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AN

ESSAY

ON THE

NATURE OF DISEASES.

BY

A. GREEN, L.L.B.

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ON THE

NATURE OF DISEASES.

We are perfectly ignorant as to what it is that vitality consists of. We know that there is a great difference between a living substance and the same substance when dead; and even between this dead substance and a substance which never has lived: but we no more know what it is that constitutes vitality, than what it is that constitutes attraction. Whatever be the nature of vitality, it abounds profusely throughout the creation. It seems to cost nature as little effort to make a living thing, as to make a thing without life. We must not suppose that the Creator of the universe exercises a special and miraculous interposition of his power, in the separate formation of each individual living substance. It is by his power

that the law of vitality has been created; and the agency of the law seems as constant and as unerring, as the agency of any law by which the works of nature are carried on. The law of attraction, being once established, continues every where to perform its work; and the law of vitality, in like manner, in the sphere for which it was designed, is as constant in its effects.

With regard to the soul of man, it is not my intention to say any thing. That belongs not to my present subject. I speak only of such living powers as man possesses, in common with all other things having life.

Vitality is a common principle, pervading the whole animal and vegetable creation. Whatever difference there may be between the animal and the vegetable part of this creation, in the general principles of vitality they are alike. Every individual comes fresh into existence, and, if suffered to pass its course without interruption, passes through maturity to age, and dies. The vitality that has become extinct in the parent exists in full vigour in the offspring, and without diminution of its power. The necessity of food is common to both animals and vegetables; and, with both, this common con-

dition prevails, that individuals, when dead, become food for the living. In this, too, there is a complete reciprocity. A dead animal or a dead vegetable is food to a living animal or a living vegetable. In many other respects too we see that animals and vegetables resemble each other. They both require air and heat, and both have a fixed degree of heat within themselves. Both have fluids circulating in appropriate vessels. Both seem to possess all the essential conditions of life in common. Two bodies may possess very different degrees of hardness, though both are held compact by the same law of attraction. And in the living system, the most perfect animal, and the meanest vegetable, exist by the same law of vitality; and are, in all the essential respects of life, only different individuals of the same system.

The principle of vitality, far from being an extraordinary effort of nature, seems in constant activity, wherever the requisite conditions are present. Amongst the most requisite is heat; and wherever a suitable degree of heat prevails, nature seems to teem with life. Yet all that we commonly see gives but a faint idea of the extensive prevalence of vitality. The microscope discovers to us a profusion of

life far surpassing any idea that we can form of numbers; and yet of beings seeming to us so insignificant, that we can form no idea for what purpose they exist at all. Whether amongst these beings new species are perpetually springing into existence, or each is propagated by similar parents, it is in vain for us to enquire; or how all this profusion of life is produced or supported, or for what it is designed, we know not. We cannot know the designs of the Creator, nor comprehend his power; but we may observe some of the effects of his power, and learn from thence to explain some secondary causes of things lying within our own experience. The power of vitality may be investigated in the same way as we may investigate the power of attraction; and though we cannot explain its nature or its cause, we may trace its effects; and by so doing we may acquire some little portion of knowledge that may be useful to ourselves.

When we regard the complication and delicacy of an animal body, particularly of an animal of the more perfect class, we are inclined to wonder that such a piece of mechanism should ever all be right. Far from wondering at disease, we might be led to wonder that

there should ever be health. Yet this would only be wondering, because the machinery so far surpasses our own arts of construction. That power which caused such machines to exist, can keep them in order. The principle of vitality has been created for the purpose, and is sufficient for the purpose for which it is designed. It is as little liable to err, as the law of attraction is to err. It never fails: it is never unequal to its purpose. It is the engine by which the Almighty accomplishes a certain work, and it is sufficient for the work that it is to accomplish.

It is not likely that an animal body, complicated and delicate as it may be, will ever, of itself, go wrong. It may be put wrong, by some foreign, disturbing force; it may be injured in various ways; but it has no tendency or liability to go wrong of itself. On the contrary, when it has been put wrong, it has a strong tendency to set itself right again. The power of vitality, whatever it may be, is sufficient not merely to preserve all the complicated construction in perfect order, but, in a considerable degree, to repair the effect of injuries, and to put all in order again, after having been deranged. It seems, therefore, absurd

ever to ascribe disease to the fault of any thing going wrong, or to suppose that any organ of the body will go wrong. Wherever there is disease, we may fairly presume that there is some foreign disturbing cause to derange the machinery, or impede the action of its organs. A tendency to get right, is quite inconsistent with an intrinsic liability to go wrong: and when we find any thing go wrong, even under all allowance for the complication and delicacy of the machine, we may fairly presume that some disturbing cause has intervened. We may fairly presume that every animal, if not in some way injured, would pass through all the stages to old age and death. Death from old age is as natural a change as any other that an animal must undergo. We are not to assume that because it is natural to die, it is therefore natural to have disease. Disease is an injury produced by some cause not intrinsic in the constitution of the animal itself. It is a hurt of some kind, and not a failing in the principle of vitality. The cause of the injury may often be difficult to trace; but we should certainly be wrong, in supposing that a living body will ever be disordered without some injury having been received.

I am not going to undertake to point out all the causes of injury, or all the sources of disease; but I wish to direct the attention of physiologists particularly to one cause, which I think may be the source of many, or perhaps I might say of most, of the diseases to which we are subject. The explanation which it affords of the nature of disease is, at least, intelligible. Whether it will be deemed satisfactory or not, I must leave to others to decide. It is something in favour of an explanation, that it is intelligible. A theory that is intelligible has, at least, a chance of being correct.

