Malaria : a neglected factor in the history of Greece and Rome / by W.H.S. Jones ; with an introduction by Sir R. Ross ; a concluding chapter by G.G. Ellett.

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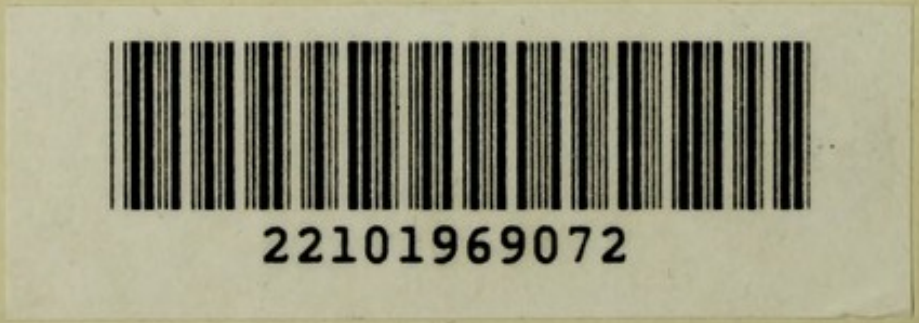

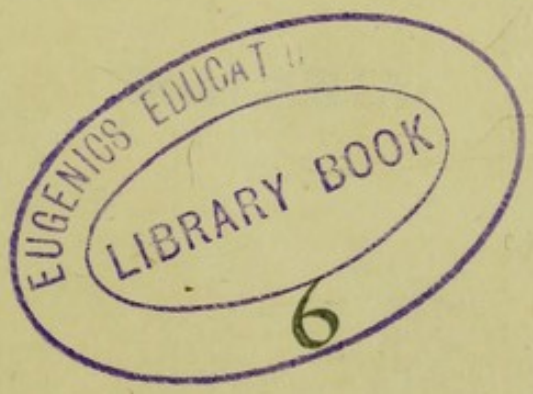

MALARIA

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A neglected Factor in the History of Greece and Rome

BY

W. H. S. JONES, M.A.

WITH AN INTRODUCTION BY

MAJOR R. ROSS, F.R.S., C.B.

&

A CONCLUDING CHAPTER BY

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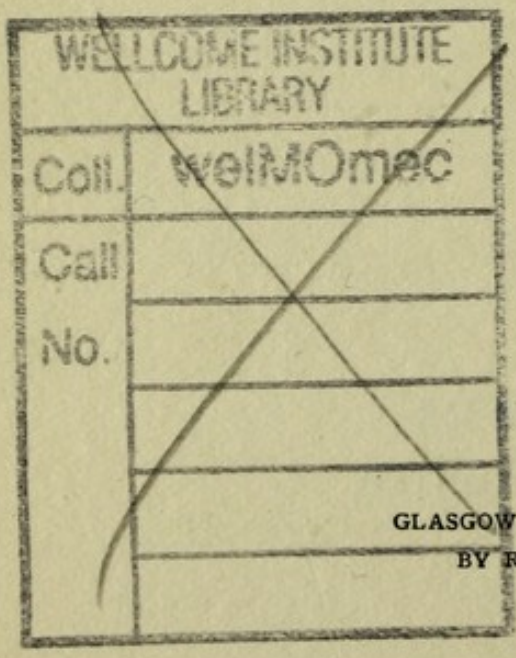

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PREFACE

THIS little book owes its being to the suggestions and encouragement of Mr. A. E. Shipley and Major Ross. Since there are few previous works on the same subject, a large amount of correspondence was necessary with authorities on ancient medicine, both British and Continental. A great part of this was undertaken by Mr. Shipley, and to him are due my most grateful thanks. Among other specialists who have given generous help must be mentioned Dr. E. T. Withington, Professor Clifford Allbutt and Professor E. V. Arnold. In addition to this, it seemed well to invite the direct co-operation of medical men. Mr. G. G. Ellett has added a chapter on malaria as a factor in morality, and Major Ross, besides supplying many notes, criticisms and comments, has written an introduction. The object of the writers has been to show how important it is to stamp out malaria as soon as possible.

Most other diseases, however distressing to individuals, brace a people by weeding out the unfit; malaria plays no such useful part in the economy of nature. It seizes all, fit and unfit alike, gradually lessening the general vitality until, in some cases, it has exterminated the people among whom it has become endemic.

Very important evidence is cited in the additional notes on pp. 60 and 76. I hope that some readers will be encouraged to search for fresh evidence, and to publish their conclusions. That hope is the only justification for publishing the present inquiry.

W. H. S. JONES.

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CHAPTER I.

INTRODUCTION.

By RONALD ROSS,
Professor of Tropical Medicine, University of Liverpool.

The author of this very instructive and interesting little book has asked me to write a short introduction to it. I can only hope that my foreword will not prove incongruous with a work over which he has spent so much enthusiastic labour.

The student of biology is often struck with the feeling that historians, when dealing with the rise and fall of nations, do not generally view the phenomena from a sufficiently high biological standpoint. To me, at least, they seem to attach too much importance to individual rulers and soldiers, and to particular wars, policies, religions, and customs; while at the same time they make little attempt to extract the fundamental causes of national success or failure. We may suspect that these are really more sociological than humanistic—that is, common to races of animals and of

men rather than peculiar to the latter. I see no reason to suppose that the Roman and the Megatherium were not struck down by similar causes.

There must be a great complex of causes which produces racial predominance and decay —a complex of still greater intricacy in the case of man. Possibly the causes of racial death may be classified under the same headings as those of individual death—physiological, pathological, and traumatic. For example, the individual man is built up from a single zygote, or combined cell, by means of reiterated division, until ultimately his body is composed of billions of cells organised in different castes and professions—so that he is in fact himself a great nation of associated beings. Death may overtake this microcosmic nation either (apparently) from exhaustion of the power of cellular reproduction; or from pathological destruction, poisoning, or paralysis of certain essential castes of cells; or from forcible disruption of the whole organisation. Hypothetically, then, we might expect similar phenomena in a race of animals or a tribe of men—decadence or death from exhaustion of the reproductive faculty, from pathological "necrobiosis" of individuals, or from direct destruction by enemies.

Such a conception (which can of course be enunciated here only in the briefest manner)

will force itself especially on those who have had opportunities of knowing many races of mankind. What is it that causes the infinite diversity of type and of ability? Why, for example, in India, do we obtain under much the same conditions of race, climate, and government so many different types, from that of the brave and massive Sikhs to that of the timid and feeble inhabitants of many localities? Success in war must be rather a result than a cause. The wisdom of individual rulers can exert but a temporary effect. Doubtless, marriage customs, by the substitution of parental for sexual selection, must exert a bad effect on the eugenics of some races. Overcrowding may act by the greater facilities which it gives for the dissemination of parasitic diseases, by the production of poverty, or by some other, and as yet unknown, means. Vices, superstition, misgovernment, and finally intellectual decadence, like failure in war, are probably secondary to the original causes.

