to the operation, but some months afterwards she finds her backache no better. In fact it would have been quite as rational to say that the backache caused the endometritis as to say that the endometritis caused the backache. It may have been necessary to operate on the womb, but the operation ought to have been accompanied by the advice to live differently in the future. Otherwise the causes which led to the endometritis originally, will, if they continue, be apt to lead to a recurrence of the original condition; and as these causes are also the causes of the backache, it is hopeless to expect an improvement in the latter until they have been removed. Many other instances of this fallacy occur in medical practice. Common ones are, that constipation causes cancer, and that constipation causes headaches, whereas a truer view would be that the causes of constipation, viz., improper feeding, were the cause of the cancer in the one case, as also of the headaches in the other. And this difference of view is not theoretical only, but highly practical also, since the adoption of means proper to the cure of the constipation may be expected to eventuate, and will eventuate in the prevention of the more serious or even incurable ailment that would otherwise have occurred. Perhaps I ought to say that by cure of constipation, I mean also real cure, since it can by no means be admitted that a recurring condition for which aperients require to be repeatedly administered, is cured or can be cured by such means.

Recurring constipation cannot be cured by taking aperients, any more than recurring or chronic diarrhœa can be cured by administering astringents, the proof of which, as it has been given in "Air, Food, and Exercises," need not be repeated here. But a very practical proof which cannot be gainsaid, is the innumerable number of aperient pills, patent or otherwise, on the market at present, and the fact that the large number of persons who think it necessary to take them, go on doing so in greater and greater numbers till the end of their lives. Or perhaps—for this is very common—they vary the sort of aperient, replace pills by saline aperient mineral waters, or both by cascara, &c., never really getting rid of the trouble for which they originally began the use of the aperients—until perhaps they find themselves suffering from some malady which no one can cure. Constipation and cancer no doubt in many cases follow one another in time, but the nexus between them is much rather to be found in the view that the causes of the one are, when continued longer, the causes also of the other, than that they are cause and effect of one another. They are rather successive effects of common causes (mal nutrition) than the cause and effect of one another. It is said that 178 tons of pills are taken in England every year. As if constipation could be cured in that way!! I knew a person and a sensible person too who took a daily aperient for thirty-five years!!! That she did not see after, say, six months' experience that constipation could not be cured by taking aperients is one of those facts which it is so difficult to explain, although unfortunately this blindness is so common both among men and women as almost to make one despair of the general common sense and intelligence of the race.

A few words must be said here on the reason why many recurring ailments to which women may be liable are so apt to be aggravated at the menstrual periods that with one accord the sex attribute their headaches, back-aches, neuralgias, &c., to the occurrence of this condition, and almost refuse to see the proper causal nexus even when it is pointed out to them. But the explanation is really very simple. At the menstrual period, which, as we said, is the expulsion from the body of the unimpregnated ovum, and the demolition of the nest which was being prepared for it, at this time there is congestion of the womb and neighbouring parts, the blood being directed to them in larger quantities for the carrying on of the physiological work in hand. If now there is backache, at any rate, and in any case, at this time, slight smouldering dull ache, perhaps only felt on making some movement, with a certain amount of passive congestion, this dull, slight, nagging pain is increased by the physiological or healthy congestion, and the pain becomes acute or severe, perhaps intolerable. It is no wonder then if the sufferer attributes her distress to the onset of the period and refuses to listen to any other explanation. No doubt the pain is much aggravated at that time, becoming so much more severe that she forgets there was a minor degree of it present before, revealed on making certain movements. The real explanation nevertheless is that the backache and general discomfort are *occasioned* indeed by the occurrence of the menstrual period, but that the true *causes* are to be found in the state of the woman's general nutrition ; and if she is wise she will begin treatment whenever the period is over, in the hope that before the occurrence of the next one she will suffer less from her recurring constipation, headache, backache, neuralgia, megrim, biliousness, or whatever it may be, than she did before. And of course it will be necessary to continue treatment during many intervals before she experiences much amelioration of her recurring malady. It is a good plan, since it is a close imitation of nature's own methods, to omit treatment during one week in four, continuing only the general dietetic arrangements, and if necessary or practicable resting in bed for one or two days, The treatment consists mainly in the use of three measures :—

(1) Alteration of the diet, since it is through bad blood-making that the recurring ailment has come on, and because bad blood is chiefly made through wrong feeding.
(2) The use of methodised exercises.
(3) The use of hot applications to the abdomen and of wet sheet packs and local applications, sitz baths, &c.

The first measure must of course be continued even during the period, although a day or two of hot drinks only (milk and soup) when keeping to bed may be necessary if the patient is very ill and her pain very severe. But the second and third measures should certainly be omitted for a week, as, if resorted to at that time they would probably aggravate the trouble ; and then for the next three weeks, or until the onset of the next period, they should be resumed. Under this imitation of and co-working with nature, continued for as long as may be necessary, we may hope for cure in a large number, in fact the very large majority of those recurring maladies to which women are subject. (I do not say that men also should not be treated on similar lines. In fact it is best to apply the same principles to them also in the management of recurring ailments, because although they have no periodic physiological functions like those of women, periodicity and intermission and peristalsis, and exacerbation and recession are qualities not of sex but of humanity, and even, as we have already seen, of the action of energy in general, including of course anthropino-zoo-dynamic or the power of human life. And anyone who thinks of this with insight will see also its application to children; so simple on the one hand, and yet so all-embracing on the other, are the principles which govern the world and the universe in which we live). In this way and by the application of principles so far reaching and yet so simple that the marvel is that every child, or at any rate every grown woman, has not seen them for herself, all these recurring ailments, the headaches, the backaches, colds, megrims, neuralgias, bilious attacks, out-of-sortnesses, &c., to which women are so subject can be dealt with and cured while yet in the simpler forms. And the most important consideration remains, namely, that the further development of these simple maladies into the incurable ones, the development from headache, neuralgia, constipation, &c., of apoplexy, chronic incurable rheumatism, Bright's disease, and cancer, as also the occurrence of dangerous or even fatal pneumonia or influenza and pneumonia, can be so surely prevented if the warnings, the merciful and life-preserving warnings of nature, are listened to and reflected on and acted on in time. If the reader says to herself—"I am not going to accept this doctrine. I am not going to attempt to keep the body under. I am going to have a good time. This doctrine is like that of the spiritual adviser to which human nature replies—What? Always fast and vigil. Always watching and prayer? I am not going to do it. I would rather take my chance and die." Well; all the expert can do is to declare the law. He does not make it. Nature makes it and the Author of nature. But it is worth our while to ask, whether breach of the law of nature does lead to so good a time, whether it does eventuate in as much comfort, joy, happiness, cheerfulness, peace, and calm to bear the inevitable ills of life, as an attempt, however humble, to see the law under which we live, and an effort, a repeated effort, however inefficient, to obey it. And if it can be shown to women that if they obey, they may remain long on the earth and see their children grow up, and be themselves centres in course of time round which the children may revolve with their various families of children and children's children—well we must each make up our own mind whether such a life is worth having, especially as each of us finds himself or herself in it unconsulted, and when further, even before we thought much about it, we had been the cause in turn of the arrival of successors on these changing scenes. It would not much affect the processes of nature if public meetings assembled, attended by thousands and thousands of people, unanimously determined that they would never rest until the obnoxious law of gravitation (let us say) was removed from the statute book of nature. If, in order to show their violent protest against this obnoxious law, they should cast themselves down one by one from the top of the loftiest chimney of their city, what hope might we cherish that the hundred thousandth would not be killed equally with the first? And if the corpses were allowed to remain, so that in time the heap might be raised so high that falling among them would not be followed by death, would not the obnoxious law of gravitation have been vindicated all the same? If we refuse to understand that if we do not keep the body under, it will inevitably keep us under, whose fault is that? Nature's? or our own? What can human beings do, finding themselves in scenes which they must traverse, unconsulted as to whether they would accept life's privileges and responsibilities, its joys and sorrows, or not—what can we do but attempt to discover the laws under which we live? And try to obey them? Happily it is very easy to see what these laws are. She who runs may read. I do not say that it is always easy to obey—but reflections on these conditions must be left to the intellect and the conscience of each as she finds herself journeying through life. When the expert has declared the law, his responsibility ceases.

