AN INAUGURAL DISSERTATION
ON
Malaria

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Malaria.

It certainly cannot be expected that I will be able to throw any additional light upon this already almost threadbare subject, after so much has been said and written upon it by men of the highest talents and most profound learning of almost all ages. All that I propose to do, and in fact all that I can do, will be to speak of the theories, now most in vogue, concerning the generation of malaria together with some of its most general properties; and finally, its effects upon the human economy, as they have been set forth by the recognized authorities, instead of attempting to present any ideas literally original. In other words, this will be, from the very necessity of the case, a mere compilation from the writings of others, as I am entirely or almost so, destitute of experience upon the subject.
From time almost immemorial it has been observed that persons residing near lands or marshes were subject to a peculiar class of diseases, which have been ascertained to be produced by certain emanations from these low grounds or marshes. Upon these paludal exhalations has been conferred the title of malaria or marsh miasm. Now, what is this invisible poison? What is its essential nature and what are its properties? So far as regards its intimate nature it must be confessed that we know but very little if anything. We can only know its presence by its effects. Yet we do know the circumstances that are essential to its production or generation together with some of its more general properties and some of the laws that govern its operation. In the first place we will notice the materials required in the generation of malaria, and the
Circumstances most favorable to its production. Dr. Wood thus speaks: "The circumstances which appear to be essential to the production of miasmata are heat, moisture and vegetable decomposition." That heat is one of the requisites towards the evolution of malaria all writers agree; for the effects to which this poison gives rise are rarely if ever felt beyond the 56th degree of North latitude. So also insects where there are alternations of heat and cold, we find that malarial diseases seldom prevail when the thermometers indicate a degree of heat below sixty. On the contrary when the heat of summer rises as high as 80°, they become quite prevalent. It is not only necessary that the heat should arrive at a high degree of elevation, but also that it should be maintained at that elevation for a considerable length of time.
Hence it is, that in countries where there is a regular change of seasons, miasmatic diseases do not make their appearance until towards the middle or close of the summer. In addition to this, it has also been ascertained, that the degree of heat modifies the degree of virulence of the malarial poison; and that the nearer we approach the Equator, the more violent do the diseases dependent upon this cause become. Thus the malignant fevers of Italy, of Western Africa and the West Indies differ very materially from the comparatively mild intermittent of North America. That moisture, too, is one of the necessary agents in the generation of the noxious effluvium of which I have been speaking, is equally obvious from the notorious fact, that its ravages are only observable in the neighborhood of marshes or
pools of water along the banks of streams or in fine wherever there is water in a state of stagnation. The evening dusks have even been noticed to greatly favor its diffusion. Again it has been learned that a very dry season, that dries up the marshes that ordinarily give rise to a great deal of sickness renders the surrounding country comparatively healthy. The decomposition of vegetable, or according to some authors, of organic matter is generally reckoned the third and last requisite in the generation of the miasma of poison. This opinion has however in the last fifty years met with considerable opposition from some of the most talented members of the Medical profession, who contend very strenuously that all that is necessary in the process above spoken of is the action of the Sun's heat upon water at
or near the surface of the earth. The latter is the view taken of the subject by Dr. Williams, in his Principles of Medicine, and also by Dr. Watson in his work on the Practice of Medicine. Both of these authors I believe, found their belief chiefly upon the researches which Dr. Ferguson made, while in connection with the British army. And last, but not least, our own distinguished Professor of Theory and Practice has become one of the strongest advocates of the theory adopted by Williams and Watson. He states that he has been heaping up facts for a great many years that have thoroughly satisfied him in his own mind, that malaria has been and indeed always is produced wholly independent of vegetable decomposition. He further adds arguments almost innumerable founded upon his own experience upon
the subject together with a great number of quotations from Ferguson, to substantiate the correctness of his belief. The opposers of this theory, on the other hand, who, by the way, comprise by far the greater portion of the Medical Profession, with equal assiduity maintain that organic matter in a state of putrefaction is not only one of the materials required in the production of malaria, but that it is the sole source from which this poison takes its origin; heat and moisture being only accessory circumstances, operating merely in bringing about that putrefaction. As before stated all those who oppose the opinion that organic decay is an essential circumstance in the production of marsh-miasm found their arguments principally upon the researches of Dr. Ferguson, who has enjoyed admirable opportunities of making observations upon this point, and who brings up numerous in...