Among the most potent of these, and yet strangely overlooked by historians, must be widespread disease. I do not mean epidemic infection such as plague and cholera, which sweep through a population for a time and then leave it, but those endemic diseases which, when once introduced, oppress it for ever—particularly those which attack the children, kill many of them, and render a large percent-

age of the remainder sickly for years. I am aware it has been argued that such maladies really enhance development by destroying the unfit and leaving finally a robust and immune race; but there is no evidence that they do really select or destroy the unfit in preference to the fit; while, as regards the acquirement of racial immunity, this, if it really exists at all, must take thousands of years to be established. On the other hand, in the international struggle for existence or supremacy, a people of whom a large proportion have passed through a sickly childhood cannot but be at a disadvantage compared with more healthy nations; and it is quite possible that the sudden introduction of an endemic disease among a people hitherto dominant in the world may end in its rapid downfall as regards science, arts, commerce, and war. It is believed, for instance, that many of the native races of America were destroyed after the discovery of the continent, not so much by the arms of the white men as by their diseases. I have heard that not so long ago a third of the Andamanese Islanders were swept away by measles. Whole populations have disappeared before small-pox and syphilis; and I suspect that tuberculosis has had a marked, but as yet undetermined, effect on the world's history. In warm climates, intestinal parasites, dysentery, and malaria probably have a most malign influence. I have

long suspected that the extreme feebleness of many crowded Indian populations is principally due to the common round worm, which prevails to a shocking degree among both children and adults. I have seen whole villages and plantations persecuted by the blood-sucking *Ankylostoma*, or actually destroyed by the parasite of kala-azar. Modern science has of course shown that disease is very largely nothing but parasitism or its results; but this fact has not yet penetrated sufficiently into our studies of history. Historians, in attributing the downfall of nations to human agencies, have overlooked the probably greater effects produced by those obscure or invisible foes which destroy us from within.

It is this important theme, applied to the downfall of the greatest of nations, which Mr. Jones has studied from the historical point of view. The suggestion is that the conqueror of Greece was not so much the Macedonian or the Roman as that great tyrant which now holds half the world—malaria. In order to understand his work, the reader should know the following facts about the disease. It is due to multitudes of minute animal parasites of the blood, which produce fever recurring every one, two, or three days (quotidian, tertian, or quartan fever). If not treated by cinchona—which was discovered only a few centuries ago—the parasites remain in the body for many years, causing frequent relapses of fever, anaemia, and enlarge-

ment of the spleen. They are carried from man to man by the agency of a class of gnats, called Anophelines, which breed in small pools of water on the ground. Where such pools are numerous in the hot months of summer and autumn, as in marshy localities, the insects generally abound; and if a patient with the parasites in his blood enters the locality, they become infected by biting him, and then pass the microbes on to any healthy persons they may feed upon subsequently. The disease may thus be spread slowly by the gnats from a single patient until it infects the whole country; and where it has once entered, it is passed on from generation to generation. *Ceteris paribus*, where there are the most suitable pools in the summer, there are most Anophelines; and where there are the most Anophelines there is the most malaria—though qualifying circumstances exist. Thus valleys and flat water-logged plains are generally the most malarious—the fact which gave rise to the synonym "marsh fever." In very malarious places, children frequently become infected after birth and remain infected until puberty, when the survivors acquire partial immunity. In many low-lying villages almost every child contains the parasites and looks more or less wasted and pale, with greatly enlarged spleen and a dusky complexion. People who live on the surrounding hills, though these may be healthy

enough, easily become infected when visiting the lower villages for marketing or agriculture.

We have all heard of Mauritius, that earthly paradise which witnessed the sorrows of Paul and Virginia. But in 1866 malaria was introduced in some manner, and has caused infinite injury to the island ever since. So also in many localities the disease has crept from village to village, enfeebling and stupefying the inhabitants like cretinism. An intensely malarious locality cannot thrive. The children are wretched, the adults frequently racked with fever, and the whole place shunned whenever possible by the neighbours. The landowner, the traveller, the innkeeper, the trader fly from it. Gradually it becomes depopulated and untilled, the home only of the most wretched peasants.

Turning now to Greece, we shall easily understand from a consideration of its topography how readily it must fall under the sway of malaria. Rugged and mountainous, the only habitable spots are a few small plains and valleys—that is, just those places where pools of water most suitable for Anophelines are likely to be formed. True, the rainy season in Greece is the winter, when the insects do not breed; but still, even in the summer the valleys are traversed by perennial fountains and streams which issue from the surrounding mountains, and which, while they make agricul-

ture possible, at the same time tend to produce small marshes—often close to the villages. From these the insects can swarm into the houses, where they become infected by biting the inmates, and so carry the infection from person to person for months, until almost everyone in the locality contains the germs of the disease. As is now known to a certainty, such is the actual method by which malaria is propagated.

I suppose that this sub-family of gnats must have been present in Greece from very remote prehistoric times. But it does not therefore follow that malaria also existed there from the same time. The gnats alone are not sufficient; they are only the carriers of the parasites, and these also must be introduced at some period or other before the disease can spread in a locality. It is quite possible that if ancient Greece was peopled by invaders coming from northern non-malarious latitudes, it might have had no malaria for ages, in spite of the presence of the Anophelines, until some person, with the parasites in his blood, happened to visit the country. Then, if he was bitten by the insects, they would carry the infection to others in his neighbourhood, and from these to others further afield, until the disease would be gradually spread all over the country, just as has certainly occurred recently in Mauritius, and probably in many other lands besides these.

For example, I think there is much reason for supposing that malaria was not always present in Italy, and that the Campagna, now so desolated by it, must have been healthy until quite up to the historic period. So also, perhaps, the divine valleys of Greece may have remained unsullied by this miasma, this pollution, until soldiers, merchants, or slaves coming from Africa or Asia, the ancient homes of malaria, introduced it. Once introduced, it must have spread from valley to valley with fearful effect upon the inhabitants. It would probably have seized first the most low-lying and fertile valleys, especially the cultivated outskirts of the cities, and have thence spread into the upland villages and even into the heart of some of the cities. Everywhere the children would be attacked and would remain infected, with pale complexions, emaciated frames, and enlarged spleens, until puberty, when a partial (but only partial) immunity might rescue the probably stunted bodies of the survivors from further illness. Gradually the whole rural life of the affected area would be vitiated; the hardy peasantry and the vigorous soldiers would no longer be found; the rich would desert their villas, and the priests the rural shrines of the gods. Still further, supposing that at the same time numbers of Africans and Asiatics had been poured into the country as slaves, these people,

already probably inured to malaria in their tropical homes, would survive, while their fair-haired masters and masters' children would gradually tend to be eliminated; so that, after perhaps a century or two, the whole character of the population might gradually be changed.[1] And I suspect this change would be much more fundamental than any which could be produced by temporary wars and invasions, because the same cause would tend to produce the same results from century to century, the fairer northerner succumbing[2] where the more inured races of the south survive—just the opposite, in fact, to non-malarious countries, where the more vigorous northerner tends to oust the southerner. Of course, on this hypothesis, we might expect the original races to survive better in the non-malarious islands of the archipelago—a thing which travellers aver has actually happened.

Malaria has quite possibly produced similar results in southern Italy; but its effect on that

[1] This certainly holds good in the case of Rome. See Juvenal, *Sat.* III. 60:

> non possum ferre, Quirites,
> Graecam urbem. quamvis quota portio faecis Achaei?
> iam pridem Syrus in Tiberim defluxit Orontes.
>
> [Note by W. H. S. Jones.]

[2] This may be illustrated by the fact that troops inured to the climate of Gaul, Spain, and Germany were struck down when they came into Italy. The former countries were probably healthy. See Caesar, *de bello civili*, III. 2, and Tacitus, *Histories*, II. 93. [Note by W. H. S. Jones.]

country was probably less marked than its effect on Greece, because the ratio of malarious to non-malarious areas in the former seems to be much smaller than in the latter, where almost every valley can harbour it.

Modern Greece is intensely malarious. In the Copaic Plain, examined by me last year, I estimated that quite half the children were infected, even in June before the annual malaria season had commenced. The Attic Plain is, and probably always was, much healthier owing to its dry climate; but numbers of other plains and valleys are certainly as bad as the one I studied. The Grecian Anti-malaria League has collected excellent statistics on the subject, and these have been published by Drs. Savas, Cardamatis, and others. For instance, it has been estimated that in the unhealthy year 1905, out of a total population of only about two and a half millions, nearly a million people were attacked with malaria, and nearly six thousand died. Blackwater fever, the worst form of malaria, is exceedingly common. I have never seen, even in India and Africa, villages more badly infected than Moulki and Skripou in the Copaic District. The Greek Army is as heavily infected as was the Indian Army until the last few years.