As to tumours and tumour-growth, the same principles hold, as we have seen in the last Conversation. Tumours are divided into various sorts, but the great division is into simple and malignant, that is, into those on the one hand which do not tend to return after removal, and into those which on the other hand do so tend. But this division is, after all, one of contraries and not of contradictories, that is, no hard and fast line can be laid down between the two sorts, which shade off into one another by degrees so insensible that we cannot tell where simplicity leaves off and where malignancy begins. But the great point I wish to make about tumours is that they are over-growths either of tissue more or less normal (simple tumours or homologous hypertrophies, as they are often called) or they are over-growths of tissue more or less abnormal (malignant growths or heterologous hyperplasias, as they are called). But, hypertrophies or hyperplasias, over-growths of natural structures or over-growths of unnatural structures, both are over-growths, and over growths are produced by over nutrition, that is by taking into the body more food than is necessary to replace the waste sustained by the body in being made the vehicle and agent of life. An important step in cure therefore must needs be restriction of the diet, even when it is found possible and when it may be necessary to remove a growth by operation. For if the advice be not offered that in future the patient ought to live in a different way from that pursued in the past, what guarantee have we that the same causes which have produced the over growth in the past may not cause a recurrence of it in the future ? Or, if no new growth forms, is it not likely that the woman will be ill again in some other way ? Even if the advice be offered, and even if the patient, being convinced, attempts to restrict her diet accordingly, recurrence may sometimes happen. In this sad case however, patient and adviser will at least have the melancholy satisfaction of feeling that they did all they could to obviate the evils which still unfortunately overtook her. The further question of tumours which may have sprung from some nodule too large even at birth has been dealt with in the last Conversation, as also its relation to the general nutrition.

Here again therefore we leave off as we began, and restate our definition that the animal body is a machine procreated by zoo-dynamic or the power of animal life, as a house for the habitation of life, and that the primary function as also the most trying labour manifested in the body is tropho-dynamic or the power of assimilation. Even respiration, as it is performed through organs which appear as a diverticulum from the fore-gut, is a function subsidiary to the power of assimilation, so that our definition seems to be true from whatever aspect we view it. From which again it becomes evident that for the cure of most illnesses, not change of air is desirable, but rather change of diet and regimen. Not of course that change of air and scene is undesirable, but that it ought to be accompanied by the other advice also. If an elderly woman (or man) has a cold and hoarseness, and then developes influenza, and if it be thought desirable therefore to recommend a change of air to Torquay or Brighton, or Biarritz or Pau, obviously it will still be wise to inquire what causes made her ill at home, so that when at Brighton or Pau, and also on her return home, she shall, if possible, remain well.

The views expressed in these Conversations and particularly the view that the chief cause of disease is not the breathing of bad or vitiated air, but too much food ; as also the view that food is not the cause either of the energy of the body or of its heat, appear in sharp collision with much of the health-literature of the day. I have thought I couid not do better than insert here some remarks by the medical adviser of a popular journal which has recently appeared. After recommending the use of warm clothing to prevent an undue loss of body-heat with which I quite agree, he goes on to say—

"Our food supplies us with this natural warmth ; therefore, in the cold weather, when heat waste is greatest we need more food than usual. Our winter diet, then, should consist of a plentiful supply of all the heat-producing food-stuffs.

"These are the fats, sugars, and the starchy foods, and every winter meal should contain a fair proportion of these.

"The best beginning for a cold day is a good breakfast, A big plate of porridge and cream, a cup of rich cocoa, with plenty of hot milk, plenty of sugar with both, bread and butter, and some bacon and eggs, is the good start which is half the battle of keeping warm throughout the day.

"At this point, let me say that people who have no appetite for breakfast are usually those who suffer most from the cold. My strong advice to them is to cultivate a breakfast appetite as soon as possible. The toast and tea breakfast, which so many people say is all they can face the first thing in the morning, is useless in the winter.

"At the other meals during the day plenty of fat meat and starchy vegetables—such as potatoes, turnips, &c.—should be taken. Such dishes as Irish stew and beef-steak pudding are splendid winter diets on account of the heat-producing elements they contain.

"A very good plan at teatime is to substitute cocoa or chocolate, both of which are most nourishing and heating, for the usual tea which is merely a stimulant.

"Thin people who suffer much from the cold will find that a glass of rich milk, heated, but not boiling, taken between meals, or a course of cod-liver oil will help them to ward off the winter's discomforts.

"Plenty of open-air exercise is perhaps the best means of all for keeping out the cold. Exercise stimulates the circulation so that the heat-carrying blood flows rapidly to all parts of the body, imparting a general feeling of warmth. On the other hand, sitting huddled over a fire draws all the blood to the parts of the body nearest the heat, since the blood-vessels dilate on that side, leaving the parts away from the fire more than usually empty of blood, and therefore colder."

I am in entire agreement with the last paragraph about exercise, although of course my readers will feel that I must enter a warning that even as to exercises, it is not a wise policy to first work the organism too hard with digestive labour, and then to work off the effects of too much food by exercises. This plan over works the body in two directions, both wearing, and too close together. But as to the practical advisability of exercises for the good of the body, I quite agree, even if I feel that under a properly regulated regime the business of life will afford sufficient exercise in most cases for health. But as to the rest of the advice and as to the spirit of it, the disagreement is sharp and fundamental. The " good breakfast " described is far better calculated to make one cold than warm. People who take such a breakfast also are very apt to feel faint and tired in the forenoon, and also to feel thirsty, and if they meet these feelings by lunches or alcohol they are apt to suffer in some of the ways we have so often described. Further, it is in direct opposition to my experience to say " that people who have no appetite for breakfast are usually those who suffer most from the cold." The reverse is the case as those know well who have given the no breakfast plan a fair trial.

Breakfastless persons are far warmer and also far more active than those who take breakfast, especially the heavy breakfast here recommended. I think the writer might have realised this when he found himself advising his clients to take " a glass of rich milk, heated, but not boiling, between meals " ! ! ! Evidently the cause of the spring illnesses * whose existence is proved by common experience and by the Registrar-General, is not

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* See page 135.

understood by this writer. It is just this sort of diet, as it is the principles on which the offering of this advice is founded, which is the cause of the almost universal occurrence of colds, influenzas, inflammations, and fevers, in early life; with the subsequent occurrence of rheumatism, gout, Bright's disease, apoplexy, and cancer which destroy life over fifty or sixty years of age. The difference is so great and marked that no one can fail to be struck by it who attends to the matter at all. Even then it is, however, not a difference of contradictories because the unknown writer does not advise continual eating, any more than I advise total abstinence from food. But it is a difference of contraries, and of marked contraries, for between the five pounds avoirdupois weight of daily food recommended (by implication) by the unknown adviser, and, say, the sixteen ounces of food which according to my judgment is sufficient for the average man, there is a difference so great that every one who considers the question must be struck by it; and the average reader would be apt to describe the two forms of advice as contradictory of one another. The reader must make up her mind between the two, for certainly they cannot both be correct.