stances in which intermittent fevers have occurred in peculiarly dry, rocky and elevated situations, entirely destitute of all vegetable matter. From this Dr. Ferguson concludes that the cause that produced these fevers must have originated entirely independent of vegetable or any other organic matter. Notwithstanding all this, however vegetable matter in some form or other must have been present, for in every instance, which Dr. Ferguson brings up the ground had been previously drenched by copious rains. Now, might not these rains have washed some organic matter there which may have become so thoroughly mixed with the soil, as to have been overlooked by the most scrutinizing observer. At all events it appears that an accurate chemical analysis would have been necessary to have demonstrated the non
existence of such substances; for it is well known that the seeds and other particles of vegetable matter abound in all soils however distant from all growing vegetation. Besides, the well known fact, that miasma may be carried for miles upon the winds, might render it possible that they may have been thus carried to that singularly dry, rocky and elevated region of which Dr. Ferguson speaks. Another fact that goes strongly to prove that organic matter may be present in quantities sufficient to give rise to malaria and yet escape notice, is that the microscope has laid open to our view an organic world before invisible. Now might there not be something going on in this world sufficient to produce an exhalation, which the most accurate chemical analysis cannot detect in the air, yet in
quantities large enough to render it unwholesome. Again it is asserted that we frequently see large accumulations of vegetable matter in a state of decomposition and yet see no malarial diseases in its immediate vicinity. Admitting this might not be with equal propriety say that we often see large collections of water under favorable circumstances, and yet see no sickness near its edge, and then argue that water has nothing to do with producing malaria. The latter circumstances, however, ought to be regarded as phenomena that cannot be easily accounted for, and moreover are not much to the point in question. On the contrary in proof of the fact, that organic decay does very material by to the production of this morbid agent, we have innumerable instances which have passed under the observation of almost
every one who has ever paid the subject any attention, in which cases of miasmatic fever have occurred clearly traceable to organic matter in a putrid state. Again it is found that these diseases are so ripe in no situations, as along the banks or more particularly near the delta of tropical streams, where there is vegetable matter in every conceivable variety of form and in every stage of decomposition. So also the overflow of grounds covered with a luxuriant vegetation has been observed to give rise to similar fevers, by causing the death of the plants and exposing them to decay. Thus the submerging of grounds for the purpose of enriching them, and the damming of streams are known to produce a great abundance of sickness in their neighborhood. The commencement of cultivation in a new
country has often been noticed to greatly increase the amount of disease, in consequence as it is thought, of the turning up of the soil loaded with organic materials and exposing them in a moist condition to the action of the sun's heat. The digging of canals have been thought to operate in a similar manner from the same cause. Dr. Wood thinks that one reason why miasmatic diseases are more prevalent during the latter part of the summer and autumn than at any other time, is because, by this time vegetable life has frequently run its course, and in consequence thereof, there is an abundance of the paludum necessary to the production of the cause of these diseases supplied. Upon the same principle he also thinks that long continued dry weather that causes the death of the plants, followed by warm rains that cause their decay produces a great
amount of malaria. It is not from marshes alone that this poison is emitted, but from any part of the earth's surface (that is in malarial latitude), where there is vegetable matter exposed to the action of heat and moisture. It has even been known to arise from the tops of some of the highest mountains. Lastly, it has been ascertained that although diseases are found to increase with the first steps of civilization in a malarious region, yet as the population increased, they diminished and the country became more healthy, even than it was originally; being as it is supposed to the circumstance that the growing crops consume the decomposed vegetable matter that before gave origin to these diseases. From these facts, which are substantiated by a great majority of the best authorities, I think that we are fully warranted in the conclusion that malaria cannot be produced without the aid of vegetable or organic
materials of some kind; and that although there are a few instances in which malarial fevers have prevailed without any obvious origin in the putrefaction of vegetable products, yet the very fact that such diseases do, in a great majority of cases originate under such circumstances, is strong presumptive proof, that such products are always concerned in their production. But granting that malaria is the result of some change going on in the organic world, we are still very far from having any definite knowledge regarding its real nature. Hitherto chemists have been utterly unable to detect any difference between the air of the most pestiferous regions and the most salubrious atmosphere. Carbonated hydrogen has been suspected of being the poisonous ingredient in a malarial atmosphere, as this gas has been long known to be a product of marshes; but then it is equally well known that it is not
capable of producing the effects that are generally ascribed to malaria, or we would find miasmatic diseases prevailing most extensively in mines where this substance is most abundantly generated. Sulphured hydrogen has also been thought to be the deleterious principle in the air of malarious districts. But the effects of this gas too upon the human economy are found to be quite different from those of the poison under consideration. Others again have contended that those diseases which are generally attributed to the malarial influence are due to the presence in the air of some organic matters in a state of suspension; or to the existence of animalcules or microscopic fungi which are supposed to find circumstances favorable to their development in organic decomposition, and which find their way into the system through the medium of the atmosphere.