Of course we must not assume that an event actually did occur only because it may have

occurred; but *a priori* it seems likely that malaria was introduced into Greece about the time of the Greek invasions of Asia and Africa, by slaves or by sick soldiers returning to their homes. It would require, say, half a century to obtain a firm hold of the country; and would then probably undermine that august civilisation when at its height. Let us gaze for a moment at those magnificent marbles which have recorded for ever the finest development of the human form—were these gods and heroes born out of the imagination of a people infested and degraded by malaria? What trace or suggestion of that disease would the well-trained eye of the medical man detect either in them or in the less idealised figures on the tombstones? All these are evidently the creations of a large and healthy northern race, more akin to the Scandinavian race of to-day (at least so it appears to me) than to any other.[1]

I find it difficult to imagine that the people who produced this great sculpture, and the no less magnificent science and literature of ancient Greece, could have ever suffered very much from malaria. True, it may be said that the disease was present among them during the whole of the great age, but only

[1] I do not know whether the thing has ever been suggested or done, but it would be interesting to ascertain whether the Greek statues have long heads or broad ones, and to compare the measurements with those of the modern people of southern Europe.

to a slight degree; but this is difficult to understand, because the existence of even a few endemic cases would suffice, given the presence of the carrying agents, to produce a wide and rapid extension. Again, it may be argued that the malaria as seen in Greece to-day was not a cause but a result—due to the neglect of cultivation caused by the devastation of wars; but here also I may say that I have seen no evidence of the hypothesis that uncultivated lands are really more malarious than cultivated ones. All cultivation requires water, and frequently requires artificial irrigation; while the mere occupancy of cultivated land by the peasantry tends to ensure the presence of the parasite—so that devastation should and does, I think, reduce malaria instead of increasing it. On the whole, therefore, it seems probable that malaria would have reached its present degree of prevalence in Greece very shortly after its introduction; and must have been the cause, or a cause, of the rapid decline of the country after the great age, and not the result of that event.

The difficult task of seeking historical evidence in this connection has been ably taken up by Mr. Jones; and I hope his work will not only be of interest to scholars, but will stimulate further research in a direction which has not been much followed. He

suggests, moreover, that the story of malaria in Greece should be of importance to all malarious countries, and should help in the war which is now being commenced against the disease in many places. In this war we must welcome every possible ally.

CHAPTER II.

MALARIA IN ANCIENT GREECE.

A FEW years ago the writer was investigating the change in the Greek character which took place during the fourth century B.C. The following results seemed then, and still seem, certain.

There does not appear to have been any increase of immorality between, say, 500-300 B.C. But, nevertheless, morality changed. Home-life took precedence of city-life. Patriotism decayed, and lofty aspirations almost ceased to stir the hearts of men. In art there appeared a tendency to sentimentalism; philosophy in many quarters became distinctly pessimistic. Some schools of thought actually took "absence of feeling" or "absence of care" (*ἀπάθεια*, *ἀταραξία*) as the highest goal of human endeavour. Dissatisfaction and querulousness are marked characteristics of the age. By 300 B.C. the Greeks had lost much of their manly vigour and intellectual strength.

The cause of this change appeared to the present writer to be partly the decay of

religious feeling, and partly the growth of the human intelligence, which resulted in dissatisfaction with existing institutions. Doubtless both of these tendencies were factors in the change, but they did not seem at the time of writing the earlier essay, and they do not seem now, to be sufficient by themselves.

The recent investigation into the prevalence of malaria in Greece, and into its effects upon the inhabitants, suggests that a similar agency may have been at work during the fourth century B.C. Malaria, like influenza, differs from many other diseases in that it does not strengthen a people by weeding out the unfit. Its result is to produce a general lowering of vitality without bringing about a very large number of deaths. Malaria usually becomes chronic, at least until a comparative immunity has been gained. In such cases despondency and nervous debility leave a permanent mark upon the victim. It should, then, be carefully noticed that, quite apart from the actual facts of the case, malaria would tend to produce those characteristics which have been mentioned above.

Of course malaria must be very prevalent to bring about any change in the character of a people. Now the extent of the infection is another distinguishing mark of malaria. Recent statistics show that some 40 per cent. of the population of Greece have the disease.

Immunity among adults may come after awhile, but, ere it be attained, the general health will be lowered. All children in some districts, many in others, pass through a childhood subject to a succession of weakening febrile attacks.

Four points must be fully discussed in the present inquiry:

(1) Did malaria exist in Greece?
(2) If so, to what extent was it prevalent?
(3) When was it introduced, or when did it become common?
(4) Is there any ancient evidence of its effect upon character?

All these aspects of the question are important. Nevertheless it must be noticed that the precise date of the introduction of malaria is by no means so vital a point as to determine the period when it became widely extended. It may have lurked in corners without doing much harm; but its prevalence would necessarily bring about a decline in vigour and a change of character.

Means of identifying malaria.

If care be taken, malaria is by no means a difficult disease to identify. A good test is periodicity. "Any febrile complaint with a definite tertian or quartan periodicity is certainly malarial. No other infection

exhibits this type of periodicity. You may be sure, then, that a patient complaining of fever recurring every forty-eight or seventy-two hours, whatever else he may have, certainly has malarial disease."[1] It does not, however, follow that a fever with a different periodicity is not malarial.[2] A patient may be infected with both the tertian and the quartan parasite, or there may be cases of "double infection," *i.e.* cases where the patient has been twice infected with the same kind of parasite, so as to bring about a new periodicity. For example, a quotidian fever may be the result of double tertian infection. It may, then, be safely concluded that a considerable number of quotidian fevers will be malarial. But in order to strengthen the case as much as possible no stress will be laid upon quotidians in the present inquiry.

Another excellent test is enlargement of the spleen. This is the test which was most used by Major Ross when he was investigating the prevalence of malaria in modern Greece. He calls it a fairly trustworthy one, provided that no other cause of splenomegaly be present.

[1] Sir Patrick Manson, *Lectures on Tropical Diseases*, pp. 153, 154.

[2] Sometimes the fever is not *intermittent* but *remittent*, *i.e.* it diminishes in intensity without temporarily ceasing altogether. The present discussion will be practically confined to the regularly intermittent types. The reason is because it is almost impossible to distinguish the irregular forms of malaria from typhoid.

Once more, however, in order not to over-estimate the evidence, it will be well to use splenic enlargement as a confirmatory test only.

Symptoms of a malarial attack.

The paroxysm is divided into three stages —the cold stage, the hot stage and the sweating stage.[1]

(1) The attack begins with a feeling of weariness, headache, nausea and vomiting. The patient begins to shiver, and there is a reduction of the skin temperature, combined frequently with internal fever. The pulse is quick, small and hard; urine is increased.

(2) The second stage is marked by the heat and redness of the skin. The pulse is full and bounding. Delirium is sometimes present. Intense thirst is suffered.

(3) The third stage is characterised by more or less sweating, followed by a cessation of fever or even by sleep.

The first or third stage, or both, may be mild. The most common variation is the hot stage alone.

The disease causes anaemia and splenomegaly as after-effects.

[1] This description is taken from Osler, *The Principles and Practice of Medicine*, pp. 16, 17.

It would not be surprising if the symptoms described by the ancient medical writers did not agree in all respects with those given above. Diseases have a way of changing more or less in degree, and even in type,[1] but it will be found that in this case the type has remained practically unchanged.