The cause to which I allude is not any deficiency in the principle of vitality; but, on the contrary, the constant and unerring activity of this principle. It is the profusion in which life abounds, wherever the requisite conditions are present. Of these conditions, one of the most requisite is a suitable degree of heat; and this is found in the body of every animal and every vegetable that we know, and particularly in animals of the higher order, or what are distinguished as warm-blooded animals. The microscope shows us that every part of the bodies of these animals is the habitation of innumerable living beings. All the secretions, not

only of a diseased, but even of a healthy animal, when placed in the microscope, are found to be teeming with life. We may presume that those minute beings are innocuous to the animal whose body forms their natural habitation; but it is possible, and I think that analogy justifies us in presuming, that there are also species which are not harmless. We may reason by analogy from what we can observe in parasitical species of a larger size, in regard to such other species as are too minute to allow of much observation. Their minuteness alone may not render them insignificant. The want of size may be balanced by the immensity of number; and it seems scarcely reasonable to suppose, that while our bodies constitute the crowded residence of living beings, we should be always exempt from being, in any degree, affected by such a world within us: and could we know the history of those minute beings, we should probably find in it an explanation of many of our most formidable diseases.

But though we cannot trace the history of these beings with any accuracy, yet we may form a probable idea of their power of producing disease, by a comparison with the effects often produced by other creatures of a larger

size, and which fall more easily under our observation. The human body is subject to being infested by a great variety of the inferior orders of living creatures—of worms and insects, and perhaps of orders still lower than these—some of which are known to be productive of little inconvenience, while others are often the cause of great suffering.

Probably most or all of those creatures by which we are liable to be infested, might be easily destroyed by medical applications, if it were possible to make such applications, in all cases, come in contact with the creatures that we wish to destroy. This, however, is often very difficult to effect. The creatures are often so enveloped, or so situated, as to defy the skill of the physician to molest them. Even among those which infest the skin, and which, from their position, might be supposed to be easily reached by medical applications, some are found to be so buried and protected, by some means or other, as to be safe. And if it be difficult to destroy any such creatures as infest the skin, it may readily be imagined how very difficult, or how impossible it must often be, to destroy such as infest the internal parts of the body.

It is very probable that no part of the body is exempt from the intrusion of vermin, of some species or other. The several species may vary in size, from that of the large worm often found in the intestines, to that of the animalcule, capable of penetrating into the minutest vessels. Worms of considerable size have been known to exist in the blood-vessels, and even in the heart. Such instances may be uncommon, but they prove the possibility of living beings existing in such situations. Warmth is so favourable to the existence of animalcules, that we cannot suppose them not to abound in every part of the body, where there is a place of residence fit to receive them. The lymphatic vessels, the various glands and cavities of the body, and even the sheaths of the nerves, may be the residence of different species of these minute creatures; and may be subject to the intrusion of some varieties of a noxious character. It is difficult, indeed, to subject many of these creatures to observation; for even in the microscope they are only observable while alive, and in motion: but on the death of the animal whose body they inhabit, they also die. Every analogy, however, leads us to infer that they are capable of existing in every vessel and in-

terstice of the body. Whether they are ever of any use we do not know. Their place of residence may be given them for their own benefit, and not for the benefit of the animal in whose body they reside. Perhaps all that we can hope of them is, that in general they may be harmless. When they are otherwise, they may prove the source of a great variety of diseases.

I think we may with great probability surmise, that all diseases which admit of being communicated from one person to another, by contagion or infection, are of this nature, and are the effect of some species of animalcule unobservable to the eye. Some species are communicated only by contact; some only by contact with such parts as have the skin very thin, or where the cuticle has been removed. Other species are communicated at a considerable distance. In these cases the animalcule may be driven by the breath, or more probably may fly. We see that animalcules can swim in liquids, and analogy leads to the inference that some species of them may fly. These animalcules, then, constitute what is termed the miasma of disease. They may abound generally through the air of a whole district, or they may be confined to within a very short distance of the body from

which they proceed, or they may be communicable only by contact, or not even by contact without the previous removal of the skin. They may attach to some persons and not to all. They may affect some persons more severely than others, as some persons suffer more than others by the venom of poisonous insects. They may be affected by the weather, for most animalcules are affected by trifling changes. They may vary with the climate. They may have periodical returns. They may have all the characters commonly belonging to the miasmata of disease.

This theory of the nature of disease and the mode of its being communicated, is much confirmed by a consideration of the means usually found most efficacious, both for curing many diseases which may be with great probability supposed to be of this nature, and also for preventing infection.

For preventing infection, fumigations of strong mineral acids, or of chlorine, have long been known to have very great effect. This effect is commonly ascribed to their decomposing the miasmata of the disease: a much more probable explanation is, that they produce their effect by destroying the animalcules passing through the air. Those minute creatures are very readily

destroyed; and the fumigations, as usually conducted, would seem to be quite sufficient for their destruction.

With respect to contagious diseases, or such as are communicated only by contact, the case may be different. It is possible that in some of these diseases the egg, and not the living animalcule, may be transferred by the contact; and in such cases fumigations, or even lotions, may be useless.

The means of cure found most serviceable in many diseases are precisely such as would be most likely to be destructive of animalcules. At least, such means as are termed specific remedies seem to be always of this nature.