These then are shortly the views, and such is the evidence for them, which have projected themselves on my mind after some forty years' experience of the practice of medicine. The prevailing question in my mind is—not why I have been compelled to adopt them, but how it is that all practitioners of medicine and all medical advisers have not come to the same conclusions. There is one great reason for this indeed to which I will refer directly; but before doing so let me recount another incident which shews how far the medical profession is from attempting to give effect in practice to views such as these, even when one might have thought that theoretically they had been convinced of their truth. A compeer of my own who has done me the honour—the high honour I venture to call it—of consulting me about members of his family both in the past and the present generations—told me recently that a member of his family was suffering from asthma, and that a throat and nose specialist was treating the patient for it. The mucous membrane of the nose was being burnt, I understood, with a wire made white-hot by the electric current. Of course I said I was very sorry to hear of the illness, and hoped that the treatment would do good, and that the patient would soon be well. But I could not help feeling as if I was somewhat of a hypocrite in hoping that the treatment would do good, because I knew perfectly well, or at least was and am firmly convinced that the treatment can do very little good, unless, that is, it is accompanied by restriction of the excess of starch and sugar in the diet, which is the true cause of the illness. And if this restriction is adopted, then I know also that no cauterisation of the nasal mucous membrane will be required, or that it will probably not be required. Of course I do not dispute the existence of the congestion or even inflammation of the mucous membrane lining the nose. Of course not. That is part of the general congestion of the mucous membrane lining the whole respiratory tract which exists in every case of bronchial asthma.- I imagine indeed that my friend would admit this. As also would the nasal specialist whom he consulted. And perhaps some day when instruments are still further adapted to the body than they are now, we may attempt to reach parts of the respiratory mucous membrane in the bronchi themselves, and to cauterise them as we are now doing the nasal mucous membrane. But what prospect shall we have of curing asthma by this means? Very little, I venture to say—unless, coincidently, we recommend a reduction of the nutritional cause, the excess of food, nearly always consisting of an overplus of starch and sugar, which is the real cause of the congestion and inflammation both of the mucous membrane lining the nose and the parts lower down the respiratory tract. Dare I say anything more of my friend? Dare I refer to the purple colour of his hands caused by overloading of his own blood with an excess of nutritive material, in plain English, of too much food? Or am I free to say how my heart sank when he told me that he was on his way to work off by "exercise" what ought never to have been allowed to enter his blood at all? These are the disappointments of the too sensitive philosopher I suppose, wounded quite unwittingly in the house of his friends, and by the conduct of those whom for a long time he had been attempting—not with any gain to himself—to persuade to a different view and to different conduct. And when some day an attack of pneumonia or perhaps of influenza and pneumonia flings his friend into bed with the greatest danger to his life, the too sensitive philosopher will have no desire to say "I told you so;" although he will be compelled to realise that it is unjust and also futile to attribute to the weather or to hard work or to exposure, or to mystery, or to fate, or to delicacy of constitution, effects which are really due to our wrong habits.

But these reflections lead on to the other consideration to which I promised to refer. The evidence for the view I am advocating seems so clear and convincing that the difficulty is to say how it is to be evaded. But of course if it is accepted, or rather let me say if it is not to be ignored, then undoubtedly a certain amount of self-government, a certain amount even of restriction must necessarily be exercised by each individual on herself (and himself). It is quite true that such restraint and self-government eventuate in the greatest happiness and in the enjoyment of the best health in the end. They do so indeed long before the end. They do it in the middle, and even soon after the beginning, of the treatment in most cases. But at first, no doubt, self-restraint is uncomfortable, and I imagine that many of us secretly shrink from the adoption of views which, when they affect conduct, as all convictions ought to do, seem bound to make us a little uncomfortable. Well—each of us must be fully persuaded in our own minds. In nature, so far as my reading of her goes, there are no rewards and there are no punishments, If there were, perhaps it might be open to us to object that a certain amount of favouritism was shewn to some and not to others. But if there are no rewards and no punishments (and perhaps this is a question rather of words than of things) no one who looks at the facts, even for a very short time, can fail to see that there are consequences grim on the one hand, and pleasurable on the other, but always inevitable, even if they do not always seem to fall on the breakers of the law in the first case, or on those who attempt to keep it in the other. And from the point of view followed in these conversations, consequences of breach of the laws of health are illnesses, painful or otherwise, but even if not painful in the restricted sense, then at least inconvenient and uncomfortable. And other evil consequences are shortening of life and the occurrence of death earlier, often by many years, than in the course of nature it ought to occur. How much earlier it is not possible to say. But if an addition of from ten or fifteen to say twenty or twenty-five years to healthy and efficient and happy life were in question as dependent on our living in one way rather than in another, surely sane persons would adopt the one rather than the other. In my judgment, this amount of difference at least is at stake. I incline to think indeed that the difference would be found to be much greater. We are continually falling into errors of various sorts and failing to make distinctions of one sort or other in our journey through life ; and I should like to mention here definitely three insidious fallacies to which human beings, men and women alike, are specially prone. Incidentally they have often been referred to in these Conversations. First we are very apt to mistake the discomfort of indigestion and dyspepsia for hunger and thirst. When we do so we frequently take food or drink, when what we ought to do is to abstain from food or to restrict the supply. Second, we are apt to be confused between a feeling of fatigue and rheumatism. As rheumatism is congestion or inflammation of the connective tissues, and as fatigue is a certain amount of healthy congestion of the same tissues, it is really quite easy to mistake the one for the other. Then, as fatigue is supposed (till we think more about it) to be due to a "run-down" state, and as that run-down state is again supposed to be due to under nutrition, we not only rest to get rid of the fatigue, but we also have supper before doing so, *i.e.*, we take food in this condition also when it would be much better for health if we refrained. The proof that it would be much better to refrain is that we are apt to wake tired when we ought to wake fresh and active, sometimes even to fail to sleep at all, when we eat before sleeping; but we are too apt to overlook this condition, or if we do notice it, to try to account for it in other ways. And thirdly, we are too apt to attribute to delicacy of constitution and to too great susceptibility of nervous organisation what ought really to be attributed to love of ease and to self-indulgence. It is really easy to be very lenient with ourselves and to attribute to weakness and delicacy what our friends see is often only whim and "pretty little Fanny's way." Whether this too amiable self-indulgence is commoner among women than among men I will leave to my fair readers themselves to say. But whether it is commoner in one sex than the other is not so important a question as is the treatment which ought to be adopted for it; and as there is no doubt whatever in my mind that it is destructive to health to attempt to meet whimsicality and flightiness by frequent little meals of tea and bread and butter, or by boxes of chocolates, or by alcoholic drams, or by expensive journeys and change of air, I am bound in faithfulness to declare the truth as I see it. I need not labour this question. Avoidance of these three insidious fallacies would make such a difference to the happiness of life and would enable us to meet our duties to the younger and helpless generations so much better, that I beg my readers to attempt to steer clear of the three-fold fallacy of mistaking indigestion for hunger and thirst; rheumatism for fatigue; and flightiness and instability and self-indulgence for delicacy and over-sensitiveness, to others' pain. Because assuredly when these conditions are met by food and drink instead of being met, as they ought to be, by abstinence or at least by restriction, the effects on health and happiness, our own and that of other people, are disastrous; our lives are made miserable by recurring illnesses either of the same sort, or of different sorts ; and life itself is shortened by periods of from five to ten, or fifteen or twenty, or twenty-five, or even more years. Without knowing anything of the particular circumstances of each case, I never see a death announced at between fifty and sixty years of age, or even between sixty and seventy, without saying—Oh ! if we understood nutrition ! Oh ! if we wished to understand the action of tropho-dynamic on the human body ! ! For if we wished to know, we should know. If we made ourselves receptive to the light and heat, and waited for them, they would flow into and illumine and warm us.

CONVERSATION VI.

Part I.

ON CHILDREN'S AILMENTS.