Greek terms for "fever."

Before going on to inquire into the prevalence of malaria in ancient Greece, it will be necessary to discuss the equivalents of the English word "fever."

The most common general term is πυρετός. Derived from πῦρ, fire, it is probably used in the sense of "heat" in *Iliad* XXII. 31 (of the dogstar):

φέρει πολλὸν πυρετὸν δειλοῖσι βροτοῖσιν.

The ancients seem to have taken the word to mean "heat," as is plain from the Latin poets Vergil, Lucan and Statius, who appear to have this line in mind when talking of the "burning dogstar." On the other hand a scholiast remarks that the word might mean "fever" as well as "heat."

It is a fact that the sense of "fever" does fit the passage. Summer and autumn are the seasons when fever was most prevalent

[1] *E.g.* influenza.

in Greece. It seems likely, however, to judge from the usage of later non-medical writers, that either *νόσος* or the plural would have been used if a disease had been meant. In any case, even if "fever" be the meaning here, it is not necessarily malaria. It might very well be typhoid. In the present inquiry that meaning will be assumed to be true which tells most against the writer's own theory.

After this solitary instance in Homer there is a large gap. Hesiod does not appear to use *πυρετός*, although he might well have been expected to do so. The present writer cannot find that the word occurs again before Aristophanes. Herodotus does not use it, nor does Thucydides. It is remarkable that when the latter, in his description of the plague, wishes to express "feverishness," he seems to avoid the word *πυρετός*, and uses instead *καῦμα* or *θέρμη*.[1] On the other hand, when Galen is describing the same plague and is roughly quoting the words of Thucydides, he employs *πυρετὸς* twice within a few lines.[2]

The places in Aristophanes, where *πυρετὸς*

[1] Thucyd. II. 49.

[2] *περὶ διαφορῶν πυρετῶν*, Kühn, VII. 290: *καθά φησιν ὁ Θουκυδίδης. ἀλλ' ἐν καλύβαις πνιγηραῖς ὥρᾳ θέρους διαιτωμένων ὁ φθόρος κατὰ τὸ σῶμα ἐγίνετο. τῷ δ' εἶναι τοὺς ἐν τῷ σώματι χυμοὺς ἐκ μοχθηρᾶς διαίτης ἐπιτηδείους εἰς σῆψιν ἀρχὴ τοῦ λοιμώδους γίνεται πυρετοῦ. τάχα δὲ καὶ κατὰ τὸ ξυνεχὲς ἐξ Αἰθιοπίας ἐρρύη τινα σηπεδονώδη μιάσματα τοῖς ἐπιτηδείως ἔχουσι σώματα βλαβῆναι πρὸς αὐτῶν, αἴτια πυρετοῦ γενησόμενα.*

seems to occur for the first time after Homer, are interesting. In the *Wasps* (date 422 B.C.) occurs the following passage:

φησίν τε μετ' αὐτοῦ
τοῖς ἠπιάλοις ἐπιχειρῆσαι πέρυσιν καὶ τοῖς πυρετοῖσιν,
οἱ τοὺς πατέρας τ' ἤγχον νύκτωρ καὶ τοὺς πάππους ἀπέπνιγον,
κατακλινόμενοί τ' ἐπὶ ταῖς κοίταις ἐπὶ τοῖσιν ἀπράγμοσιν ὑμῶν
ἀντωμοσίας καὶ προσκλήσεις καὶ μαρτυρίας συνεκόλλων.
1037-1041.

"And he says that he attacked last year the shivers and fevers which by night strangled your fathers and throttled your grandsires, etc."

A fuller explanation of these words will be given later. It is sufficient to notice here that from this time onwards πυρετὸς is a fairly common word, while the verb πυρέσσω (first, apparently, in Eurip. *Cycl.* 228 and Pherecrates in Athen. III. 75), "I have an attack of fever," also frequently occurs.

In all the Greek medical writings, which date from 400 B.C. onwards, πυρετοὶ are divided into two classes, (*a*) continuous (συνεχεῖς) and (*b*) intermittent (διαλείποντες). The second class is again subdivided according to periodicity, the simpler forms of which give (1) quotidians (ἀμφημερινοί), (2) tertians (τριταῖοι) and (3) quartans (τεταρταῖοι). The first mention of this division which is to be found in non-professional writings occurs in the *Timaeus*[1]

[1] Date uncertain; probably written between 380 and 360 B.C.

of Plato. This passage is to the effect that a body produces:

(1) continuous burnings (ξυνεχῆ καύματα[1]) and πυρετοί, when suffering from excess of fire (πῦρ);

(2) quotidian πυρετοί, when suffering from excess of air;

(3) tertian πυρετοί, when suffering from excess of water;

(4) quartan πυρετοί, when suffering from excess of earth.[2]

In the popular speech, then, there is a tendency to limit πυρετοὶ to definite fevers, namely, to those exhibiting a certain periodicity. It cannot be said that this tendency is present in the professional writers, though even there πυρετοὶ usually means intermittents.

A similar tendency is noticed in modern times. In districts where scarlatina is constantly prevalent, "He has the fever," will nearly always mean one thing. An ordinary person would not usually apply the expression to a typhoid patient. On the other hand, to a medical man both typhoid and scarlatina would be "fevers."

[1] The term καῦμα is used by Thucydides to signify feverishness. See above. πυρετοὶ seems to be added by Plato because of its connection with πῦρ.

[2] *Timaeus*, 86 A: τὸ μὲν οὖν ἐκ πυρὸς ὑπερβολῆς μάλιστα νοσῆσαν σῶμα ξυνεχῆ καύματα καὶ πυρετοὺς ἀπεργάζεται, τὸ δ' ἐξ ἀέρος ἀμφημερινούς, τριταίους δ' ὕδατος διὰ τὸ νωθέστερον ἀέρος καὶ πυρὸς αὐτὸ εἶναι· τὸ δὲ γῆς, τετάρτως ὂν νωθέστατον τούτων, ἐν τετραπλασίαις περιόδοις χρόνου καθαιρόμενον, τεταρταίους πυρετοὺς ποιῆσαν ἀπαλλάττεται μόγις.

MALARIA

The present discussion will be occupied with the intermittents, and in the next section their symptoms, as given by the ancient medical writers, will be fully described. In the meantime two other names must receive attention.

(1) *καῦσος*. This fever ("the burning disease") is very clearly described by Hippocrates.[1] The chief symptoms are bodily ache and lassitude, intense thirst, sleeplessness and (sometimes) delirium. The tongue is rough, dry and very black. There are gnawing pains about the bowels. The alvine discharges are watery and yellow. Major Ross says that this disease must be typhoid only, so that it will be neglected in the present inquiry.

(2) *ἠπίαλος*. This curious word first occurs in Theognis.[2] It is used twice by Aristophanes.[3] Galen gives a brief account of the disease. It was a protracted quotidian, and of

[1] *περὶ διαίτης ὀξέων*, Kühn, II. 65: *καῦσος δὲ γίνεται, ὁκόταν ἀναξηρανθέντα τὰ φλέβια ἐν θερινῇ ὥρῃ ἐπισπάσηται δριμέας καὶ χολώδεας ἰχῶρας ἐς ἐωυτά, καὶ πυρετὸς πολὺς ἴσχει, τό τε σῶμα ὡς ὑπὸ ὀστεοκόπου ἐχόμενον κοπιᾷ καὶ ἀλγέει. γίνεται δὲ ὡς ἐπιτοπουλὺ καὶ ἐκ πορείης μακρῆς καὶ δίψεος μακροῦ, ὁκόταν ἀναξηρανθέντα τὰ φλέβια δριμέα καὶ θερμὰ ῥεύματα ἐπισπάσηται. γίνεται δὲ ἡ γλῶσσα τρηχείη καὶ ξηρὴ καὶ μέλαινα κάρτα, καὶ τὰ περὶ τὴν νηδὺν δακνόμενος ἀλγέει, τά τε ὑποχωρήματα ἔξυγρα καὶ ὠχρὰ γίνεται, καὶ δίψαι σφοδραὶ ἔνεισι καὶ ἀγρυπνίη, ἐνίοτε δὲ καὶ παραλλάξιες φρενῶν.*

[2] Ll. 173, 174:

ἄνδρ' ἀγαθὸν πενίη πάντων δάμνησι μάλιστα
καὶ γήρως πολίου, Κύρνε, καὶ ἠπιάλου.