The term specific remedy, though very often used by medical writers, is as often disavowed. It has often been held that no such thing as a specific remedy exists, yet still there is a kind of undecided disposition to use the term. Experience seems to confer on some remedies the character of specific, though not infallible. I think the exact meaning of the term may be thus explained. In all diseases caused by animalcules there may be two very different indications of cure. The one is to destroy the animalcules; the other is to endeavour to support the constitution of the patient against their

ravages, till the animalcules, from some unknown cause, become of themselves extinct. Or if this be impossible, yet the fatal termination may, by such means, often be deferred, if it cannot be prevented. The first of these remedies, that of effecting the destruction of the animalcules, may be properly termed specific. To entitle a remedy to the character of being specific, it is not necessary that it should be infallible, but only that the action of the remedy, when it is effectual, should be not merely aiding the constitution of the patient to resist the suffering, but the direct destruction of the cause of the disease.

Specific remedies are generally such as might be supposed to be likely to effect the destruction of animalcules; and the nature of these remedies affords a strong presumptive proof of the nature of the diseases in which they are found successful.

Among the diseases which appear to be of this nature may be mentioned, first, the several kinds of *psora* and *tinnea*. The remedies which experience has directed for these diseases, are precisely such things as might be supposed most likely to kill any minute creature lodged in or under the skin. Sulphur, mercury, helli-

bore, and some other drugs are commonly used, and found successful in these cases. These medicines, being combined with unctuous substances for the purpose of enabling them to penetrate the skin, are thus brought in contact with the animalcule, and effect its destruction. Various unknown causes may occasionally prevent their passing through the skin or coming in contact with the animalcule; and in such cases the effect will fail. Generally, however, these medicines may be termed specific for cases of this nature, for they generally effect the destruction of the animalcule, and in so doing remove the cause of the disease. Such at least seems to be the most rational inference from the nature of the remedies, and all the circumstances attending the disease and the progress of the cure.

The syphilis is probably also a disease caused by a peculiar species of animalcules, which are communicated only by contact to parts of the body where the cuticle is wanting, or has been removed. These minute creatures seem to follow the course of the absorbent vessels, and probably reside in those vessels and the glands connected with them. Mercury is here a specific. It destroys the animalcules, and so cures the

disease. The well-known necessity of continuing the medicine for some time after all appearance of disease has vanished, is probably nothing more than the necessity of continuing it till the animalcules are entirely extirpated.

The hydrophobia is a disease communicated only by contact, and where the cuticle is wanting or has been broken. It probably consists of a peculiar species of animalcules, which no means have yet been found of destroying. As we know nothing of the nature of these animalcules, or in what vessels or interstices they reside, or what medicines would destroy them, even if those medicines could be made to come in contact with them, there can be little hope of ever being able to effect a cure, unless chance should discover some remedy. The formidable symptoms might lead to a conjecture of the animalcules residing within the sheaths of the nerves; but suppose that by experiment we knew this to be fact, the cure would seem to be out of our reach, by any means hitherto known. Yet still it is possible, that some remedy may be found. The deadly poison of the Indian arrows is more quickly fatal than the hydrophobia, and was supposed to be as certainly so, till it became known that the

country affords a plant which has proved a remedy.

The plague probably consists of a peculiar species of animalcules which are communicated only by contact. Oil has been said to prevent the communication; but having been communicated there is no specific means yet known of destroying them.

In one very important particular this disease differs from those already mentioned. If the constitution of the patient can resist for a certain time, the disease of itself gets well. The animalcules, for of such we have supposed the disease to consist, become of themselves extinct. Why this should happen we do not know; yet there is nothing very extraordinary in it. Many conjectures might be easily formed to account for it. The particular sustenance of the minute creatures may be exhausted, or the constitution of the patient may undergo some change that may be unfavourable to them. A very trifling change may be sufficient for their destruction.

In such cases the business of the physician consists in merely combating the symptoms, and endeavouring to support the patient as long as possible, in expectation of a spontaneous cure.

The small-pox, the measles, the scarletina and the hooping-cough are probably caused, each by its peculiar species of animalcules. These do not require actual contact for communication. They may be communicated, as is known, at a considerable distance, probably by flying, or floating through the air.

For these diseases no specific remedy seems to be known. The physician must endeavour to combat the symptoms while the disease goes through its course. The exact time of this course is probably connected with the natural term of life in the animalcule. Why they should be unable to continue their breed, or to breed a second time in the same body we do not know; but in the history of the inferior classes of animals many phenomena more surprising than this occur. Some creatures return to a former place of residence, and others as invariably abandon a place they have occupied. But it would be in vain to endeavour to assign reasons for the habits of animalcules, unless we knew more than we are ever likely to know of their nature and instincts. We must often, in the history of these creatures, be satisfied with knowing facts, without being able to account for them.

From the similarity of circumstances many other diseases may, in the same manner, be considered with great probability as proceeding from a similar cause, and as being produced by different species of animalcules.

The sea-scurvy may, from its symptoms and from the nature of the remedies found most useful, be with great probability supposed to be the effect of animalcules of a peculiar species. Some of the vegetable acids are found to be efficacious in destroying these creatures, and are consequently to be considered as a specific remedy for this disease.

The ague is probably caused by a species of animalcules bred among the putrid vegetables of marshy ground. These creatures are destroyed by arsenic and quinine, which medicines therefore are to be regarded as specifics for this disease. The animalcules seem to be dispersed through the atmosphere in the neighbourhood of marshes, but not in general to spread to any great distance from the place. They constitute what is called the malaria of many countries.

The typhus-fever seems to be caused by another species, bred among putrid animal substances. This species may be communi-

cated from one person to another without actual contact, though the communication seldom extends to a great distance.

