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ON THE CAUSES, NATURE, AND TREATMENT OF THE LATE EPIDEMIC FEVER IN ROTHERHAM.

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On witnessing epidemics in different localities, every one must have noticed some difference either in their symptoms, duration, or mortality; and it cannot be considered as uselessly spent time to endeavour to account for the causes of such peculiarities. For this reason I venture to bring before the notice of the Society the following observations on the apparent causes, symptoms, duration, and treatment of the fever which has been prevailing in this district since the month of March, 1845.

Rotherham had been a very healthy town for a great number of years, until it was visited by the epidemic cholera in 1832. It is situated on the declivity of two hills, east and west, with plenty of descent for drainage into the river, which runs *close to the town*, in a northern and easterly direction. Until the year 1827, there were large springs of water constantly running in several streets, which amply supplied the wants of the inhabitants; but these were taken away by the water-company, and latterly, the supply of water allowed by this company has been very scanty, so that the lower class of the inhabitants have been deprived of sufficient water to clean their premises. The consequence has been an accumulation of filth in many of the dirty alleys leading out of the main streets, which used to be washed away when water was plentiful.

The common sewers of the town are very imperfect, being made *small* and with *flat bottoms* so that they very frequently become clogged up, and I am informed, there are no drains at all leading from the narrow alleys, where the lowest grade of the inhabitants are congregated together in the closest manner, in houses almost without ventilation, and it was in these places that the cholera broke out in 1832. Even the dwelling-houses which are built round the shambles in the centre of the town, do not possess one privy amongst them, and they are obliged to secrete and preserve their excretions in their badly-ventilated houses, and throw such refuse into the street twice a week, to be removed by the scavenger. For several months in the spring and summer of last year, some of the common sewers were open in the town, for the purpose of being repaired or enlarged; this was done

slowly, owing to few workmen being employed at once. Many of the large gas-pipes in the streets were broken during this process, and there was a constant exhalation of *carbonic acid, carburetted, and sulphuretted hydrogen gases*, issuing from these open pipes and sewers, before and during the time the fever was raging. As this process was going on in one street, I have often been compelled to avoid inspiring at the time I passed it, the atmosphere was so suffocating.

Added to all this, the church-yard, measuring only 4386 square yards, is situated in the centre of the town, and has been the only cemetery for the interment of the whole parish, amounting to 13,000, until about three years ago, when a new cemetery was laid out about a mile from Rotherham, which unfortunately, is very little used. The accumulation of dead bodies in this church-yard has been so rapid, that it is difficult to find a grave filled up to less than three feet from the surface; some of them I have heard are much nearer; 1911 bodies have been interred in it the last ten years, and now it is so full that when many graves are opened a most noxious gas ascends, which does not require two visits to ascertain. The bodies are often exposed, half decayed; and not unfrequently large quantities of horribly-smelling liquid is taken out of a newly made grave and poured down the street, destined to find its passage into a sewer, which perchance may be blocked up, exhaling its horrible odour through its course, to the great annoyance and danger of the inhabitants. In July, 1841, fifty graves were opened in this church-yard in the course of two days, for the purpose of interring fifty unfortunate persons who were drowned by the overturn of a boat in the river, and immediately afterwards, typhus fever of a very low character, broke out all round the church-yard; and I am in some doubt whether the town has ever been free from epidemic fever since that period.

The quantity of *rain* which fell from June to September, 1845, was unusually great. The *barometer* was *very low*, the mean height being twenty-nine instead of thirty inches; and the mean *temperature* was 51°·9, instead of 57°. The north and north-east winds prevailing, the temperature of the whole month of May was below the average; but the wind turning south-west, the temperature of June rose above the average of the month; and in July, August, and September, it again was much below. The *barometer* continuing, all this time, *very low*.

All these circumstances combined, must have *materially reduced* the proper proportion of *oxygen* in the atmosphere,

That the very wet season has had some share in generating and spreading this disease, can scarcely be doubted. Dr. Edward Harrison on this point says, "The connection between humidity and the rot in sheep is universally admitted by experienced graziers; and since the land in the county of Lincoln has been well drained, the rot is become far less prevalent." Sir John Pringle informs us, "that persons have maintained themselves in good health during sickly seasons, by inhabiting the upper stories of their houses, and by confining sheep on high grounds through the night, they have escaped the rot."