Approximate date of Theognis, 540 B.C. (at Megara).

[3] *Wasps*, 1038 (quoted above), and *Acharnians*, 1165: *ἠπιαλῶν γὰρ οἰκάδ' ἐξ ἱππασίας βαδίζων κ.τ.λ.*

such a kind that the patient felt fever and shivering at one and the same time and in every part of the body. He adds that some Attic writers use the word to denote the shivers which precede an attack of fever.[1] Major Ross, who has given his opinion after examining such evidence as the present writer could put before him, inclines to the belief that ἠπίαλος (the disease) was malaria or typhoid, though it might possibly be Malta fever. Of course, it is also possible that the disease was one which does not now exist.

Did malaria exist in Greece?

If tertian and quartan fevers existed among the Greeks, they certainly suffered from malaria. But it will be useful to apply the confirmatory test, splenomegaly, and to enter more fully into the symptoms and variations of the intermittent fevers which are described by the ancient medical writers.

[1] περὶ διαφορῶν πυρετῶν, Kühn, VII. 347 : τούτου τοῦ γένους (sc. χρόνιος, ἀμφημερινός) ἐστὶ καὶ ἠπίαλος πυρετὸς ἰδίως ὀνομαζόμενος, ὅταν ἅμα πυρέττουσί τε καὶ ῥιγοῦσι, καὶ ἀμφοτέρων αἰσθάνονται κατὰ τὸν αὐτὸν χρόνον, ἐν ἅπαντι μορίῳ τοῦ σώματος ... φαίνονται δὲ τῶν Ἀττικῶν ἀνδρῶν ἔνιοι καὶ τὸ πρὸ τοῦ πυρετοῦ ῥῖγος οὕτως ὀνομάζοντες. Other interesting passages bearing on the point are Hesychius, ῥῖγος πρὸ πυρετοῦ· ἐκαλοῦντο δὲ οὕτω καὶ οἱ ψυχροί. Aristophanes, fr. 315 Dindorf, ἅμα δ' ἠπίαλος πυρετοῦ πρόδρομος, which seems to settle the meaning in the *Acharnians* and the *Wasps*. Hippocrates, περὶ ἀέρων κ.τ.λ., Kühn, I. 527 : τοῖσι δὲ ἀνδράσι δυσεντερίας καὶ διαρροίας καὶ ἠπιάλους καὶ πυρετοὺς πολυχρονίους χειμερινούς. This last passage gives some colour to the view that ἠπίαλος (the disease) was typhoid. Aristotle, *Problemata*, XXVII. 2 : ὅμοιον δὲ ἔοικεν ὥσπερ τοῖς ἠπιαλοῦσιν, οἱ ἅμα τῷ ῥιγοῦν διψῶσιν. But see p. 37, note 1.

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The evidence that enlargement of the spleen was common is copious, but practically confined to professional works. This is only to be expected, especially as the Greeks had the excellent sense not to talk overmuch about their ailments. In a curious passage of the *Timaeus*[1] Plato describes the spleen as a receptacle for the purgations of the liver, and accounts in this way for splenic enlargement. When it is remembered that the Greeks held that tertians and quartans were caused by bile, the words of Plato at once become full of meaning. Hippocrates says that men who drink marsh water get enlarged spleens.[2] The phenomenon Hippocrates really observed was that dwellers by marshy places suffer from enlarged spleens. His interpretation of this phenomenon is incorrect. The enlargement was in all probability caused by malaria conveyed from one person to another by mosquitoes bred in the marshes.

Splenic enlargement is also caused by typhoid, and it may be remarked in passing that there is a tendency among modern

[1] 72 C: διὸ δὴ καὶ ὅταν τινὲς ἀκαθαρσίαι γίγνωνται διὰ νόσους σώματος περὶ τὸ ἧπαρ, πάντα ἡ σπληνὸς καθαίρουσα αὐτὰ δέχεται μανότης, ἅτε κοίλου καὶ ἀναίμου ὑφανθέντος· ὅθεν πληρούμενος τῶν ἀποκαθαιρομένων μέγας καὶ ὕπουλος αὐξάνεται, καὶ πάλιν, ὅταν καθαρθῇ τὸ σῶμα, ταπεινούμενος εἰς ταὐτὸν ξυνίζει. Compare with this Galen, περὶ χυμῶν, Kühn, XVI. 385, σπλῆνες μεγάλοι διὰ τὴν τοῦ μελαγχολικοῦ χυμοῦ περιουσίαν. The full import of the latter passage will be discussed later.

[2] περὶ ἀέρων κ.τ.λ., Kühn, I. 533: τοῖσι δὲ πίνουσι [sc. ὕδατα ἑλώδεα καὶ στάσιμα καὶ λιμναῖα] σπλῆνας μὲν αἰεὶ μεγάλους εἶναι.

physicians to diagnose most of the fever cases described in the Hippocratic writings as some form of this disease. This may be correct. Malaria and typhoid are sometimes extremely difficult to distinguish in ancient writings, especially when the former is of a complicated type.[1] But typhoid will not account for the many other fevers, mentioned in the same writings, which have a definite tertian or quartan periodicity. These must be malarial; and no one who reads the few passages about them which occur in the non-professional writings, or the accurate descriptions given by Hippocrates and Galen, will fail to come to the conclusion that they were among the commonest of the diseases with which the Greeks were afflicted. But the risk of confusing malaria and typhoid must make the historian cautious. Many fevers are described in the ancient writers which are, in all probability, though not certainly, some form of malaria. In the present inquiry no stress will be laid upon these, in order that there may be a firm foundation of fact upon which to build.

For these reasons it seems desirable not to

[1] The difficulty may be best understood by considering a particular case. Suppose that outbreaks of malaria and typhoid occurred together, as they are wont to do in autumn. A Greek physician would almost certainly not distinguish between them, and his description of the epidemic would be a combination of the symptoms of both diseases. A modern physician, who usually has a predisposition to think typhoid the more probable disease, naturally hesitates to give a definite opinion.

discuss at length the vast number of cases in which splenomegaly is mentioned in the old medical writers. It will be sufficient to state that in a great number of instances it is allied with other symptoms which evidently show that it was not caused by any disease so serious as typhoid. Pyaemic fevers other than malaria may, of course, be meant, but the probability is that the latter disease is the one described. One or two examples must suffice. Hippocrates states that in autumn quartan fevers and splenic diseases are very common.[1] The same writer says that bilious persons who have enlargement of the spleen are evil-complexioned, ulcerous and emaciated, and suffer from foul breath and constipation.[2] These are most certainly the symptoms of malarial cachexia.

Malarial fevers in ancient medical writers.

Major Ross has kindly forwarded the following particulars about malaria.

There are four kinds of malaria *parasites*, quartan, mild tertian, malignant tertian, and quotidian.