It is well known, that of a number of persons exposed alike to any kind of infection, it seldom happens that all are equally affected. This circumstance may be thought an objection to the theory of infection being of the nature described. I think, however, that this objection is not of much weight. Different individuals may fare very differently under the same circumstances, either from differences of constitution, or from some accidental cause not easily understood. Of a number of cattle in the same field, and exposed to the attacks of any noxious insect, some will commonly suffer whilst others escape. This may be owing to accident, or it may be owing to some peculiarity of constitution. Though we may not know the cause, we know the fact; and we therefore need not be surprised at a similar uncertainty in the attacks of those minute beings which I have supposed to constitute the essence of infection. There is indeed an un accountable capriciousness in the selection which many kinds of vermin will often be found to make of different individuals. Some persons will be severely attacked, while other persons,

under the same circumstances, will be as generally shunned by the same tribe of insects; and a similar capriciousness may be the cause why some persons suffer by infection, while other persons, exposed to the same danger, escape with impunity.

Many local complaints may admit of being explained on the same hypothesis, of being caused by animalcules of different kinds.

The inflammation of the iris affords, perhaps, one of the most remarkable examples. From the situation of the part affected, the progress of the disease is easily seen. The eye, when attacked by this complaint, seems on a sudden to be all going to destruction, without any apparent cause. When mercury is plentifully administered, the disease is arrested and the eye gets well.

These symptoms are easily explained, on the supposition that the disease is the effect of a peculiar species of animalcule infesting the eye, and which, beginning with the iris, continues its ravages until arrested by the mercury, and thus destroyed. The eye is then at liberty to recover from the effects of what it has suffered.

The treatment commonly found useful for foul and obstinate ulcers seems to indicate

a similar cause of disturbance preventing the natural progress of healing. Escarotics of various kinds, and even red-hot iron, which are found to be most useful, would not seem to be very likely means of curing a sore; but on the supposition that the sore is prevented from healing by the presence of noxious animalcules the cure is easily explained. The hot-iron and caustics may kill the animalcules, doing perhaps at the same time a little harm to the sore. Being freed from the animalcules the sore afterwards gets well, by the natural process of healing.

We may proceed to trace the work of animalcules in many other diseases.

The calculus of the bladder is probably produced by the work of some species of animalcules. The calculus is commonly considered as a deposit of substances which have been held in solution, and which has been compacted into a round or oval shape, by the pressure of the bladder. But this explanation is very unsatisfactory. A simple deposit would be in the form of a fine powder, or possibly of crystals; but certainly not in the form of a hard, smooth stone. The powder, as deposited, would be expelled, and not remain to become

agglutinated into a large mass. It is much more probably produced by the work of some species of animalcule, somewhat in the manner that the tartar on the teeth is known to be of similar production.

Among the medicines found useful for the stone, some may, perhaps, act by destroying the offensive animalcules, and thus preventing the stone from becoming larger; though they cannot undo what has been already formed. Such medicines seem more suited to prevent than to cure.

The ossification of arteries, and the scirrosity of glands, may all be the production of similar work. At least, this is a much more probable explanation of the nature of these complaints, than the supposition that bone can be formed by any action of the diseased part itself. We might as well suppose, that any other kind of secretion could be formed by a part not intended to form it, as that bone could be produced by a part not designed to produce it.

The remedies for these diseases would seem to be such medicines as would destroy the animalcules. But probably the stony matter already formed can never be dispersed.

The obstruction of the lacteal vessels, a very

common disease in children, is probably in like manner occasioned by some particular species of animalcules or vermin infesting those vessels. Such a supposition is at least rendered probable by the nature of the remedies which are commonly found to be the most serviceable in this disease; and which are precisely such things as might be supposed to be the most suitable for destroying or expelling any vermin of this description.

The knee-joint is subject to a peculiar species of lameness, caused by the presence of a small substance, like a piece of bone, moving loosely about, within the cavity of the joint, and which, by sometimes getting into an inconvenient situation, produces a sudden impediment to the motion. Whence this substance is produced is unknown. I think that there is strong probability in the supposition which I would offer, that this substance is produced, like the calculus of the bladder, by the work of some species of animalcules existing within the cavity of the joint. That some animalcules exist there, as in all other parts of the body, we can have little doubt. The microscope shows that every part of the body, that can be subjected to examination, is teeming

with them in profusion. The microscope will not, indeed, show us which species are noxious and which are not, or in what way such minute creatures often busy themselves; but it is certainly not surprising that their work should sometimes prove an inconvenience to the animal in whose body they reside.

The gout, the rheumatism, the numerous class of nervous diseases, may probably all, in the same manner, be occasioned by various species of animalcules infesting different parts of the body.

We know by the microscope that animalcules abound in every part of the body; and we may reasonably conjecture, from all the circumstances, that some species of animalcules are noxious. But we cannot ascertain so well the existence of minute vegetables, because the want of motion makes these objects not so distinguishable in the microscope. We may, however, very reasonably presume, that where animalcules abound, minute vegetable productions will also flourish. Warmth is equally favourable to both; and it is therefore probable that minute vegetables are as abundant throughout the different parts of the body as minute animals: and we may with

equal reasonableness conjecture, that among the varieties of minute vegetable productions, some may be noxious.

The diseases caused by minute vegetables may be supposed to be probably more difficult of cure than diseases produced by minute animals; for it is generally a more difficult thing to destroy a vegetable than to destroy an animal. It is often found very difficult to destroy a noxious weed. Many vegetables are so tenacious of life, and so productive of seeds, that scarcely any art can get rid of them.

Of the diseases which seem to be caused by minute vegetable productions, one of the most dreadful, or perhaps of all the most dreadful, is cancer. This, and generally such sores as are termed malignant, are probably caused by some species of minute or microscopic plant, growing in the flesh, and there extending its roots, and spreading itself in all directions. Topical applications and internal medicines are alike unavailing in checking its progress. The seeds of the plant are carried, as foreign substances are often carried, to different parts of the body; and, germinating in fresh situations, multiply the ravages of the disease. A total extirpation

at an early period seems to afford the only probable chance of cure.