In the second report of the Commissioners on the state of large towns, and in Mr. Chadwick's last report of the Poor-law Unions, it is stated, "The existing drains *favour* rather than prevent the accumulation of refuse matter, as they are *flat at the bottom*; which, combined with a *defective supply of water*, lead of necessity to deposits, which, undergoing decomposition, give off those poisonous exhalations, especially sulphuretted hydrogen, which constitute one of the principal causes of fever, which ravages our towns and cities." "An ample supply of water is the prime essential in all sufficient draining." Dr. Arnott remarks that "the immediate cause of many of the diseases which impair the bodily and mental health of the people, and bring a considerable proportion prematurely to the grave, is the *poison of atmospheric impurity*; and it is through the *medium of the respiratory organs* that the *germs of typhoid*, as well as *intermitting and remitting fevers*, are introduced into the system." "The use of water, in a sanitary point of view, ought to include the supply of *water-closets*, the *scouring of pavements*, the *cleansing of carriage-ways*, and, above all, the *flushing of drains and sewers*." Sir James Clark regards "the respiration of a deteriorated atmosphere one of the most powerful causes of tuberculous cachexia; and, if an infant, born in perfect health, of the healthiest parents, be kept in close rooms, in which free ventilation and cleanliness are neglected, a few months will often suffice to produce tuberculous cachexia." I am glad to see the bill in Parliament to remedy these evils makes a provision for "*an ample supply of water*."

The causes above-mentioned are in operation, more or less, in every town; and as it is very clear they are influential in the production and extension of fever, we must expect to find that disease more prevalent in towns than in the country, where the effluvial gases are more at liberty to follow the bent of their nature, and diffuse themselves through the circumambient atmosphere with velocities inversely proportioned to the square roots of their densities.

Some difference of opinion having been expressed, as to whether fever can arise from the *want of a sufficient quantity of oxygen in the atmosphere respired*, which I am willing to acknowledge appears to me to have been the exciting cause of the epidemic I am now describing, I beg to quote a few passages from the most celebrated writers on this subject.

Dr. Williams, in his "Principles of Medicine," page 81, says, "The excretions are defective in fever; and there can be little doubt that many of the constitutional effects of these fevers are, in great measure, due to this important element. The positively noxious properties which excrementitious matter retained in

the blood is known to possess, must be taken into account when we attempt to explain the states of constitutional irritation and depression, with perversion of functions, which fevers so generally present. The changes in the blood, manifest in some cases by its fluidity and by petechial appearances, may also be referred to defective elimination of effete matter." At page 232, "The lateritious sediment in the urine indicates an increased excretion of the solid constituents of the urine, for there is often an excess of urea as well of the urates; and comparing this with the scanty secretion of urine during the febrile excitement, and the decay of tissues which is always taking place, we can scarcely avoid the conclusion that these excrementitious matters had been accumulating in the blood from the impaired function of the kidneys during the fever; and that now, as the fever subsides, and their function is restored, the accumulated matter is thrown off." At page 120, "It is supposed by most chemists that the urea excreted by the kidneys is chiefly derived from the transformation or decay of the textures of the body; most of their carbonaceous matter being abstracted by the affinity of the oxygen of the blood, and carried off by the lungs in the form of carbonic acid gas."

On referring to Professor Alison's "Outlines of Pathology," *impure air* is particularly mentioned as a cause of fever, *producing a general depression of vital action*. At page 485, he says, "We have good evidence that all these idiopathic fevers either originate from a malaria, or propagate themselves, in part at least, and in certain circumstances, by contagion." At page 506 "The malarious poison does not appear to diffuse itself readily through the air, nor to rise high above the surface emitting it; the inhabitants, even of a ground-floor of a house in a malarious district, being often affected in a much larger proportion than those of the upper stories. Although the heat of the sun appears to be one of the conditions of the development of the poison, yet its immediate effect on the poison that has been already evolved seems to be to dissipate and dilute it, for it is much more dangerous to visit the most malarious spots at night than at noon day." At page 523, "Whatever be the mode in which the morbid cause in fever comes to affect the circulation, it is to the *direct action of the cause*, and not to the influence of any local diseased actions, that we must ascribe the enfeebled state of the circulation, the altered state of the blood, the peculiar vitiated state of the secretions, and in a great measure also, the deranged state of the nervous system." "The sedative effect on the heart is often such as to enfeeble, and sometimes nearly to suppress, the febrile re-action, as in congestive fever; that on the brain may produce fatal coma, as in nervous fever; that on the vital functions of the capillary vessels may be such, and so long continued, as to cause fatal inanition and exhaustion." At page 141, of *Billing's Principles of Medicine*, he says, "From the very nature of fever, which I have described to be a disease essentially affecting the whole nervous system, it follows that the functions of the viscera must be disturbed; and though, as just pointed out, sometimes disease of one organ predominates, sometimes of another; yet, *every organ* suffers more or less *congestion in every fever* from the *loss of nervous influence*."

In *Müller's Physiology*, 2nd ed., vol. 1, page 159, it

is stated, "The absorption of oxygen, and the separation of a portion of carbon, (or carbonic acid,) are, therefore, the causes to which arterial blood owes its property of being the *sole stimulus of living structures*. Venous blood, which has not undergone this change, has a *poisonous action on the organs of the body, particularly on the nervous system, and annihilates their irritability*, its action being similar to that of *carbonic acid, sulphuretted hydrogen, carburetted hydrogen*, and some other gases, by which the *irritability of the organs of the body is destroyed*, and by most of which the *arterial blood is darkened in colour*." At page 345, "It appears that the quantity of gas contained in the blood amounts in the mean to 1-10th, and sometimes is as much as 1-8th of the volume of the blood itself; that the *oxygen in venous blood equals, at most, 1-4th, and often only 1-5th of the carbonic acid which the same blood contains*; while, in the *arterial blood, the oxygen equals, at least, 1-3rd, and almost one-half of the quantity of carbonic acid*."

