

'MIASMA' THEORY AND THE POSSIBILITY OF MALARIA ERADICATION**Ademola O. Awoyemi****Department of Epidemiology and Community Health, College of Medicine,
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Malaria as a disease entity caused by plasmodium species only became recognized towards the end of the 19th Century. Prior to that time, Malaria or 'bad air' was believed to be the cause of fevers or paludal. This article traces the history of 'Miasma' theory which had been accepted for Centuries before the 'Germ' theory became established. Comparing the 'Miasma' theory with current understanding of Africans about disease causation, it was concluded that there are great similarities. It is therefore recommended that concurrent application of both the 'Germ' theory and the 'Miasma' theory could lead to a more effective control or even global eradication of malaria.

Key words: Miasma, malaria, eradication

BACKGROUND

The role of the environment in the causation of malaria became clearer with the demonstration of the plasmodium under the microscope by Laveran in 1880 (1). Since that time the germ theory has become established in the causation of diseases, particularly communicable diseases. The further discovery by Ronald Ross in 1897 of the mosquito as the vector of malaria finally nailed the previous theories about causation of diseases (1).

For many decades, quinine and later chloroquine seemed to be the solution to the treatment of malaria. Unfortunately the development of resistance to chloroquine by plasmodium that started in the 1960's became a concern to the medical profession. Various reasons and research findings have been advanced for the probable causes of this resistance. These have included mutation, plasmid transfer, genetic alteration, cell membrane alteration and selection exhibited by the parasite. These various methods have provided answers but not absolute solutions to the problem of

malaria (2). On the other hand, the effect of altering the environment was also recognized as being effective in the control of malaria. Hence, measures such as draining of swamps, prevention of stagnant water around houses and other buildings and filling up of ponds and podles were recognized means of reducing mosquito population. In addition, spraying of the surrounding of premises and fields with insecticides such as DDT and the inside of living quarters with combined knockdown and residual insecticide products have been used over the years (3, 4).

However, just like the protozoan plasmodium, the Anopheles mosquito has increasingly developed resistance to these insecticides which had previously proved effective. These developments have therefore resulted in new drugs being developed in the quest to effectively control the disease. Also new techniques of reducing man/mosquito contact were developed with the hope that malaria transmission would eventually be effectively reduced to the barest minimum. The latest technique advocated being the

use of insecticide treated nets. In addition to the above stated knowledge of malaria causation, other environmental conditions such as temperature, vegetation, humidity and topography have been known to be important factors.

Yet despite this vast knowledge about the epidemiology of malaria, the battle against the disease is very far from being over. It is in the light of this development that this proposal is being made in order to stimulate interest in a theory which for centuries had been given consideration in disease causation but was suddenly abandoned for the germ theory. The intention is to establish the fact that this theory and the later embraced germ theory do not necessarily have to be mutually exclusive. Indeed the full understanding of this theory will greatly enable us to understand better the germ theory.

THE 'MIASMA' THEORY: HISTORICAL ASPECT

As early as 95BC, Lucretius hypothesized that swamp fever might result from a living organism. However up till the late 19th Century, it was generally believed that 'fevers' (from Italian mal'aria) was caused by a poisonous vapour or "miasma" released from swamps. Climate, season and geographical location were all thought to influence the outbreak of fevers that were thus often referred to as 'paludal'.

However it was known that not all swampy areas were malarious and fevers could be acquired in other geographical zones (1). It was not until mid 1800s that many scientists began to rally behind the animalcular theory (or organismic theory), the precursor of the germ theory which was to come later.

The major breakthrough to confirm these scientific hypotheses occurred in 1880 when the French Physician, Charles Louis Alphonse Laveran discovered the malaria parasite. In spite of Laveran's discovery of the *Plasmodium falciparum*, a large part of the scientific community continued to remain skeptical. It was only in 1887 that William Osler, the great American Physician, first Professor of Medicine and eventual Chair of the Johns Hopkins University, finally gave credit to Laveran and acknowledged the pathogenic nature of the parasite and its aetiological association with the disease (2-4).