The caries of the teeth is probably the effect of some minute plant, growing in the hard substance of the tooth. It is fortunate that this plant does not extend itself to other bony substances; and that its further progress is stopped when the destruction of the tooth is finished.

The white-swelling of the knee-joint has very much the appearance of being caused by some species of vegetable, growing from the covering of the bone. It is perfectly unaffected by any medical treatment, as might reasonably be expected to be the case, if this hypothesis concerning its nature be correct. I say hypothesis, because, though I offer this opinion of its nature, I by no means wish to represent the fact as proved, though I think that it is founded on very strong probability.

It is needless, and would only be tedious, to multiply instances. The reader will easily apply the observations already made, to a great variety of diseases. The superabundance of animal and vegetable life will probably be found to be the most frequent cause of disease, in some cases the most trifling, and in other

cases the most destructive. How all such minute animals and plants come to exist, is a question of little importance to our present subject. We know that such things do exist in inconceivable profusion, and that wherever there is found a situation with conditions suitable to their existence, no art that we can use will prevent their formation. Whether they are all the progeny of similar parents, or whether their nature may not be often changed by the conditions of their place of residence, as many well-known vegetable productions have been changed by cultivation, is a question on which naturalists are able to give very little information. No creature similar to the tape-worm is, I believe, known of, as existing out of the body of some animal. We may justly wonder how it comes to be there, and what is the parent from which it is produced. Possibly some animalcule, or some creature of the lowest class of animal nature, is by the circumstances of a new situation, changed or enlarged into what we see. Nothing, however, that I have offered concerning the theory of disease is so wonderful, or so unaccountable, as the existence of this creature. There may be in the lives of the lowest classes of animated

beings many conditions of which we have no experience, and consequently no knowledge.

Many species of animalcules are very easily destroyed; but what destroys one species will favour the production of other species; so that one set seems to be destroyed only to make room for others. Mercury is, in general, very destructive of them; and hence, probably, is derived its great use in medicine. Mercury, however, will not destroy all kinds of animalcules; and in the human body it probably cannot be brought into contact with them all.

It sometimes happens that a violent fever of any sort will cure a previously existing disease. The history of such cure may be easily explained in accordance with the theory here given. Supposing the previous disease to have consisted of some species of animalcules infesting some particular part of the body, the cure of the disease will be effected by whatever will effect their destruction. Many species of animalcules are readily destroyed by even a very small variation of temperature. During any violent fever, the internal heat of the body is increased a few degrees; and such increase of temperature is quite sufficient to account for the destruction of those animalcules which

may have caused the previous disease. According to this theory, it is clear that the fever will be of no use towards effecting the cure, unless it be of such violence as to produce the requisite increase of temperature. Possibly, too, it may be necessary that such increased temperature should be continued for some time. If we imagine the animalcules to be oviparous, a momentary increase of temperature, though sufficient to destroy all that were living, might not extirpate the breed. It would only suspend and not cure the previous disease.

If it were possible by any means to increase, at pleasure, the temperature of the body, or to produce an artificial fever without endangering the life of the patient, such means might form a valuable addition to the healing art.

I am enabled to relate the following case from the most unquestionable authority.

A patient, far advanced in consumption, lay down when in a state of intoxication, on the wet grass, and fell asleep. The consequence was a violent inflammation of the lungs. To avert the immediate danger, notwithstanding his previous debilitated state, he was bled freely, and more than once. By this treatment the inflammation was subdued; and, to the

surprise of his medical attendant, it was found that the previous disease was also cured, and the patient was restored to perfect and permanent health. I mention this case on the authority of a man who, through a long course of medical practice, was held in great estimation, both for his talents and his integrity. He was not likely to be mistaken in the case; and no one who knew him would suspect him of a wilful misstatement. I therefore feel great confidence in stating the facts as true.

This case admits of an easy explanation on the supposition that pulmonary consumption consists of animalcules of some particular kind infesting the lungs. The increased heat during the inflammation had destroyed them. Why the heat of any part should be increased during inflammation is another question. Experiment shows that it is so, and that is enough for our present purpose.

Perhaps a different explanation will be offered of these facts, in something like the following terms: the inflammation, it may be said, produced a new action in the part affected; and that such new action effected the cure of the previous disease. But it seems to me that this would be an explanation in words

without meaning. What kind of action was brought on, or how any disease could produce a better action than what would exist without it, is not easy to understand. We can easily understand what is meant by animalcules being killed by an increase of temperature; and such explanation has at least the merit of being intelligible: but it accounts for all the facts in a manner at once so simple and so satisfactory as, I think, affords a strong presumption of its truth.

Would it be wise to advise a consumptive patient to go to sleep on the wet grass? In a desperate case, a desperate remedy may be worth consideration.