Andral, Gavarret, Simon, and Dr. G. O. Rees, informs us, as the result of numerous experiments, that the blood in typhus fever is found to be very deficient in fibrin and albumen; it coagulates imperfectly, and often remains in a semi-fluid state; the clot is soft, friable, of a very dark, almost black-red colour, and is very rarely covered with a buffy coat, and very soon becomes putrid; and in the latter stages, the quantity of blood-corpuscles and solid contents decrease remarkably rapidly. In thoroughly-developed typhus, Dr. Armstrong found the blood of the temporal artery as dark as that of a vein; Dr. Stevens found the chloride of sodium in typhus blood very sensibly diminished; and Dr. Clanny found all the salts diminished.

It is well known that the atmosphere cannot be breathed by man with a larger proportion of carburetted hydrogen in it, than one part in ten; the proportion of *carbonic acid gas* in atmospheric air is never more than one part in a thousand; and that inhalation of sulphuretted hydrogen gas would convert the per-oxide of iron of the red globules of the blood (the oxygen carriers,) into a black sulphuret of iron; and, at once, prevent the change from venous to arterial blood.

What is malaria? It is the emanation from decomposed and decomposing vegetable and animal matter; carburetted, sulphuretted, and phosphuretted hydrogen gases with carbonic acid gas. The immediate effect of breathing an atmosphere charged with these gases, would be:—

1st. A diminished quantity of oxygen to combine with the carbon in the venous blood in the capillaries of the pulmonary artery; the blood would become loaded with carbon, and imperfect arterialization must be the consequence.

2nd. The brain and nervous system would be imperfectly stimulated by arterial blood; and as the quantity of carbon increased, the arterial would be converted into venous blood, or nearly so, which would have a poisonous action on the nervous system.

3rd. The blood circulating as arterial would not contain that quantity of free oxygen necessary to combine with the carbon and hydrogen of the metamorphosed tissues which it meets with in the general capillary

system, and therefore they could not be removed as they are in healthy circulation.

4th. The secretions would be stopped in consequence of the deteriorated quality of the blood, and loss of energy in the nervous system; and the excrementitious matter, instead of being excreted, would be absorbed and circulated in the blood.

We are all aware that every part where blood-vessels and nerves are to be found, is continually wearing away; and if the supply of oxygen, nitrogen, carbon, and hydrogen, be not constantly kept up, the individual must perish. He first loses his fat; then his muscles; and, lastly, the substance of his brain, followed by deranged intellect and death—just as we see in the advanced stage of fever. The seat of fever, then, appears to be in the capillaries; in this structure secretion, nutrition, waste and decay go on. As long as the *vital principle is greater than the chemical force*, health is the result. But when the *vital principle is deteriorated by a deficient supply of oxygen in respiration*, feverish action is the consequence.

The foregoing explanation may account for the cold or collapsed stage of fever very easily, which would terminate here, if the individual remained in so depraved an atmosphere as to be insufficient to supply oxygen enough to excite reaction. But it will be asked, how can the animal heat be so much increased as it is during the continuance of fever, if there is a deficient supply of oxygen. When *reaction* takes place, nature makes an effort to restore the normal state of the capillaries. Respiration and circulation are increased in speed; there is then a normal quantity of oxygen inhaled (if the atmosphere become pure,) with every inspiration, and the respiration and circulation are doubled; consequently the animal heat is increased nearly two-fold: The red blood-corpuscles, or oxygen carriers, again gradually resume their office; remove a portion of the decayed tissue; but, in consequence of the depraved secretion, and large quantity of carbon in the blood, it requires a certain time to overcome this derangement; and this time constitutes the *period* of the continuance of fever.

I would by no means wish to insinuate that this is the only mode in which fever is generated. It is often the consequence of animal poisons introduced through the capillaries to the nervous system; and many other causes of fever are too well known, and generally acknowledged, to require any notice here.

(To be continued.)

ON PLACENTA PRÆVIA.

(A paper read before the Medical Society of University College, London, on Friday, January 30th, 1846.)

By JOHN ELLIOT WOOD.

(Continued from page 85.)

Reflecting upon these circumstances, Mr. Kinder Wood, of Manchester, was induced to consider whether, in very urgent cases, we might not be justified in so far imitating nature as to extract the placenta before the fœtus, and by this means arrest the flow of blood. Writing in 1821, he says, "If we find so much exhaustion as to make us fear the effect of further