[1] *ἀφορισμοί*, Kühn, III. 724: *τοῦ δὲ φθινοπώρου καὶ τῶν θερινῶν τὰ πολλὰ καὶ πυρετοὶ τεταρταῖοι ... καὶ σπλῆνες.* Another most interesting passage is Hipp. *προρρητ.*, Kühn, I. 227.

[2] Hippocrates, *περὶ παθῶν*, Kühn, II. 396: *ὁκόσοι δὲ σπλῆνα ἔχουσι μέγαν, ὅσοι μέν εἰσι χολώδεες, κακόχροοί τε γίνονται καὶ κακοελκέες καὶ δυσώδεες ἐκ τοῦ στόματος καὶ λεπτοί ... καὶ τὰ σιτία οὐ διαχωρέει.*

Quartan. Fever lasts on the average 9 hours and recurs every third day.

Mild tertian. Fever lasts 11 hours and recurs every other day.

Malignant tertian. Fever lasts up to 40 hours—rises slowly, halts for hours, declines a little and then rises again to a greater height; and lastly falls. Recurs every other day.

Quotidian. Fever lasts 6 to 12 hours and comes on every day.

But a quotidian *fever* may be produced by (1) three parallel generations of quartan parasites; or (2) two generations of tertians; or (3) one generation of quotidian parasites.

There are also mixed infections, due to different parasites together, and double quartans.

To discuss fully all the different accounts of quartans, tertians and quotidians, as described in the Greek writers, would occupy a large treatise. It is certain, therefore, that they were constantly prevalent, and that they were more common diseases than other kinds of fevers. But it is not the object of the present inquiry to enter into details. The main point is to identify these fevers with malaria. The best description is to be found in Galen, who seems to have made a special study of periodicity. Although Galen is a late writer, who lived in Rome in the middle of the second

century A.D., there is no risk in accepting his evidence. His account agrees in all essentials with the testimony of older writers, and there is no evidence that Galen describes diseases unfamiliar to his predecessors.

In the treatise *περὶ τύπων* Galen divides intermittents into (1) quotidians, with a daily access; (2) tertians, with an access every other day; (3) quartans, with an access every third day.

Quintans, and even less frequently recurring fevers, are also mentioned. There is also distinct recognition, both in this treatise and in others, of "mixed" and "double" infections. One instance only shall be quoted here. In the book *περὶ περιόδων* he remarks that a fever with attacks recurring every day is liable to be diagnosed by the uninitiated as a quotidian. But if a man take pains and have a genuine interest in medicine, he will not forget that the same effect can be produced by two tertians or three quartans.[1]

There was also a fever which he calls "semi-tertian." It is regarded as a mixture of the tertian and a *continuous* quotidian.[2] It was a dangerous disease,[3] attacked usually men

[1] Kühn, VII. 476, 477: *ἰδιώτης μὲν γὰρ νοῦν ἔχων, ἐπειδὰν θεάσηταί τινα καθ' ἑκάστην ἡμέραν παροξυνόμενον, ἐάν θ' ὑστερῇ σμικρὸν ὁ παροξυσμὸς ἐάν τε προλαμβάνῃ, φαντασίαν τινα ἔχει περιόδου τῆς καλουμένης ἀμφημερινῆς· εἰ δέ τις καὶ φιλόπονος εἴη καὶ φιλίατρος, ἔννοιά τις αὐτὸν εἰσέρχεται δυοῖν τριταίων ἢ τριῶν τεταρταίων.*

[2] *περὶ διαφ. πυρετῶν*, Kühn, VII. 369.

[3] *περὶ τύπων*, Kühn, VII. 467. Hippocrates notices this, Kühn, III. 408.

in the prime of life, and especially in the autumn, and was marked by the length of the attack.[1] There seems to have been much irregularity in the length and severity of the paroxysms.[2] This fever was probably some variety of the tertian type, whether mild or malignant, produced by mixed or double infection.[3]

As an example of intermittent fevers, Galen gives a full account of the tertian.[4] It begins with rigor and finishes with sweat and vomiting of bile. In some cases the intermission is short. Such fevers he calls "protracted" tertians (*παρεκτείνοντες*). Occasionally the fever lasts for 40 hours, or even longer.

To descend to details, tertian fevers begin with shivering, and chill in the extremities. The pulse is hard and contracted. Gradually the chill is superseded by fever, and the pulse becomes quicker and larger. The patient often feels internal fever while the limbs are still chilled. The fever gradually increases until it has spread over the whole body. Then it subsides little by little, the decrease being usually (*τοῖς πλείστοις*) accompanied by sweating.

[1] *Ibid.* 467, 468.

[2] *περὶ τῶν ἐν ταῖς νόσοις καιρῶν*, Kühn, VII. 435. Galen says here that this disease was very common in Rome.

[3] Probably malignant tertian, which, when double, produces continuous fever with a tertian exacerbation (Note by Major Ross).

[4] *περὶ διαφ. πυρετῶν*, Kühn, VII. 371 foll. and *περὶ τῶν ἐν ταῖς νόσοις καιρῶν*, Kühn, VII. 413 foll.

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The references in the Hippocratic writings to tertians are very numerous, and nothing would be gained by quoting them in full. The same applies to quartans. Special mention, however, may be made of a passage in the first book of the *Epidemics*, where, among other interesting remarks, it is stated that the quartan is the longest but least severe type of intermittents, while the semi-tertian is the most deadly.[1] From other medical writers are quoted below two passages of Oribasius, dealing with tertians and quartans respectively.[2] For

[1] Kühn, III. 408, 409.

[2] Oribasius, VI. 9 (*ed.* Bussemaker and Daremberg, V. 281): *ὁ μὲν τριταῖος πυρετὸς ἔκγονος ὑπάρχων τῆς ξανθῆς χολῆς κινουμένης εὐθὺς κατὰ ἀρχὰς ῥῖγος οὐκ ἀγεννὲς ἐπιφέρει διαφέρον τοῦ τεταρταϊκοῦ ῥίγους τῷ κεντεῖσθαι δοκεῖν καὶ τιτρώσκεσθαι τὸν χρῶτα· ἐν δὲ τοῖς τεταρταίοις ἡ εἰσβολὴ κατάψυξιν ἔχει σφοδράν· τῶν δὲ ἀμφημερινῶν οὐδὲ προηγεῖται ῥῖγος, ἀλλὰ περιψύχονται μόνον. ἔστι δὲ ἐν τοῖς τριταίοις καὶ τάξις ἀκριβὴς τῶν σφυγμῶν. ἐπιφέρει δὲ καὶ δίψος κατὰ τὰς ἀκμὰς σφοδρὸν ὁ τριταῖος καὶ διακαίει τὸν ἄνθρωπον, καὶ μικρὸν ὕστερον παρακμάζει καὶ τὸ θερμὸν ὁμαλῶς ἐκτέταται παντῇ· εἰ δὲ ἐπιβάλλοις τὴν χεῖρα, κατὰ μὲν τὴν πρώτην ἐπιβολὴν ἀπαντᾷ θερμασία πολλὴ καὶ δριμεῖα, καὶ οἷον μετὰ ἀτμοῦ τινος ἀναφερομένη, νικᾶται δὲ ὀλίγον ὕστερον ὑπὸ τῆς χειρὸς ἐπιμενούσης. πιόντος δὲ τοῦ κάμνοντος αὐτίκα δὴ μάλα πλῆθος ἄνεισιν ἀτμοῦ θερμοῦ διὰ τοῦ δέρματος ἀγγέλλον ἱδρῶτας· ἔμετος δὲ ἐπιφαίνεται χολῆς, ἢ γαστήρ που κατέρρηξε, καὶ οὐροῦσι χολώδη. ἐπὶ τούτοις εἰς ἀπυρεξίαν παύεται τὸν σύμπαντα χρόνον τοῦ παροξυσμοῦ ὡρῶν οὐ πλειόνων δυοκαίδεκα ποιησάμενος. τὸν μὲν οὖν ἔντος τῶν δεκαδύο ὡρῶν παυόμενον ἀκριβῆ τριταῖον ὠνομάσαμεν· ὅς τις δὲ ἂν ἔχῃ πολυχρονιώτερον τούτου τὸν παροξυσμόν, ἐκεῖνον ἁπλῶς τριταῖον ὀνομάσομεν· ὅστις δὲ ἂν ἐπὶ πλεῖστον μὲν ἐκτεταμένον τὸν παροξυσμόν, ὀλίγον δὲ τὸ διάλειμμα, τοῦτον αὖ πάλιν ὀνομάσομεν ἐκτεταμένον τριταῖον.*