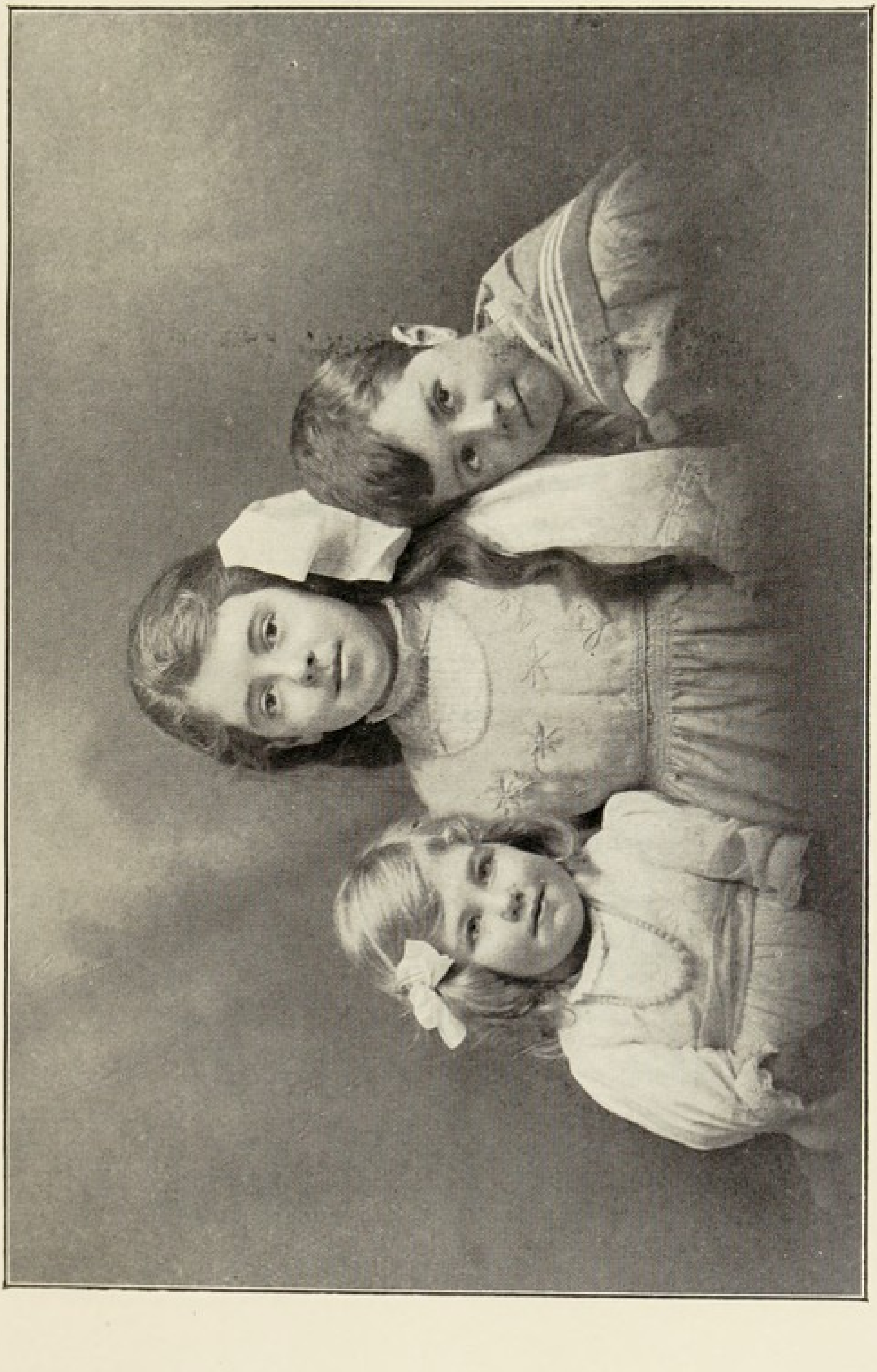
I do not propose to deal at length with the ailments of children, since to do this would demand a treatise for itself ; but only to make some general observations which may help mothers in dealing with them. And I do not know if the reader will be surprised to hear that the same general principles appear to me to obtain in this department of medicine as those already declared as governing the cure and prevention of nearly all the illnesses of men and women. The reader will perhaps say—What ? A growing child ? Is such to be treated as we would a full-grown person who may perhaps have, for a long series of years, ingested into the body more food than was required for its proper nutrition ? But can this principle possibly apply, or is it likely that it also applies, to children still growing ? In order to answer this question let us ask—how much does a growing child grow ? Few people have thought of this. The most rapid growth is during the first year of life, when babies grow from, say, six or eight pounds to twenty pounds in weight ; or about twelve pounds in the year. That is to say, a baby a year old weighs three times as much as he did at birth. But after all, when we come to think of it, this increase is only at the rate of one pound a month, not a very great deal, amounting as it does to about half-an-ounce a day. Of course there is another element to be considered besides mere growth, and that is the amount of change, and therefore the danger that must arise to a child's body when it grows to three times the weight at the end of the year that it had at the beginning of it. These changes must make greater demands on the growing organism than at any other period of life. This is true, and no doubt accounts to some extent for the still far too great mortality exhibited by infants in the first year of life. In the years 1901 to 1905, infant mortality varied from 151 to 128 in England, averaging 137.8 per 1000 births. In 1906 the death-rate under one year of age per 1000 was 132, and in 1907, it was 118. Still, there can be little doubt that, notwithstanding the great increase of weight in the first year of life, and in spite of the severe strain which this must necessarily entail on the young organism, a great reduction could be made in this far too great mortality if proper attention, or anything approaching proper attention, were given to the feeding of infants. Even amongst the poor, however, the commonest faults by far in this respect are too frequent feeding and improper feeding, rather than providing too little food. Without recommending that we should go so far in infrequency of infant feeding as did Oribasius and Paulus Aegineta in ancient times, who said that twice a day was a sufficient number of times to feed an infant, or three times at the most, we may safely say that four meals in the twenty-four hours are sufficient for an infant, at any rate after the first month of life. I wish, however, to remind the reader that this immense relative growth is naturally effected on a milk diet and a milk diet only. Human milk has the following average composition. It consists of protein or nitrogen-containing material 2.3 per cent. (in the form of albumen 1.3 per cent. and casein 1 per cent.), of fat 3.8 per cent., sugar 6.2 per cent., and water 87.4 per cent. As the total solids therefore contained in human milk only amount to about 12.6 per cent., it would be difficult to understand how it would be physiologically possible to build up the body of an infant out of such material, were it not also true that the human body itself consists of some sixty to sixty-five per cent. of water, and only of some thirty-five to forty per cent. of solid stuff. The same surprise is apt to affect us when it is suggested that we can physiologically feed the body on fruit in later life, or the body of the expectant mother and her developing baby on fruit, since fruit contains from about eighty-five to eighty-eight per cent. of water and only some fifteen per cent. of solid material. But a proper appreciation of the problem of nutrition, and of the meaning of the body as the house of life, seems to show from first to last that we have been in the habit of viewing the whole question too crudely, and, under the view that the strength of the body and its heat both come from the food, of introducing too much food, so choking the body up, and preventing it from acting as the efficient vehicle or medium or instrument of the power of human life. A proper appreciation of the fact that it is and must be through the action of the power of life itself that we are able to assimilate food at all might have kept us right on this point; for if the strength of the body comes from food whence comes the strength and power to assimilate food? The view, on the other hand, that the universe is the manifestation of the working of an infinite and eternal energy, or dynamic, and that the power of animal life or zoo-dynamic is one of the forms, or phases, or genera, of this energy, with tropho-dynamic, or the power of assimilation, as a sub-division or species of it, is, I venture to think, much truer to nature and much more explanatory of the processes of life. And, this being so, it must drive the cruder idea out of the field. In this way we get to understand better how it is possible for the body of an infant to grow in the first year of life to a weight about three times what it had at birth, out of a diet consisting of about eighty-seven per cent. of water. From this point of view, also, we may realise better the meaning of the ancient philosophy which made all things consist of modifications of the four elements, earth, air, water, and fire, for if we call fire, heat, and water, moisture, we have at once two of the essential conditions of life under their most modern names ; and as animals live on the earth, and all require the use of air, we find how remarkably close to the realities of things was that philosophy which we are so apt to smile at as archaic and quite out of date.

That milk is the suitable diet of infancy and the only one, might have been thought to be a fact in the possession of all human beings, or at least in the possession of all mothers. But it is not so, or it would not have been possible for Professor Irving Fisher to record the following in Bulletin No. 30, on National Health, U.S.A. " Recently a case came to light of a new member of a mothers' club who was feeding her five-months old baby on sausage, tea-cake, &c., and giving it drugs when she wanted to go out. She was greatly surprised when informed of the wrong she was doing." ! ! ! Professor Fisher is not a medical man. The same kind of experience, however, is constantly being paralleled and detailed to us by medical men, medical officers of health, and district visitors in town and country districts, both in this country and abroad. On the other hand, perhaps, no measure introduced in recent years offers a more hopeful means of improving infant health and reducing infant mortality than the attempt to establish municipal milk depots, and coincidently to teach the principles of the proper nutrition of infants. From infancy to childhood, from childhood to adolescence, from adolescence to maturity, and from maturity to senility and decay, are only stages of life gradually overtaking one another; and perception of the true principles of nutrition in the first of these will, it is to be expected, gradually lead to truer illumination in respect of the others.