The difficulty of destroying animalcules, or vermin of any kind, by means of medicine, arises from the difficulty of making the medicines come in contact with them. Many medicines are known to pervade the body in a manner very astonishing. Sulphur and mercury, for instance, if taken into the stomach, soon give indications of having pervaded the skin; and arsenic applied to the skin soon gives proof of having found its way to the stomach. Similar observations may be made of many other medicines. Yet we have no proof that

these medicines enter into all the different kinds of vessels. Indeed, it is most probable that they do not. But further, it may even be possible for medicines to enter the vessels in which any noxious species of animalcules or vermin may be lodged, and yet not come in contact so as to destroy them. Worms in the intestinal canal would seem to be quite within the reach of medicine. Medicines may very easily be sent through that canal; and such as, if they were to come in contact with the worms existing there, would immediately destroy them. Yet these creatures are often so enveloped either in mucus or in folds of the skin as to be out of reach. They are often thus so protected, that medicines intended for their destruction will pass harmless by them; and for the same reason it may be difficult to destroy such vermin, or minute creatures, as may be infesting other vessels or cavities of the body. The increased internal temperature caused by fever will pervade all kinds of vessels and all parts of the body; and may therefore succeed, in some instances, when all other means have failed.

Perhaps it is on account of the different degrees of internal heat, in different kinds of

animals, that the same disease will not exist in them. In this respect, the hydrophobia is a most remarkable exception; for it will exist in animals whose natural internal temperature is very different. There would be no probability of this disease being cured by the heat of the most violent fever.

It is possible that noxious animalcules lodged in some part of the body, may cause disease in a very distant part. Such we know is the case with vermin in the intestinal canal. They often cause disease in parts very distant, and of which they would not readily be suspected of being the cause, had not experience proved the fact. The intestinal canal itself may sometimes probably be infested by some noxious species of animalcules, too small to be detected, yet producing symptoms similar to what might be produced by larger vermin.

As fever has been supposed sometimes to have a beneficial effect, by such an increase of internal temperature as may be destructive of certain species of animalcules, is it an unreasonable hypothesis to suppose that the benefit of a cold bath may be owing to a decrease of internal temperature having a similar effect? I believe it has been found by experiment, that

a sudden plunge into cold water reduces the internal temperature of the body a very few degrees, and that only for a very short time; but it may be sufficient to destroy some noxious species of animalcules. The human body cannot bear much depression of internal heat, and therefore the means of cure in this way are very limited.

Though we may be subject to various sufferings from animalcules and other species of vermin infesting the internal parts of the body, yet the injury sustained from this cause is altogether much less than might have been expected, from a consideration of the facilities afforded, in all the different parts of the body, for the production of those creatures. The warmth and moisture of all the internal parts of the body would seem particularly favourable for their production. The mere absence of atmospherical air seems to be no inconvenience to creatures of this inferior class. They seem either to live without air, or to derive the benefit of it by communication with the body of the animal in which they reside. A consideration of these circumstances might lead us to apprehend a much greater amount of injury than what we really experience.

To counteract these circumstances, seemingly so favourable to the production of those creatures, nature has made provision in several ways for the protection of all parts of the body against this apparent danger. That the provision made for this purpose is not always completely effectual, is only what may be observed of many or of most of the provisions of nature intended for various purposes. It may be observed of many of the provisions of nature, that they answer their purpose generally, though not universally, the exceptions bearing but a small proportion to the whole.

To protect the several parts of the body against the intrusion of noxious animalcules, or of vermin of larger size, nature has furnished various secretions which are known to be in general very destructive to those inferior classes of creatures. It is probable that without such provisions we should scarcely exist at all, and that our life would be destroyed almost as soon as it should be begun.

No part of the body would seem to require more protection in this respect than the lungs. With constant warmth and moisture, and open as they are to the atmospheric air, they would seem to offer every facility to the breed of vermin of

various kinds, and some even of a superior class. To guard against this danger, nature has furnished an abundant supply of carbonic acid gas, with which the lungs are constantly filled. This gas is known to be very destructive to all classes of creatures, and its abundant production in the lungs is probably designed for this purpose. It would destroy almost any species of vermin, and so affords the necessary protection to the lungs. That it sometimes fails, as we must suppose it to do in pulmonary consumption, is only what is common to almost all the provisions of nature. In general it succeeds; and probably without it the lungs would in a very short time, perhaps in a few days, or a few hours, so swarm with vermin as to be rendered useless.

The carbonic acid gas formed in the lungs is commonly considered an excrementitious matter. This opinion I think is an error. It seems to me much more likely that this gas is formed for the purpose which I have described. It is well calculated to answer this purpose, and it is also evident that some provision for this purpose must be necessary, for without it the lungs must very soon become useless. I think, therefore, we are justifiable in assuming that this gas is the provision required.

But then it may be enquired, what purpose are the lungs meant to serve in the animal economy? for we cannot suppose that they were formed for no other purpose than to produce a gas for their own protection.

The action of the lungs on the blood remains a mystery. We know, however, that the benefit of the atmospheric air, whatever that benefit may be, is not necessarily attended with the production of carbonic acid. The fœtus, before birth, has the benefit of the atmospheric air, communicated to it in some way or other without the production of any carbonic acid. The gills of fishes take what is required, from the atmospheric air that is mixed with the water; but in doing so they do not produce any carbonic acid. If they did, the acid would appear in bubbles in the water. The production of carbonic acid gas, or the disengagement of carbon from the blood, cannot, therefore, be reasonably considered as the use for which the lungs are designed. I do not pretend to say what is the use; that must be a subject of future experiment.

The intestinal canal is protected by having in one part the carbonic acid gas, and in another part the sulphuretted hydrogen gas. Both

these gases are known to be very deleterious to the lower classes of creatures, and are, therefore, well suited to prevent the intrusion of vermin.

In addition to these means, there are also other provisions for affording more perfect protection to this important canal. The bile, by its intense bitterness, is probably of use in this respect. Nature too has, by our taste in the choice of our food, and of the condiments taken with it, provided a further means of protection. The use of salt, to which we are strongly impelled by our taste, is in this respect particularly important. Fermented liquors and spices contribute, also, to the same purpose, though not in so great a degree.