In proof of this hypothesis, it is asserted that organic matter has actually been detected in the air about marshes. It is also asserted that Plasmodia produced, in several different animals, effects similar to those produced in man by pestilential miasmas, by exposing them to the effluvia arising from putrid animal bodies. This theory, however, as well as all others that have been advanced in regard to the essential nature of malaria, amounts to nothing more than mere conjecture; and in the present state of our knowledge we will have to be content with knowing that such a poison does exist and that it produces certain well-known effects upon the human economy.

In the next place it will be proper to notice some of the physical properties of malaria and the laws which appear to govern its operation. It has been ascertained to be of greater specific gravity than the atmospheric air. Hence it
is that we see persons who sleep upon the ground much more subject to the contraction of intermittent or remittent fevers than those who take a more elevated position; thus we sometimes see people who occupy the ground floor of a building affected while those who occupy the upper stories of the same house escape. Hence too the greater salubrity possessed by hills over the neighboring valleys. To this last general law there are some exceptions, for we sometimes observe that elevations are more sickly than the adjoining low lands. This is, according to the best authorities, owing to the fact that the miasmata are carried up in concomion with mists or fogs, as these are frequently observed to rise above the low situations and collect around the summits of the adjacent hills. Another very extraordinary property possessed by malaria is its apparent
affinity for moisture. Water, either in the
liquid form or in the state of aqueous vapors
appears to be capable of dissolving and holding
it in solution. Upon this principle we may
account for many seeming phenomena. It is
probably owing to this cause more than any other
that very copious rains operate beneficially in
promoting health. In like manner may
the protective influence of running or deep
water be accounted for. Thus persons living
on the opposite side of lakes or other large bod-
ies of water, from points where malaria is evi-
ded, are less exposed to its effects than others who
lie an equal distance from these places by
land. Also persons on board of ships re-
main perfectly secure, while miasmatic dis-
ases are raging with the utmost violence
upon the shore near them. It is maintain-
ed by some writers that it is owing to the
affinity of malaria for moisture, rather than
to any superior specific gravity possessed by it
over the earth that it is found in a greater degree
of concentration near the earth's surface than
elsewhere. For the same reason it is more dan-
gerous to be exposed during the evening and
morning while the atmosphere contains a
good deal of moisture, than towards the
middle of the day after the dews have been
dissipated. A mixture of salt and fresh wa-
ter has been thought by some to increase
not only the amount but also the virulence
of malaria, while others attach little or no
importance to this fact. Another very im-
portant phenomenon to be noticed in con-
nexion with this noxious agent is the influ-
ence which the winds exercise over it.
In a quiescent state of the atmosphere its ef-
fects appear to be confined within quite a
small sphere; but from the agency of favorable winds, it has been known to affect persons several miles distant from its source of generation. Violent storms sometimes produce beneficial effects by dispersing accumulations of this poisonous effluvia, which had collected during a stagnation of the atmosphere. Mechanical obstructions have the power of arresting it in its progress. Thus, hills, mountains, thick groves of trees and rows of buildings have been known to arrest it, and thereby protect people, living beyond them, from marshes another, and the last singular fact, to be noticed in connection with malaria is that it is in some way prevented or rendered harmless by the air of cities. Because of this phenomenon is not precisely understood; but is generally attributed to some process in some way connected with combustion.
The mortis effects of this aerial poison upon the human economy are quite various. In a very concentrated form it seems to be capable of producing consequences almost immediately fatal. On the other hand, when existing in a more diffused state, it requires an uncertain period of incubation and even appears occasionally, to lie dormant in the system for a considerable length of time. Individuals have been known not to experience its effects until several months had elapsed after the time of their exposure to it. The most general mortis results of malaria are intermittent and remittent fevers; although it may sometimes give rise to dysentery, colic, various diseases of the stomach and liver, neuralgia &c. It not only operates in producing these diseases but also, in giving a peculiar aspect to some
of the other diseases which incidentally seize upon subjects laboring under the malarial diathesis as it is termed. One great peculiarity of the diseases produced by malaria is the periodicity of their attacks. This noxious agent has also the capacity of producing a peculiar chronic diseased condition of the system not characterized by the symptoms of an open definite form of disease, but by signs of general ill health, such as fulness of constitution, sallowness of complexion, enlarged spleen, swollen abdomen, dropsical exsiccation. This latter condition usually occurs in persons who have long resided in a malarial region, and who have become acclimated as it were, and not in strangers who are generally taken with some special form of malarial disease. This is I believe the last effect of malaria, worthy of note, consequently with it is proper to close.