

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 proffer 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 <sup>low</sup> 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 56.<sup>th</sup> degree of North latitude. So also in climates where there are alternations of heat and cold, we find that malarial diseases seldom prevail when the thermometer indicates 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 effluvia 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 dews have even  
 been noticed to greatly favor its evolution.  
 Again it has been learned that a very dry  
 season, that dries up the marshes that or-  
 dinary give rise to a great deal of sickness, ren-  
 ders 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 miasmatal  
 poison. This opinion has however, <sup>with</sup> in the  
 last fifty years met with considerable oppo-  
 sition, from some of the most talented  
 members of the Medical profession; who  
 contend very strenuously that all that is nec-  
 essary, 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 late-  
 ter 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 connexion 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 adopt-  
 ed 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 inde-  
pendent of vegetable decomposition. He further-  
 more adduces arguments, almost innumera-  
 ble, founded upon his own experience upon

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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. You 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 miasmata 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 changes 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, so to contaminate it  
 as to render it unwholesome. Again it is  
 asserted that we frequently see large accumu-  
 lations of vegetable matter in a state of decom-  
 position, and yet see no malarial diseases in its  
 immediate vicinity. Admitting this, might  
 we not with equal propriety, say that we often  
 see large collections of water under favorable  
 circumstances, and yet see no sickness near it?  
 And then argue that water has nothing to do  
 with producing malaria. These latter circum-  
 stances, however, ought to be regarded as phe-  
 nomena 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 <sup>contribute</sup> very material-  
 ly 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 rife in no situations, as along the banks or more particularly near the deltas 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 pabulum 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 lati-  
 tudes) 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 high-  
 est 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 becomes more healthy, even than  
 it was originally; owing as it is supposed to the  
 circumstance that the growing crops consume the  
 decomposed vegetable matter that before gave ori-  
 gin 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.

With this chemists have been utterly unable to detect any difference between the air of the most putrefactive regions, and the most salubrious atmosphere. Carburetted 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. Sulphuretted 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 Magendie produced, in several different animals, effects similar to those produced in man by pestilential miasmata. <sup>(by exposing them to the effluvia arising from putrid animal bodies)</sup> 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 or near 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 connection 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 vapor, 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 bodies of water, from points where malaria is evolved, are less exposed to its effects than others who live an equal distance from these places by land. Also persons on board of ships remain perfectly secure, while miasmatic diseases are raging with the utmost violence upon the shore near them. It is maintained 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 <sup>air</sup> 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 malarial. 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. The cause of this phenomenon is not precisely understood; but is generally attributed to some process in some way connected with combustion.

The morbid 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 morbid 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 distinct 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 feebleness of constitution, sallowness of complexion, enlarged spleen, swollen abdomen, dropsical effusions &c. 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 miasmatic disease. This is I believe the last effect of malaria, worthy of note, consequently with it it is proper to close.