In 1897, Ronald Ross, encouraged by Patrick Manson to investigate his hypothesis, saw under the microscope, female pigmented crescents of the parasite in the wall of the stomach of the mosquito *Anopheles stephensi*. In 1898, Ross found the sporozoites of the plasmodium in its digestive tract. This led him to the realization that the germinal rod might be extruded during excretion of the mosquito's saliva and that it might be a way of spreading the disease (2). Ross was of course guided by Patrick Manson's scientific input and intellectual impetus and it was coincidental also in 1898 that Manson founded the London School of Tropical Medicine.

In later years, experiments by other scientists including Giovanni Batista Grassi, Patrick Manson, George Carmichael Low, Louis Sambon and A. Terri were later to establish that the malaria parasite, plasmodium was transmitted to humans by the mosquito (2, 3, 4). With this new knowledge therefore, the 'Miasma' theory

was to receive a final blow within a few years (2).

'MIASMA' THEORY REVISITED

It is hereby being advocated that the 'miasma' theory be revisited and seen in the light of knowledge now available in modern science. At the beginning of time earlier referred to, fevers were believed to be caused by contagion and miasma. Contagion of course referred to infections acquired directly from person to person through the air either by sneezing or breathing or by other means by the affected person. On the other hand, 'miasma' referred specifically to fevers acquired from swamps or other water bodies or even waste dumps from which a poisonous vapour (miasma) arises which could result in fever and ague, sore throat, lung diseases and other fevers.

In those days, definitely such knowledge was useful in controlling the environmental problems of European cities. For example, the improvement in general environmental sanitation in Europe including draining of the swamps around the city of Rome, enforcing strict refuse and sewage disposal regulations and prevention of air pollution were instrumental in controlling many communicable diseases. Hence such epidemics as ague, plague, typhoid and malaria were effectively controlled (3, 5). This was during the time the 'miasma' theory was widely accepted in Europe and before the full establishment of the germ theory. If the 'miasma' theory helped Europe so greatly in its development of Public Health why did it become so suddenly relegated to the background at the expense of the germ theory?

THE AFRICAN EXPERIENCE

At present, Africa and Asia are in a worse situation as far as Public Health situation is concerned than even Europe before the turn of the 19th Century. Environmental sanitation continues to deteriorate in Africa with attendant health implications (6). Communicable diseases are rampant including vector-borne infections like malaria, yellow fever among others. Open drains, open refuse dumps, stagnant water bodies, indiscriminate faecal disposal and overgrown bushes exist in abundance in the various communities encouraging breeding of mosquitoes and other vectors as well as vermins such as rats and snakes (6), a situation similar to what existed in Europe before environmental sanitation laws were put in place.

Casual observation of the Nigerian community of which this author has had considerable experience has shown that the present African environment definitely needs the same understanding that the European environment had before the turn of the 19th Century. For example, the understanding of the African view about disease causation is not different from what it was during the 'miasma' theory period prior to the mid 19th Century. This may sound retrogressive but unfortunately it is true. It is therefore necessary for the Public Health Practitioners in Africa to understand this historical perspective before setting out to solve the environmental sanitation problems in Africa.

Among most Nigerian ethnic groups including Yoruba, Nupe and Hausa, the beliefs about disease causation especially fevers are similar to the 'miasma' theory. The Yoruba people, for example, believe that fevers (Iba) could be caused by inhaling

'invisible substances in the air' into the lungs. Unfortunately because this is an African belief, it has been labeled up to this moment as superstition without the modern scientists considering that such beliefs were rampant in the developed world, at least, at one time (2).

'MIASMA THEORY': POSSIBLE CLUE TO MALARIA PARASITE RESISTANCE

Most Physicians working in the tropical and subtropical areas of the world have been confronted by the issue of treating supposed malaria fever in the same patient repeatedly. Often this failure in treatment has been attributed to the development of resistance by the plasmodium in the blood (7, 8). While this has been proved to be correct in certain situations, it has also been observed that not all such cases could be explained on the basis of resistance. For example, in Nigeria, such observations have been explained by the fact that many of the drugs in circulation are fake, usually not containing the active ingredient in the expected pharmacological concentration in the tablets or capsules.

On the other hand, certain attacks of malaria could only be explained on the basis of recrudescence in which case, plasmodium species somehow re-enter the blood from a quiescent stage in the liver especially in the case of *Plasmodium malariae*.