After the first year of life growth is not so rapid. It may amount to from four to six pounds in the year. This does not amount to more than a quarter of an ounce a day, so that the growing child ought to have what food is necessary to nourish the body, and in addition the food that may be necessary to supply growth to the extent of a quarter of an ounce a day, say one or two ounces of extra food at the outside. In order to supply this, and under the well-meant but quite mistaken good nature of mothers or relatives or nurses, a child may be supplied with all that it requires, and with perhaps half a pound of extra food three times a day because the boy or girl is growing!! And then the mother wonders why the child has a cold or pneumonia, or a sore throat, or measles, or some other of the continued fevers, or why, when he recovers from an illness, in a week or two he suffers from another called by the same name, or from one called by a different one. And yet it is quite easy to understand that when the child's blood is loaded with an excessive quantity of stuff from the digestion, and much of that improperly digested, the blood must be compelled to deposit some of the excess, as an exudation in some of the tissues, and so the child falls ill, not from too little food but from too much. The recurrence of illnesses in children, as in adults, must be viewed as the effect of the action of some frequently recurring cause, or of a cause which may even seem to be constant. In children also, as in adults, that cause is nearly always dietetic; and of course until rectification of this is made, no permanent cure can be expected. Still less can we hope to prevent the occurrence of subsequent illnesses. A succession of illnesses, either called by the same name or by different names, will occur, and all kinds of remedies will probably be suggested for them. A case occurs to me, one among many (although unfortunately parents are not always so reasonable in these matters as were those of the child under consideration), which I will detail, as it illustrates so well what is to be said and done in like cases. A boy of eight, whom I saw about five years ago, had suffered from a succession of colds with cough and expectoration for a long time before I saw him. The history of the case was that he would get a severe cold with feverishness, so that it would be necessary to put him to bed and have him treated. Then after a week or ten days he would get up and return to school. In two or three weeks more he would be ill again and in bed and under treatment for a similar attack. When I saw the boy he was pale and small and thin, and the friends said of him—what a small boy for his age. I recommended, seeing that the boy was growing four to six pounds in a year, that he should have food sufficient to supply this extra quarter of an ounce daily; and of course, besides this, that he was to have food sufficient for the nourishment of his body, and the restoration of its waste sustained in acting as the medium of vital energy.

But considering that he had had a succession of attacks of colds and coughs (really broncho-pneumonia) for a considerable time before I saw him, and knowing that these attacks were due to an excess of material ingested into his blood through the digestion, I recommended that he should have his breakfast at 8 a.m. before going to school, his dinner at about 1 p.m.; and about 6 p.m. only a glass of milk, with no solid food. No supper. Under this regime the boy has done well. In a year after I saw him he had had only one attack of illness which lasted for three days. His mother kept him in bed on a pint of milk a day, after which he got up and returned to the recommended regime. He has had no illness since. He has grown well and developed in every way, so much so that whereas formerly the friends said, "What a small boy for his age," they now say, "What a fine boy." The simplicity of this advice is equalled only by its efficacy. That it conforms to the simplicity (and also to the efficiency) of nature does not make me less enamoured of its value, but more. "A growing boy." Yes! but how much does a boy grow? And how much food is required to supply the necessary material? Further, let us observe that no elaborate measures were necessary for the nutrition of this delicate boy. He had the ordinary breakfast and the ordinary dinner taken by the family. No upset of the household arrangements has been necessary, and none has been made. Truly, nature's methods are wonderful, and the more nearly we can approximate to them the better for us. Many other cases occur to me. On several occasions now I have had the happy experience of witnessing the cure of suppuration in joints, and diseases of bones in growing children, after recommending restriction of the diet. I mention in "Air, Food, and Exercises" the case of a child of four years of age who was suffering from a tuberculous disease of the knee-joint, with suppuration going on in the joint and necrosis of the lower part of the thigh-bone, who was cured by having a dinner once a day, and only a glass of milk, with no solid food, morning and evening, for breakfast and tea. In fifteen months the child gained ten pounds avoirdupois in weight, got a fine rosy colour in her face, and lost the constipation from which she had suffered (although she was kept necessarily in bed all the time), besides recovering from the disease of the joint so completely as to be able not only to walk, but even to run without limping. I have seen the same happy result occur after similar treatment in other cases of suppurations in joints and glands, and in other scrofulous and tubercular affections in children. A proper appreciation of the meaning indeed of the interposition of the lymphatic system in the vertebrate animals might have shown us even without experience what the true indications of nature in such cases must be, and how suppurations in glands must almost necessarily be caused by overloading the system and so violating that economy of nature which the lymphatic system is interpolated in order to secure. Of course, some parents—the majority as yet I fear—will not listen. The heat, the animus, they manifest is sometimes difficult to understand. They will have resort to anything, to operations on the nose, or throat, to change of place, to anything rather than to regulation of the diet. No doubt they mean well. But they take a different view, or they believe that they take a different view, from the one put before them. They believe that children should be well fed. So do I. But the question is—what is being well fed? What are the tests that a child is well fed ? That he grows well and that he is free from illness ? I should say that these are reasonable tests. But now suppose that a boy has recurring attacks of asthma, and that for the cure of these his mother is recommended to take him to a milder climate, say Southport, if he happens to live in the West Riding of Yorkshire. Suppose that this is done and that in Southport the attacks of asthma are not so frequent and perhaps not so severe, but still that they do not disappear. That the child should be put on two meals and take nothing solid after dinner-time is a suggestion to which many parents will not listen. Well, after a time it is found that the child has adenoids and enlarged tonsils. The adenoids are scraped out of the nostrils and throat, and the tonsils are removed ; but no change is suggested in the mode of life or in the diet which is the real cause of the enlargement of the glandular elements of the mucous membrane of the throat and nose, and of the over-growth of the tonsils, and which has also led to the development of the asthma. Most disappointingly, other attacks of asthma occur, notwithstanding the operation for the removal of the adenoids and the tonsils. Why ? It is easy to see why, but nearly impossible to convince the parents. But it is and was because the operation dealt only with the effects, and was not accompanied by any advice as to the causes which, by leading to over-growth of the glandular elements of the mucous membrane and of the tonsils, rendered the operation necessary. The adenoids, the enlarged tonsils, the asthma were not cause and effect of one another but were concomitant or successive effects of a common cause, viz., malnutrition or, in plain English, over-feeding. It would have been as rational to argue that curing the asthma would probably have been effective in causing atrophy in the enlarged tonsils and the adenoids, as to infer that removing the tonsils and adenoids would cure the asthma. In fact it would have been more rational. Proper feeding would have had much influence in reducing the adenoids and in curing the asthma, although my experience leads me to say that it would probably have failed to reduce the enlarged tonsils. Of course proper feeding would have prevented their enlargement; but that is a different matter. By the time one sees the patient, the mischief has been done, and one must try to remedy it and at the same time, if possible, by advising about causes, attempt to prevent recurrence, or the occurence of some other ailment. But now occurs an interesting feature in this history "founded on fact." Another child in the family is found to have adenoids and enlarged tonsils. This is the kind of evidence from which it is inferred that these things "run in families." Of course if the various members of a family, inheriting similar organisations, live alike, will they not be likely to suffer from similar affections? And if they do, what is the most likely explanation of the causation of these? That they have been subject to similar environment? or that they have inherited the same tendency to disease? Suppose we try alteration of the environment, say change of diet rather than change of air, and see what happens. Well, the other child had the tonsils and the adenoids removed, and on the day of the operation, the child first operated on was in bed with an attack of asthma, the cure of which was one of the effects expected from the operation!!!! One can only marvel at the bluntness of perception which hinders so many parents, very nice, very accomplished, very shrewd, very affectionate, from seeing a causal nexus of this kind even after it has been pointed out to them. Nevertheless this kind of behaviour is going on in thousands of households among the well-to-do, and in hundreds of schools, in this and other countries at the present time; and no power of argument or persuasiveness appears to have any influence on it. The children are being sacrificed, in many cases, to the Moloch of surgery. It is the same with tubercular glands in the neck. To point out to parents that the lymphatic circulation and its glands have been introduced into the higher animals in order that nothing may be lost, and that any excess of nutriment carried by the blood to the tissues may be picked up in the lymph spaces in the connective tissue, may be conducted thence to the lymph ducts, and by them to the lymph glands, and from the glands after elaboration back again to the blood for re-use in the economy—to point out all this and to beg the parents to reflect on it, is useless. The glands are enlarged and must be removed. Or they have suppurated and have been destroyed. Well; in the last case they are better away no doubt. But even then it should not be forgotten that, part of the cleansing apparatus having been removed from the economy, its resistance has been by so much lowered. It will therefore be necessary in future to see to it most carefully that the patient is not over-fed. Yet no word of this kind is said. On the contrary, the patient being pale, weak, thin, delicate, is recommended to be "fed up"; and by and bye colds, rheumatism, and broncho-pneumonia supervene, or perhaps one of the continued fevers, the causation of which is attributed to exposure to cold, wetness, dampness, fatigue, infection, &c.; and so the round goes on. The injustice of attributing these drawbacks to delicacy of constitution, to ancestry, and to the " mysteries of heredity " never seems to occur to these good people, nor does it seem possible to convince them. What wonder then if the medical profession, finding them in this frame of mind and finding their own position seriously compromised by the controversy—but we will draw a veil over the rest.