Though all these means are not always perfectly effectual, yet they are generally so ; and they are always effectual to a very great extent. In spite of them all, vermin will sometimes prevail in such abundance as to be injurious and even dangerous ; but, if these means of protection were wanting, the abundance would soon be such as to be fatal. The want of salt alone would soon suffer such an increase of vermin to take place as would destroy life. The intestinal canal is exposed to more variety of intru-

sions than most of the other internal parts of the body; and on this account may require a greater variety in the means of protection.

When worms of large size exist in the canal they are easily recognized. But it sometimes happens that all the symptoms which usually indicate the presence of worms, will exist when it would appear that none of these creatures are present. May we not, in such cases, reasonably conjecture, that the well-known symptoms are occasioned by some species, of such minute size as to escape detection. Animalcules infesting the intestinal canal may produce the same symptoms of disease as are produced by vermin of a larger size, the minuteness in size being compensated by the almost infinity of numbers.

Wherever mucous matter is found to adhere to the coats of the bowels, it may be presumed that it is the production of some species of minute creature, which it envelopes; for no mucous, or adhesive matter, would remain long attached to any part, without some living cause to fix it. The most adhesive matter applied to the skin will not remain long; and we may reasonably extend the same observation to any matter accidentally adhering to the coats

of the bowels, and assume that no matter would adhere long were there not some living creature to produce and fix it there. That the bowels should occasionally be subject to such annoyance is certainly, when we consider all the circumstances, not a matter of surprise. It is, on the contrary, much more surprising, and is a proof of the great efficacy of the protective means, that such annoyances are not much more frequent.

The blood-vessels are provided with some means of protection which are known to us, and probably, also, with other means which are not known to us. It is known that the blood always contains salt, and this substance alone would be a great protection to the vessels. Iron, which is also destructive to the inferior class of creatures, is said to be contained in the blood. I think also a minute trace of copper has been found, which would certainly afford a very great protection.

Without some means of protection, the blood-vessels would probably very soon become useless. The means of protection, such as they are, may not always be perfectly effectual. Indeed, we know that vermin of considerable size sometimes exist in those vessels, and it is not im-

probable that many of our diseases may be produced by such causes. I may mention as a conjecture, but I do not offer it as any thing more than a conjecture, that dropsy is caused by some species of animalcules infesting the veins. If the artificial stopping of a vein by ligature will cause a dropsical affection in the neighbouring parts, this conjecture may have some probability.

All the cavities or interstices of the body are protected by the presence of deleterious gases, particularly the sulphuretted hydrogen gas; but like other means of protection, this may not be infallible; and various diseases may arise from these parts being infested by animalcules.

Some of the large glands, as the liver and the kidneys, are probably protected by the nature of their own secretions. All the different glands and vessels throughout the body will, without doubt, be provided with some means of protection, without which it would seem impossible that they should exist.

It is very probable that many of those provisions which we have been in the habit of considering as ministering in some essential purpose towards the economy of life, are in fact provisions

for the opposite purpose of destroying or preventing life. Where warmth and moisture prevail, there seems to be more difficulty in preventing than in favouring life. In the absence of all preventive means, wherever these conditions are found, swarms of living beings would every where spring into existence. Much of the wonderful machinery that we admire in the more perfect classes of animals, is, perhaps, designed for no other purpose than to save them from the inevitable destruction that would arise from this source. Perhaps some galvanic or electric action is going on to furnish the required protection. When we may suppose this action to cease by death, the body of an animal quickly becomes the prey of inferior creatures; and, if this action could cease during life, perhaps the body would as immediately become their prey. Perhaps a temporary interruption of this action from some external cause may give occasion to the existence of a set of beings, which may prove sometimes the source of great disease.

It is not improbable that the sheaths of the nerves owe their ordinary protection from animalcules to some action of this nature. That some galvanic action takes place in the nerves,

either in the conveyance of sensation, or in the power of motion, has often been conjectured; and such means would seem also well adapted to guard against the intrusion of animalcules, in a situation where their presence might be most injurious.

But the several parts of the body require to be protected, not only against the intrusion of animalcules, and vermin of various kinds, but, also, against the injury that would arise from the growth of minute vegetable productions. Such productions would soon abound, if there were no means provided for preventing them. The vessels throughout the body would soon be choked up by the growth of various minute plants, fostered by the warmth and moisture of the situation. To destroy plants is more difficult than to destroy animals; and probably it will require more elaborate means of prevention, to guard the body against the production of vegetable matters than of living vermin. By what means all these dangers are prevented it may be difficult for us to know; but is not difficult to see the necessity of some means to prevent them. Without some such means, the higher classes of animals could not exist. Their life must cease almost as soon as

formed, and the higher parts of the animal creation must become extinct.

But though vegetables may be more tenacious of life than animals, and consequently the means of preventing their production be more difficult, yet the general principle of their life being the same, it is probable that the means of preventing their formation may not be dissimilar. Some of the gases, and some of the metals are known to be destructive of vegetables, as well as of animals. Perhaps the same means as will destroy these may also suffice, if used in greater quantity, to destroy or prevent the production of the former. Whatever be the means provided for this purpose, we need not be surprised at their not being universally effectual. That they are generally so is proved by the very existence of the higher classes of animals, which without such means of protection could not exist.