Malaria recrudescence has also been used to explain a situation when a victim from a malaria endemic zone suddenly develops a bout of malaria more than a year after returning from such an area. The 'miasma' theory could explain such attacks of malaria and much more, if it

is first realized that 'miasma' (vapour) inhaled from swamps and effluvium of dirty environment such as refuse dumps as previously understood could cause fevers (not malaria fever alone), hence the unexplained 'Pyrexia of Undetermined Origin' (PUO).

According to the 'miasma' theory, fevers are caused by inhaling miasma (9). What this means, in the light of modern knowledge, is that the demonstration of malaria parasites in the blood would not necessarily account for the associated fever. This fact has been demonstrated in some parasite rate studies in the African. Malaria fever is an entity, no doubt and should not explain away the fevers caused by miasma. In other words, malaria fever and the 'miasma' theory should not be mutually exclusive. It is to be realized that just as 'contagion' is still recognized in modern science and medicine, 'miasma' also should be reinstated to its former status albeit with modern scientific understanding. It could be the only explanation for the cause of many fevers either directly or indirectly by reducing resistance to the various 'animalcule' that were later discovered.

Many doctors in Nigeria have had to treat fevers which responded to anti-malarial drugs but with no demonstrable plasmodium organisms in the blood. On the other hand, two or more members of the same family have sometimes reported in clinics having fevers at the same time yet living in environments which are well netted.

While agreeing that such situations could arise occasionally, the frequent occurrences however, points to a common factor other than mosquito bites, especially when there is no demonstrable malaria

parasite in their blood. The trend in the country's medical practice currently is to label such cases as typhoid fever usually after only one Widal test, rather than a rising titre, had been performed as a diagnostic proof.

'MIASMA' THEORY: PROBABLE ANSWER TO ERADICATION OF MALARIA

Rather than totally discard the 'miasma' theory, it is being proposed that it should be reconsidered. Indeed it may be found in the near future to compliment the germ theory rather than being antagonistic. It may even be the 'gap' in our present level of understanding of causes of diseases especially febrile ones. In fact, given the present knowledge of the African concerning disease causation, the 'miasma' theory would appear more appealing than the 'germ' theory and could even elicit his cooperation in utilizing local knowledge and technologies in finding a lasting solution to malaria control (10).

It may even be the first step towards eventual eradication - a feat which is not impossible if the African people and their beliefs and traditions are taken into consideration (10), for it is only through the full participation of the African people themselves (i.e. community participation) which is one of the principles of Primary Health Care that malaria eradication will be possible. In this regard, many African scientists with full orientation in Public Health are needed in this final onslaught against malaria.

THE WHO ROLL BACK MALARIA PROGRAMME: A STEP TOWARDS ERADICATION

The roll back malaria programme of the World Health Organization (WHO) is a right step in the right direction. The

programme has further received a boost from the commitment of the African Regional Office of the WHO recognizing the fact that an African solution is necessary to the problem through the use of local knowledge and taking into consideration the social and cultural peculiarities of the people (11). Studies on the African environment, which could explain such phenomenon as 'invisible substances' in the air or 'miasma' are needed, preferably by Environmental Health Physicians, Environmental Health Hygienists and other Public Health Practitioners.

Currently the Department of Epidemiology and Community Health of the College of Medicine, University of Ilorin (a WHO Collaborating Centre in Community based Education and Service) runs a one year Master in Public Health (MPH) programme which is inter-disciplinary. This means that candidates from disciplines that are medical or health related are admitted into the programme. In this unique programme, post-graduate students from these diverse backgrounds, including Doctors, Senior Nurses, Pharmacists, Health Educators, and Public Health Engineers among others interact with one another. Through this interaction they are able to see the solution to the problems of the African Environment from both individual and collective perspectives. It is believed that it is from such a Training Centre as this, that scientists will go out in the nearest future to solve the malaria problem together, using the knowledge and local techniques available in Africa once and for all.

CONCLUSION

The eventual eradication of malaria will depend on using the local knowledge

and technologies available in Africa and other developing areas of the world. The present impasse in malaria eradication is due to the fact that such local resources are still not accepted in the scientific world. The 'Miasma' theory is in line with the African belief about disease causation. The concurrent application of the 'Germ' theory and the 'Miasma' theory will greatly contribute to solving the malaria problem as they do not necessarily have to be mutually exclusive.

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