Now I daresay that some readers will mentally object to some of the things said in this Conversation about the feeding of children, and will perhaps wish to ask if I do not think that starvation or under-feeding occurs among children because I draw attention so much to the evils of over-feeding, of unsuitable feeding, and of too frequent feeding. As to this, of course, there can be no two opinions. Under-feeding undoubtedly exists among some children, starvation as we may call it, more or less pronounced, and where it exists it must be met by proper feeding. Nevertheless, among children, as among adults, over-feeding is a far more common cause of disease and death than is starvation. And two meals a day of suitable food is by no means a diet of starvation for children, as will I hope be plain immediately. By the kindness of the parents of the children whose photographs I am allowed to introduce here, I am able to show a reproduction of pictures of children who, whatever else may be said of them, will not fairly, I think, be described as under-fed or starved. I ought to say that the parents, whom I do not yet know personally, have been induced rather reluctantly to consent to the reproduction of the photographs because I pressed them to do so. They have no wish to make it appear that the children are prodigies in any respect, although the eldest, of nine-and-a-half years of age, is at the top of her class in school, and the second,



of six-and-a-half years, is not far from the top of his. The "baby" is two-and-a-half years of age.

These children have been brought up on two meals a day, and the two meals have been dinner and "tea" rather than breakfast and dinner. I discuss the relative merits of these rival plans later. The two older children walk three quarters of a mile to school daily, and the same distance back again. The plan the parents have followed with their children has been the rational one of trying to find out the indications of nature and then attempting to follow them. Also they say they have not been unaffected by the expression of opinions of mine on this subject enunciated now for a good many years past. The children have been offered breakfast, which has always been on the table, but when they refused it, have never been pressed to take it. So the breakfast has consisted of a "breakfast cup of cocoa one-third milk, with now and again weak coffee or tea." The family are vegetarians. At 12.45 the children are home from school and ready for dinner. Tea is taken about 5.30. "The meals the children do get are not very big ones, but of good plain food." Now I do not wish to labour this case or to attach any more importance to it than it deserves, but no reasonable person can look at the picture of these children and say that they look under-fed. In fact I fear the verdict might perhaps be the other way ! ! ! One very interesting and most important fact has not yet been mentioned, viz., that there has never been any case of infectious illness among these children, no measles, no scarlet fever, no diphtheria, no typhoid fever. Here again one must not infer too much. But this fact, so far as it goes, corroborates the view I have expounded and defended for a good many years past, that the occurrence of infectious diseases among children depends much more on indulgence in wrong food habits than on the incidence or action of infectious germs. If children are in a sound state of health, neither over-nourished nor under-nourished, but suitably and healthily nourished, no terror of the occurrence of infectious disease among them need worry their parents. Even then, of course, they need not be recklessly exposed to the dangers of infectious disease. No sane adviser would allow them to drink scarlatinal milk if he knew it. But at the same time a sound state of health will probably prevent their suffering from the effects of infectious germs even if in the ordinary way they should be exposed to them. The terror of infection is greatly exaggerated and is driving us into cowardly panic. At the same time, reason and common sense should be our guide in this as in the other affairs of life. The terror of infection has very little effect on a sensible man ; but while a medical man might not hesitate, if circumstances required it, to spend a night with a smallpox-patient, he would be most unwise to sleep with him for three weeks, as if he did so he would be very likely indeed to take smallpox. And so it is with children. If, when they are ill with some infectious disease, we cannot make out where they got the infection from, if all our inquiry fails to discover a likely cause of infection, we may be pretty sure that the children's own state was the most important element in the case, and from what we have seen, we are safe in inferring that the most likely cause of their susceptibility was some form of wrong feeding, and the malassimilation and bad blood-formation to which it gave rise.

The children whose picture is shown had their two meals at 12.45 and 5.30 p.m. Is this, theoretically, the best plan? I hardly think so. Of course, it is good enough. We can get accustomed to almost any plan of living if it is physiologically sound, and that taking two meals in twenty-four hours is a physiologically sound method of bringing up children, and of feeding grown people also, is quite certain. But there is an objection to taking the second meal at 5.30 or 6.0 p.m., viz., this: that it compels the organism to be performing the labour of digestion during sleep. Sleep, as has been seen, appears to have been ignored in modern text-books of physiology. But if sleep is necessary for the body, not only for its restoration, but also for the elimination of waste, it must be unwise to compel the organism to carry on so severe a labour as that of digestion—the hardest labour really that the body undergoes—during the time when it is charging with vital energy in preparation for the work of the next day. Many mothers are greatly distressed at the restlessness of the children after they are put to bed. Children often toss about, fling their limbs about, kick the bed-clothes off, lie uncovered and get cold, and have various accidents after going to bed, that no precautionary measures seem competent to relieve or prevent. Nearly all of these troubles are caused by too late eating. The stomach and intestines being full of food, digestion has to be effected, and this causes such an excitement and even irritation of the brain and spinal cord that sleep is very much disturbed and interfered with till perhaps two or three or four in the morning, after which, as the digestion has been completed, the child falls into a sound and quiet sleep. The nurse and mother have both gone to bed long before this, and consequently have no opportunity of observing it or of reflecting on what it means. Besides this, the child is apt to wake with a fetid breath in the morning, or with a too dry mouth; and the mother and nurse notice this but cannot account for it. But these are all effects of too late eating; and for this reason in chief, I think it better that children should have their two meals about 7 or 8 in the morning, and about 12 or 1 or even 2 in the day, than that they should have them at 12 and 5 or 6 in the evening. There is one great difficulty in the way of carrying out the former plan, and that is, the customs of social life. When children see their friends it is generally in the evening, and of course when we receive our friends, or go to see them, we expect to have rather better fare than we have in ordinary circumstances. This could be met by altering the custom of the time of entertainment for young children to a dinner at 2 o'clock; and a little milk could be offered when they went home about 6 or 7. It would be a far healthier plan than that which is being pursued at present. I know, of course, how difficult and how dangerous it is to suggest any change from the conventions of social life, or in any other arrangements that depend on feeling and fashion, rather than on reason and the fitness of things. And of course the evening is the most leisured time of the day, especially for the elders who may wish to join the children's parties. But I think that this little change, both of the time and of the food-arrangements during the time of entertainment, would be greatly for the benefit of the children; and therefore I suggest it. In his "Apologia" (p. 121), Cardinal Newman says: "The true medical adviser must ever appear to the ordinary person, at first sight, as if he were advising contrary to nature and contrary to life." One must run some risks if one wants to do any good. War is not made with rose-water, and opposition to the power of mere convention or fashion, and passive resistance to her world-power, is often less hopeful and often costs as much as to wage war on the battle field. A humourist once said that "it had been pounds out of his way being born"!! This is a phase of the question of life which we dare not overlook. These unexpected questions often prove to be the ones which it is most difficult to settle. Tact, however, and common sense may do much in these directions. And, of course, exceptions have to be allowed for sometimes. But on the other hand the exceptions must not be permitted to occur too often, or the laws of nature will be violated. The monk Lessius advocated the following out of the principles of Cornaro in diet, but allowed for the occurrence of exceptions. I am afraid that the exceptions must have been too numerous, for the good monk died at sixty-nine, while Cornaro himself, although he had mismanaged his constitution sadly in his youth, lived to at least ninety-seven years, and perhaps more. If, therefore, exceptions are to be allowed in the management of the diet of susceptible children, as they must sometimes, these exceptions must not be numerous. But I hope I have been able to suggest to my fair readers that if children suffer sometimes from starvation and underfeeding, the chief cause of their recurring illnesses is not this but the reverse.

Part II.

EFFECTS OF ANXIETY ON HEALTH.