In the bodies of cold-blooded animals there will naturally be a less disposition to the formation of animalcules and minute vegetable productions, than in the bodies of animals possessing a higher temperature; for an increase of warmth is, of all circumstances, the most favourable to such productions. Probably it

is in part for this reason that the organs in warm-blooded animals are required to be more complicated than in animals of colder blood. I do not indeed mean to represent this as the only reason of the superior organization of the warmer-blooded animals, for we cannot suppose that their higher temperature was designed for the mere purpose of causing an inconvenience which should require elaborate organs for its correction. The warm-blooded animals, doubtless, possess the higher qualities of life in greater perfection than animals of colder blood, and their organization must for this purpose be supposed to be more perfect; yet this superiority will necessarily be attended with its correspondent inconvenience, requiring also a more perfect organization for the purpose of protection against minute animal and vegetable productions. In the coldest blooded animals we may therefore expect to find the organization the least complicated.

That in the bodies of all the warm-blooded animals, notwithstanding all the preventive means, swarms of animalcules exist in almost every part, we know by actual observation; but experience shows, either that they are com-

monly of a species that are harmless, or that their number is so limited as to render them harmless. But, in the absence of all preventive means, we have the strongest reasons to believe that vermin of a more formidable species, as well as parasitical vegetable productions, would soon abound in fatal profusion. That it is in the history of these minute creatures, or minute vegetable productions, that we must look for the cause and nature of most of our diseases, we have, I think, the best reasons for presuming; and that particularly to such cause we may ascribe all such diseases as admit of being communicated from one person to another.

The effect of many of the most important medicines probably depends, as I have shown, on their entering the different kinds of vessels, and destroying any noxious species of animalcules with which such vessels may have been infested. The whole class of tonic and alterative medicines probably act in this manner. For this purpose, the combination of medicines may often be of the greatest importance. Medicines in a particular state of combination may be rendered capable of entering vessels which they would not enter if uncombined.

Many medicines, we know, when combined with unctuous substances will readily pass through the skin, which they would not pass through if applied alone; and in the same manner it is very probable that medicines taken into the stomach may, in particular states of combination, pass into vessels into which they would not otherwise enter. No rule can be given for such combinations, except what is derived from experience. It is not improbable that some of the most powerful mineral waters owe their great efficacy to some particularity of combination, for the analysis of the contents of these waters would not lead us to expect any great efficacy from them. The articles which they contain are often in such small quantity, or are things which of themselves would seem so insignificant, that we should expect but little effect from their use; yet perhaps the apparently most insignificant of those articles may, by its combination, be of the greatest importance in giving efficacy to the whole.

In some cases it may perhaps be of little importance, whether a medicine be introduced into the constitution by passing through the skin, or by the stomach. The choice may be

determined by the secondary conveniences or inconveniences attending each method.

No medicine is more commonly applied to the skin than cantharidin, which when combined with any unctuous substance readily passes through the skin, and causes, as is well known, a blister, with considerable discharge of serous matter. Such blister is probably nothing more than an inconvenience attending this mode of introducing the medicine; like the pustules which are frequently caused by the oxide of mercury, united with any unctuous substance, when applied to the skin. No one thinks of ascribing the efficacy of the medicine to these pustules; and it is, perhaps, just as unreasonable to ascribe the efficacy of cantharidin introduced through the skin, to the blister which it excites. The efficacy of the medicine is more probably owing to its passing into some of the vessels, and destroying such noxious species of animalcules as may have been causing disease. Probably, if the medicine were introduced by the stomach, it might have the same effect on the disease for which it may be required; but this effect might be obtained at an inconvenience much greater than what is experienced by the application on the skin.

The little inconvenience produced on the skin may be of less importance than an inconvenience produced on the stomach. Antimony applied to the skin, in conjunction with unctuous substances, often produces very beneficial effects; producing also a considerable sore at the part where it is applied. It seems not very reasonable to suppose that the beneficial effects can be caused by this sore. It is certainly a much more reasonable supposition that the sore is a mere inconvenience, caused by applying the medicine; and that the beneficial effects of such application are owing to the medicine entering the vessels, and to its action there. Whether it enters the constitution through the skin or by the stomach, its effect in destroying such animalcules as we may suppose to have been occasioning disease may be the same; but its effect in other respects may be very different. A little injury done to the stomach might far overbalance the injury sustained by applying the medicine on the skin. Many other medicines, as is well known, are frequently applied to the skin with great benefit, and without producing any local inconvenience. In all these cases it is probable that the medicine passes through the skin, and

finds its way to such vessels as may be the seat of the disease, destroying any noxious species of animalcules by which we may suppose the disease to have been caused.

Nothing might seem, on a hasty consideration, more likely to destroy animalcules in any part of the body, than electric shocks passed through the part. Yet experience shows that the effect of electricity in this respect is very slight, and that as a means of cure it is generally of very little use. It might seem indeed likely to pervade every vessel within its course. Yet we do not know that it really pervades any of the vessels. When a house has been struck with lightning the traces of the effect are generally very partial. The injury done will generally be found to have been confined to a very small deviation from the line of course. Persons close to the spot may have escaped uninjured; and from a parity of reasoning we may suppose that an electric spark passed through any part of the body may have very little effect in destroying such minute creatures as may be nearly in the way of its course. Perhaps for this reason electricity is of so little use in medicine, at least in any mode in which it can be artificially applied. When it is produced and applied by

the organs of the body itself, if such really be the fact, its effect may be very different.

What means may be effectual for destroying those minute creatures which I have supposed to be the cause of most of our diseases, can be known only by experience. We may know, or at least we may believe, that a disease is caused by some minute creatures of some kind, situated somewhere; but we may neither know the kind, nor the situation, nor what medicines can be made to come in contact with them, nor what will destroy them, when it is in contact, except by experience. The means of cure can only be known by experience, and experience must therefore still be the foundation of medical science; or at least of such part of it as is of practical utility.

THE END.

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