Ibid. VI. 12 (B. and D. V. 285): *ὁ τεταρταῖος τὴν εἰσβολὴν ποιεῖται μετὰ πολλῆς καταψύξεως, ἅτε ἐκ ψυχροῦ χυμοῦ, τῆς μελαίνης χολῆς, τὴν γένεσιν ἔχων, ἀλλὰ καὶ τὸ θερμὸν καὶ διακαὲς οὐκ ἔχει τοῦ πυρετοῦ καθάπερ ὁ τριταῖος. ἀλλὰ οὐδὲ χολῆς ἔμετος παρακολουθεῖ. ἐπὶ τούτοις εἰ λευκὰ καὶ λεπτὰ καὶ ὑδατώδη τὰ οὖρα τυγχάνοι, τεταρταῖος ἂν εἴη ὁ πυρετός. ἐξαίρετον δὲ ἂν εἴη τεταρταίου γνώρισμα μέγας καὶ ἀραιὸς σφυγμός.*

reasons given above, no further stress is laid upon quotidians.

Extent of the prevalence of malaria.

The preceding section has not only shown that malaria existed in ancient Greece; it has also proved it to be widely prevalent. Even if all fevers except tertians and quartans be disregarded, these are mentioned so frequently, and by such a diversity of writers, as to leave no doubt whatsoever. From the year 400 B.C. onwards there is a vast quantity of evidence which points to the unmistakable conclusion that Greece was constantly in the clutches of an insidious and demoralising foe. Plato, Aristotle,[1] the Hippocratic writings, the long line of evidence represented by the works of Galen and Oribasius, all tell the same story. There is even a reference in an inscription.[2] That references to tertians and quartans do not occur more frequently in non-professional literature is not surprising. The Greeks were not in the habit of talking about their ailments. At any rate, when occasion arose to mention a fever, it would rarely be necessary to distinguish one kind from another, τριταῖος from ἀμφημερινός, and so forth. Especially would this be the case if the various forms of

[1] See *e.g. Problemata*, I. 57.

[2] Dittenberger, *Sylloge*, 890. The inscription is Athenian, but late.

malaria were so common as to be designated in the popular speech by πυρετοὶ without further qualification. Though medical writers do not observe such a limitation, there is some evidence that the people did, as a general rule, limit πυρετοὶ to malaria. Thucydides seems particularly careful to avoid the word πυρετὸς in describing the feverish symptoms of the plague. The words he uses are καῦμα and θέρμη. Plato, also, speaks of ξυνεχῆ καύματα, and probably applies the term πυρετοὶ to continuous fevers because he conceived them to be due to excess of πῦρ. The use of καῦμα by Plato and Thucydides is a remarkable coincidence. Unfortunately there is not sufficient evidence to warrant a positive conclusion. But nevertheless, the frequent mention of malaria in the medical writers, combined with the remarkable passage from the *Timaeus*, makes it extremely likely that malaria was often called in the popular speech by the simple name of "fever." If this be so, whenever the words πυρετός, πυρέσσω, occur in non-medical writers, there is a strong presumption that malaria is meant. In any case, no doubt whatever can be entertained of its wide extension.

Owing to the incompleteness of the evidence, due entirely to the fact that few Greek states have left us any literature, it is impossible to say for certain how far malaria spread.

Attica was certainly attacked, as it is attacked now, and of course it was prevalent in the districts which came under the observation of the medical writers. It is clear, from the Hippocratic treatise on *Airs, Waters and Places*, that:

(1) the writer had been able to collect evidence about malaria from many districts;

(2) the most he could say was that certain districts were less liable to malaria than others. Without going to the extreme of saying that no district was immune, there is every reason for supposing that malaria was widely spread.

When was malaria introduced?

Up to the present the inquiry has had a firm foundation of indisputable facts. It is easy to prove that malaria was present in Greece; it is difficult to find out when it first made its appearance, or when it became endemic. It is proverbially hard to prove a negative statement, and the present writer readily admits that it is impossible to show that there was no malaria in Greece before a fixed date. This does not mean that there is no evidence. On the contrary, the evidence, with respect to Attica at least, is very strong. But it is cumulative, and depends for its full force upon a due consideration of many lines of indirect testimony.

In the first place, there is no reference to any disease which can be malaria, with two exceptions, before the middle of the fifth century. The first exception is πυρετὸς in *Iliad* XXII. 31. Now it has been pointed out that here the word may mean "heat" merely. In any case it is not necessarily malaria. But let it be taken for granted that the word does refer to malaria, it only shows that the disease was common in Homeric times at the place where the poet lived. This was probably Asia Minor. On the other hand, Hesiod, a poet of Boeotia, which is a land especially suited for the growth of the malarial mosquito, never uses the word πυρετός, even though he might well have been expected to do so. The whole question is uncertain, but whichever interpretation of πυρετὸς in Homer be accepted, nothing whatever can be proved as to the existence (or rather the prevalence) of malaria in those parts of the Greek world with which we are chiefly concerned.

The other reference to a disease which may be malaria is the word ἠπίαλος in Theognis (l. 174). Here again no conclusive result can be reached. The disease which went by this name is so vaguely described by later writers that modern experts cannot diagnose it with any certainty. Major Ross suggests typhoid, or malaria, or Malta fever.

Surely very little can be made out of this single passage, even though malaria be the disease intended; for at most it does not prove that the disease was common, and it does not show in the least that it was prevalent, or even that it existed, in Attica. And it is with Attica that the present inquiry is most concerned.[1]

It is possible that malaria did exist in parts of Greece, both Greece proper and Greater Greece, from fairly early times.[2] The fact that so large a portion of Greece never reached eminence may be due to the presence of a scourge which seems to blight the energies of its victims. But Attica, with its dry climate, would be late in becoming badly infected.

[1] I let this paragraph stand, although since writing I have seen a letter from Professor Nieuwenhuis, of Leyden, which convinces me that ἠπίαλος was malaria. "The quotation," he says, "from Aristophanes' *Acharnians* gives an instance of the fact that an attack of fever may originate in any strong bodily exertion, such as riding (ἐξ ἱππασίας), for instance, in a malarious country. Probably the many forms of malaria, which differ so widely from one another, were not all attributed to the same cause in those times, as we do at present." But although it thus becomes practically certain that malaria existed in some parts of Greece before the time of Aristophanes, it must be remembered that the vital question, the date when malaria became endemic in Attica, remains unaffected. The endemic ague of the Cambridge and Essex fens never spread over the whole of England (Creighton, *History of Epidemics in Britain*, vol. ii., p. 303), because conditions were not favourable for the growth of the mosquito. Similarly, suitable conditions were necessary before malaria could spread over Attica.

[2] Dr. E. T. Withington calls my attention to the story that Empedocles freed Selinus from a deadly disease by draining its marshes—or turning two rivers into them. This indicates the possibility of malarial centres in Sicily which would form other important sources for the invasion of Greece proper at the end of the fifth century.