There is one important cause of disease on which hitherto I have said nothing. The chief causes of disease appear, from all the considerations advanced in these Conversations, to consist in wrong alimentation, in wrong food and drink habits, in breathing bad or vitiated air, and in the mismanagement of the body in regard of exercises and of mechanical work. If, therefore, we manage properly the relations of the body to food and drink—not necessarily alcoholic drink, only, but to all kinds and quantities of drink, as to all kinds and quantities of food also—to air and to exercises, we go a very long way towards getting the body into a healthy state and maintaining it therein. There is, however, a fourth cause of ill-health to which some consideration ought to be devoted. It is true that children do not suffer from it, or hardly suffer from it ; and perhaps women suffer less from it than do men—I mean anxiety. Children are more or less outside of its influence, because they appear to accept as a matter of course the circumstances and lot in which they find themselves. Their sufferings from poverty or from hardship appear to draw compassion and the desire to relieve them rather from their elders than from themselves. Their power to prevent and help is very limited. At any rate it is only exceptionally that children seem to show signs of suffering from conscious anxiety. And perhaps women suffer less from this cause than men, on whom, on the whole, the burden falls of providing for the necessities of the home, whose affairs it is the woman's function to administer. After all arrangements have, however, been duly made for the proper regulation of food, air, and exercises, whether as occupation or as recreation, there can be no doubt that human beings may be thrown into ill health and worn down by the evil effects of too much anxiety. And some of us are of more anxious natures than others. Of course the question of anxiety is greatly a moral one, depending much on the general view which we take of life and of our relations to the universe of which we form a minute part, and which is carrying itself and us with it, and as a part of it, to the fulfilment of its destiny and of ours. Considering the very small influence which we can exert in affecting the course of the universe, or of that minute part of it which we call our world, we ought to be calm, and, attempting to do our part well, to accept the results seriously and quietly as they appear to evolve themselves. When we do this, indeed, it is sometimes surprising how the effects of human influence seem to increase and to affect the course of things much more than we thought. But many of us are not so calm and quiet as we ought to be; and the question is, when this is so and when we allow ourselves to be hurtfully influenced by anxiety, how does it affect us. The main result seems to be in causing relaxation and dilatation in organs rather than tone and the braced up state which is induced by healthy and moderate stimulation. The heart may become flabby and dilated by anxiety, its walls weak, its action irregular or intermittent, and the patient conscious of a vague pain in the left side of the chest, accompanied, perhaps, by a feeling of aimlessness and futility, as if, whatever he did or refrained from doing, it made no matter. Not infrequently sleeplessness is a symptom, the sufferer being woke up perhaps just when he was about to go to sleep, and being haunted by visions of distress and of impending trouble, often enough even much greater than he recognises that they ought to be when he is in more reasonable states of minds. And when he wakes, it is often with a feeling of throbbing in the head from over-stimulation, particularly of the longitudinal elements of the brain-vessels, whose contraction shortens and widens the vessels and tends to over-fill them with blood. No doubt this suggests the possibility of apoplexy, which is one of the effects of too much anxiety. It is interesting to notice how, in respect of this form of stimulation also, a little anxiety is good for us, for without it there would not be the healthy response which is so suitable to life and health. Excess, however, is bad, and there can be no doubt that when excess of anxiety has acted on the organism for a long time, and when such experiences have been frequently repeated, serious deterioration of power and even of structure occurs in the bodily parts. The vague chest-pain from which too anxious persons often suffer, seems as if it had some connection with the back of the head, and the pain seems to pass obscurely between the chest and the back of the head and neck. The parts affected are very often the same as those implicated in general initis. Often the breast-bone is tender, the *trabeculae cordis* or stays of the heart congested, and at the same time the back of the neck is tender to pressure, or sometimes painful even without pressure. Anxiety appears, in fact, to be one of the causes of general initis or connective-tissue-congestion, especially when it appears in the upper part of the body, in the chest and neck and head.

If now one is asked how this alteration of the general nutrition of these parts comes about, and how these congestions arise in anxiety, it seems as if anxiety (like alcohol and ether and opium and other narcotics) acts as a stimulus primarily to the longitudinal elements of structure rather than to the transverse. The first effect of the action of anxiety on the body therefore is to shorten parts and widen them, and so to increase their function. Hence we find the pulse quickening and the blood-vessels dilating, so as to give the onlooker the impression that the sufferer's face is flushed and anxious, as it is often called. No doubt these actions are soon followed by their opposites, that is, the transverse elements of structure in turn take on their characteristic action and the person may become too pale, just as formerly he was too much flushed. Frequently the mouth becomes dry, the cause of this being that, as the involuntary muscular fibres of the salivary ducts, and particularly their transverse elements, go into contraction, the ducts are emptied of contents and the mouth, not receiving its due supply of saliva, feels dry. We read that Job when he was tried "every moment" begged to be "let alone till he swallowed down his spittle." This dryness is immediately due, it is true, rather to contraction of the transverse elements of the salivary ducts than to that of the longitudinal; but remotely there had, no doubt, been over-contraction of the longitudinal, leading to an increased salivary flow. The same is true of the kidneys and of the skin, an increased flow of water from the former and of moisture and perspiration from the latter taking place or tending to take place. In this way organs in general lose their tone and tend to become flabby, and lax, and weak. The vessels of the brain, becoming dilated and weakened, with their coats perhaps infiltrated with unassimilated products from the digestion, one can see how they may tend to lose their elasticity, to become sclerosed, as it is termed, or hardened, and so to rupture, causing an attack of apoplexy, which is therefore due, in the first instance, rather to alterations in the nutrition of the blood-vessels than of the nervous system. And as similar changes are simultaneously occurring all over the body, it is easy to see how organs generally participate in the same conditions, and so, how many important parts, as the kidneys, the liver, the lungs, become over-distended, flabby, dilated, weak; and fail to perform their functions properly. In this way the whole body suffers, and one or several parts of it break down in chronic and incurable disease. No doubt anxiety acts, as do other stimuli in the body, by affecting primarily the nutritional functions. And no doubt it is true on the whole that a man or a woman will bear anxiety better, the sounder and the more healthy is the state of the general nutrition, and therefore the resisting power of the body. But unfortunately it is equally true that however healthy may be the general nutritional condition of the body, health may be ground down, worn, deteriorated, and even destroyed by anxiety too long continued, too severe, and beyond the power of life to bear. It is quite true that reason can show us that it is unwise and even irrational to permit ourselves to suffer in these ways from this cause; but emotion, while it may be influenced by the reason, belongs to a different order of human faculty, and is apt to exert her own influence, whatever reason may say. Noetico-dynamic may be acting healthily and well, and yet aesthetico-dynamic may be disturbed, although both act through the processes of tropho-dynamic. Forethought, it is true, may do much to enable us to anticipate and so to prevent the necessity of too much worry ; but there are some misfortunes which no amount of forethought would have prevented, as there are some anxieties which must deteriorate health, however wisely we may have laid our plans to anticipate and prevent them. In these circumstances one resource left to us (though not the only one by any means) is to imitate the children and to accept calmly and as a matter of course the effects of anxiety which we could not avoid. The effects of too much anxiety are not by any means unknown in England, but they seem to exert a greater influence still for evil in the United States of America. It has been calculated that there as here a great deal of the illness which occurs is preventable. According indeed to a paper recently issued by the President of the Provident Savings Life Assurance Society, of New York, some sorts of preventable illnesses are much more prevalent in the United States of America than in England and Wales. Quoting an estimate by Professor Irving Fisher, that there are constantly about 3,000,000 persons ill in the United States of America, and that *more than half of this illness is preventable*, President Rittenhouse goes on to say that "allowing for increase of population, about two persons die now where one died thirty years ago from preventable or postponable diseases of the heart, arteries, kidneys, and brain." President Rittenhouse thinks that these three sets of diseases are essentially the diseases of worry and anxiety, and the too strenuous life in general, and he says that they have greatly increased in the United States while they have either not increased at all in England and Wales or have even somewhat diminished.

He even goes so far as to say that the death-rate from diseases of the kidneys, of the heart, and from apoplexy combined has increased in the United States Registration Areas by eighty-three per cent. since 1880. Whether the increase is so great as this may be a matter of question. The alleged increase is enormous, and there may be some countervailing considerations which are not apparent and which may therefore not have been stated, especially as it is stated that in England and Wales, during the same period, the mortality from diseases of the heart, and arteries, and from apoplexy, has decreased some seven per cent. There is much strain and stress on life in England at the present time. There seems to be a slowly progressive increase in England and Wales in the mortality from diseases of the kidneys among the general population in the last twenty years, from 444 per million per annum in 1888 to 463 in 1895, and to 492 in 1907. If, in order to see whether anxiety is a probable cause of this increased mortality or of some of it, we compare the male and female mortality the following figures appear. The female mortality from diseases of the kidneys in the twenty years ending in 1907 was for England and Wales, 331 per million per annum in 1888, 355 in 1895, and 383 in 1907. For males on the other hand the rates were for 1888, 568 per million per annum, 579 for 1895, and 610 in 1907. In the English population generally the rate of mortality from diseases of the kidneys is (1) a progressive one, and (2) it is much more rife as a cause of death among men than among women; and as this is what might have been expected, had President Rittenhouse been correct in his conclusion regarding the cause, or a main part of the cause, of these diseases, we must admit that to that extent the results corroborate the probable truth of his view that diseases of the kidneys are to some extent induced by worry or anxiety. It is, however, different with diseases of the blood-vessels and with diseases of the heart, as I must now proceed to show. From diseases of the heart there is an appreciable decrease in mortality in England and Wales, since these diseases accounted for a death-rate of 1577 per million per annum in 1888, of 1463 in 1895, and of 1458 in 1907. From apoplexy, hemiplegia, and cerebral hæmorrhage, the death-rate in England and Wales was 886 per million per annum in 1888, 805 in 1895, and 718 in 1907. It is a noteworthy fact that deaths from cerebral hæmorrhage are commoner among women than among men, and I am inclined to the opinion that the reason why this is so is because of their food habits, and chiefly I think because they eat oftener than men, and because their diet consists more than with men of bread, cakes, and sweets. Cerebral hæmorrhage, therefore, appears to me to be induced rather by wrong nutrition than by excess of worry. Both sexes, no doubt, have their share of worry, but I think that on the whole men suffer from it more than women; and yet the mortality of women from cerebral hæmorrhage is greater than that of men.

According to the English Registrar-General, and examining now the male death-rate from cerebral hæmorrhage, apoplexy, and hemiplegia, and comparing it with the female death-rate, as has just been done for diseases of the kidneys, we come upon the following results. In 1888 the male death-rate from these affections of the blood-vessels was 834 per million per annum, in 1895 it was 762, and in 1907 it was 667. At the corresponding times the female death-rates from these affections were 936, 846, and 767. Throughout the twenty years, therefore, from 1888 to 1907, the female death-rate was considerably greater than the male. As the reason for this is, in my opinion, the difference in the food habits of the two sexes already referred to, and as women seem to suffer on the whole less from anxiety than men, I am not disposed to accept President Rittenhouse's suggestion that apoplexy and cerebral hæmorrhage are markedly caused by anxiety, although I quite admit that it may act as a cause contributory to their production.

Similar facts appear if we examine the mortality from diseases of the heart, for we find that women suffer from these affections to a greater extent than men. Thus, comparing the same twenty years from 1888 to 1907, we find the female mortality from heart-disease to have been 1609 per million per annum in 1888, 1721 in 1895, and 1477 in 1907; while the male mortality rates in the same years were 1541, 1502, and 1438. I hardly think that these comparative figures are compatible with President Rittenhouse's attribution of the causes of death from apoplexy, cerebral hæmorrhage, and heart-disease to anxiety. He has probably taken his figures from men only, or from men mainly, because the large majority of insured persons belong to the male sex; and if he is correct in saying that the mortality from these causes is an increasing one, then his inference as to increasing stress being a cause is probably correct. In England and Wales, however, an examination of the figures scarcely bears out the contention that the mortality from cerebral hæmorrhage or diseases of the heart is caused by worry or anxiety, while they do seem, on the other hand, to be largely or mainly caused by malnutrition. But I quite admit that anxiety may act as a contributory cause. Nevertheless, with President Rittenhouse's *general* conclusion I am in entire agreement, and to show this I will state it in his own words. He says: "The natural conclusion is that this abnormal increase in the death-rate from the early wearing out of these vital organs is due to excesses in eating, drinking, working, playing—in short, intemperate living, and the strenuous life." But I think that the more efficient part of the cause in the production of the evil effects is the intemperance in eating and drinking, and the less efficient part the anxiety to which he is disposed to attribute it. He is quite right further in drawing attention to the too early period of life at which these causes of mortality operate. And it is quite in harmony with the views propounded all through these Conversations that the medical profession should call upon the people to take command of the nutrition of their bodies, since if we do not keep our bodies under, they will assuredly keep us under; and life, while being rendered much less healthy than it ought to be while it lasts, will come to an end in pain and suffering at a much earlier age than it ought to reach.

It seems to me that if we would strive to understand the true inwardness of nutrition, if we would realise that even the plant, which, attached to the ground, derives most of its sustenance from the surrounding air, since the earth does not lose the weight which the plant gains; and that similarly the animal body derives its vital energy from the infinite stores of energy in which it lives and moves and has its being, repairing the waste of its body, and building up its substance from its food; if we were therefore to realise that the animal body is the house of life, and the effect of the power of life, rather than its cause; if we were to realise that the organs of respiration arise as a diverticulum from the fore-gut, and that they are therefore complementary digestive organs; if further we were to realise that the mouth is a comparatively late interpolation by the power of life, and that it is developed not from the alimentary tract but along with the nervous system; if we were therefore to see, what seems so plain, that the higher powers of life acting through the nervous system ought to take command of what goes into the mouth; and if, lastly, we were to consider that in human beings the mouth is filled by the hands, which are the active instruments of the will, and not by placing our mouth in the dish as a dog or a cat laps; it seems to me that if we realised even faintly the force of this cumulative argument, we should make some approach to an understanding of the meaning of animal and of human life on this planet, of the beauty and adaptation of the instruments of life to the purposes for which they are intended, of the ascending hierarchy of powers which is ever translating itself into a corresponding hierarchy of forms suitable for its expression and manifestation, and of that true evolution of that ascending power and form to which the whole scheme and process of the world and of the universe not dimly points. And if we should come to the conclusion that that evolution may not even cease with men, would not this conclusion also be one in accord with the cumulative evidence which a calm review of the facts tends to force upon us? I will not labour this conclusion any further. If the general result seems to be to diminish somewhat the sphere and scope of medical efforts in the public welfare, by confining these efforts mainly to the treatment of the effects of malnutrition immediate and remote, a coincident effect is greatly to elevate the scope and sphere of individual effort in obtaining and enjoying good health; and if the chief means by which this end is to be achieved is by self-government I must now leave this general conclusion and the cumulative evidence through which it has been reached to the judgment and conscience of my fair readers.

INDEX AND GLOSSARY.

Roman numerals refer to Preface: Ordinary numerals to pages in the Text. When "&c." appears it means "and subsequent pages."

thought, and as modern scientific men appear to think, since a species of power emanating from an infinite source must procreate forms in an infinite variety. But identity or perfect similarity of form would have to be accounted for, if it were found—which it is impossible it should be, as a rule.

Anthropino-zoo-dynamic = the human power of life: from ἄνθρωπος = human being, ἀνθρώπινος = human and ζῶον and δύναμις, 8, 31, 71, 103, 122, 194-5.

Apameibo-dynamic = the power of response: from ἀπαμείβομαι = I answer or respond. This power is manifested by all substances in nature, animate and inanimate, between which however there is no dividing line, 198

Bio-dynamic = the combined power of plant and animal life: from βίος = life and δύναμις, 198-200.

Boulo-dynamic = the power of will: from βουλη = will and δύναμις The portions of the brain through which the will acts have not been differentiated—a field of research yet in the future, as also to discover what parts or whether any parts specially respond to knowing, feeling, and worship, 82, 102, 152, 195.

Chemico-dynamic = the chemical power or perhaps, it might be called the combining power or power of combination. Heat is liberated when chemico-dynamic acts, as when any other form of power acts? 197, 200: from χεμὶκη and δύναμις.

Crystallo-dynamic = the power of crystallisation: κρύστ-αλλον = crystal, 31, 38, 197.

Electro-dynamic = the electric power: ἔλεκτρον = amber 41, 198.

Elephanto-zoo-dynamic = the power of elephant-life: from ἔλεφας = elephant and δύναμις 103.

Erg-dynamic = the power of doing mechanical work: from ἔρλον = work and δύναμις, 81, 152, 199.

Feline-zoo-dynamic = the power of cat-life, 4. *See* Feline.

Heuretico-zoo-dynamic, 200: the finding power (water finding, person finding, object finding, &c.): from εὑρίσκειν = to find and δύναμις.

Hippo-zoo-dynamic = the

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