If this be so, and it must be remembered that it is surmise only, a few words may be said about the possible fountain-head of the disease. Malaria is an African disorder, and the intercourse of merchants may have carried it from Egypt to Greece, either directly or by way of Asia. A curious side-light is thrown upon the question by a passage in which Herodotus describes the marsh-dwellers of Egypt.[1] They are, he says, much troubled by gnats (*κώνωπες*). To afford protection from the bite of these insects every man (*πᾶς ἀνήρ*) wraps himself up at night in the net (*ἀμφίβληστρον*) with which he has fished during the day. It is very likely that this region was the plague-spot from which malaria spread to Greece and elsewhere. The Athenians who took part in the disastrous expedition to Egypt[2] (456 B.C.) may have become infected and brought back the disease to Attica. It would not necessarily spread with any great rapidity until conditions were favourable. As will be seen later, the most favourable conditions occurred during the last twenty years of the fifth century.

The last few paragraphs have necessarily been little better than guesswork, and it is time to turn to the facts. It is in the *Wasps*

[1] Herodotus, II. 95. These marsh-dwellers were brave soldiers (Thucydides, I. 110). They may have become immune.

[2] Thucydides, I. 109, 110.

of Aristophanes (422 B.C.) that the word πυρετὸς first occurs in Greek literature, with the single exception of *Iliad* XXII. 31. The passage is a striking one. Last year, says the poet, I attacked the ἠπίαλοι and the fevers which were throttling your fathers by night and strangling your grandsires. The language is, of course, figurative, and refers to the attacks of Aristophanes upon συκοφάνται. But obviously the passage gains in point if Athens had recently been visited by an outbreak of fevers which were preceded by shivering. Now, in the year 425[1] the Athenians had been busily engaged on the island of Sphacteria. It is at least a remarkable coincidence that at the present day Sphacteria is one of the worst malaria centres in the Mediterranean. If it be true that malaria visited Attica about this time in the form of an epidemic there is every reason for supposing that it would stay, and, in course of time, become endemic. For the land offered favourable conditions.

Disease is an invariable accompaniment of war, and the Peloponnesian War was no exception to the general rule. But with regard to Attica during this war, there were certain circumstances which are rather peculiar, while they have a direct bearing upon the present question. The small farmers of Attica were

[1] 425 is the date of the *Acharnians*, in which ἠπίαλος is referred to for the first (or second) time in Attic literature.

compelled to leave their farms and live in Athens, the Piraeus, or even between the long walls which connected the port with the upper city. The land was no longer cultivated to any extent, because the yearly incursions of the Peloponnesians prevented the in-gathering of the crops. The necessary supplies of food were imported from abroad, the powerful Athenian navy making it possible to feed the people in this manner. In course of time cultivation of the soil must have come to a complete standstill, for in the year 413 Decelea was permanently garrisoned by the Lacedaemonians, and Attica became practically a waste. But to allow land which has been under cultivation to lie untilled and undrained is to offer the most favourable conditions to malaria.[1] A few infected persons are enough to set the parasites breeding in the mosquitoes which hatch out from stagnant pools of the waste land, and then these insects begin to do their deadly work. It is certain that had there been infected persons in Attica during the Decelean War, malaria would have become endemic. It may be noticed in passing that a precisely

[1] Hirsch, *Handbook of Geographical and Historical Pathology*, pp. 273, 274. Major Ross disagrees with this. See Chapter I. (end). I would urge, however, that there is much historical evidence for the sudden increase of malaria after land has been allowed to go out of cultivation, and therefore to become, under certain conditions, marshy. See Hirsch, *loc. cit.* The evidence is especially strong in the case of ancient Italy, as will be seen later. The disappearance of malaria from the English fens presents a kind of converse.

similar condition of affairs obtained in Italy during the Hannibalic War (218-204 B.C.). Vast tracts of land must have been neglected, and, apparently, left untilled for many years; for in the next century pasture land has largely superseded ploughed land. It is, to say the least, likely that the malaria parasites, introduced from infected quarters of Italy, by Greek slaves perhaps, or even by the Carthaginians themselves, spread gradually over the country, and helped to produce that decline which historians have traced during the second century B.C.

There is other evidence that malaria was, during the fourth century B.C., a disease but recently endemic in Attica. It seems to have attacked chiefly adults, for Galen, in the eighth book of his treatise on Hippocrates and Plato, blames the philosopher because he does not classify diseases according to the ages which are most subject to them. In the passage from Hippocrates, quoted by Galen, πυρετοὶ are included among the diseases to which childhood is especially liable. This may mean that Hippocrates was acquainted with regions in which children were attacked by malaria, but older people were partially immune; while Attica, in which Plato lived, was recently infected. It is extremely difficult, except in marked cases, for any one but a modern specialist to diagnose malaria in young people, so that it is quite natural that Hippocrates

speaks of πυρετοὶ without further qualification. Major Ross informs the present writer that in modern Greece young children are subject to a series of attacks up to the fifteenth year, and that then they become partially immune. He is inclined to think that if the disease occurred very commonly among older people, it probably had been recently introduced. On the other hand, malaria is not nearly so marked in children as in adults. The important point to notice is that it would have been difficult for Hippocrates to diagnose malaria in children, although he could have told they were suffering from fever.

How malaria spreads.

As is well known, the malaria parasites infect a certain genus (*Anopheles*) of mosquitoes, which in turn infect man. Thus malaria cannot enter a country unless both factors be present, even though conditions be favourable. A striking instance of this fact is afforded by the island of Mauritius, which, up to the early sixties, was a health resort for Anglo-Indians, although malaria parasites must have been constantly brought in by malaria patients. But in an unlucky hour the *Anopheles* mosquito crept in, an epidemic followed, and now malaria is endemic in the island.[1]

[1] Taken from Sir P. Manson, *op. cit.* 103, 104.

Sir P. Manson[1] gives a vivid account of the way in which malaria may attack a village community. Imagine, he says, some district in which *Anopheles* mosquitoes abound, but which is luckily free from malaria. A stranger with parasites in his blood comes to the village and is bitten by the local mosquitoes, which thus become both infected and infective. The disease spreads rapidly, and is at first severe. After some years the survivors become immune, or partially so. But the children become infected soon after birth, and continue to be diseased for some years, gradually becoming immune. "This is the condition of every village in every highly malarious district; the adults are immune, the children are nearly all of them full of malaria parasites." In a less highly malarious district the adults are not always immune.

In ancient Greece malaria certainly attacked adults. Greece was not, then, a "highly malarious district." The prevalence of the disease among older persons may be a sign that the infection of the country is recent, and this explanation, which is certainly a possible one, must not be overlooked. There is a most important passage in the Hippocratic treatise *On the Nature of Man*[2] which bears very closely upon this point. The author is discussing at some length πυρετὸς ξύνοχος, ἀμφημερινός, τριταῖος

[1] *Op. cit.* 102. [2] περὶ φύσιος ἀνθρώπου, Kühn, I. 369, 370.

and τεταρταῖος. He seeks for the origin of the quartan in black bile, remarks that it is much longer than the tertian, and that the age most subject to it is from the twenty-fifth to the forty-fifth year.[1] He does not say anything about the ages subject to quotidians and tertians, and he does not say that young people were not attacked by quartans. On the other hand, Hippocrates does say that children were attacked by πυρετοί, and many of these, at least, must have been malaria. The inferences which it seems fair to draw are as follows:

(1) The districts which fell under the observation of the Hippocratic school were infected with malaria. Either they were not subject to it so as to be, in the words of Sir Patrick Manson, "highly infected," or, more probably, they had but recently been overrun by the disease.

(2) If this be so, Galen's criticism of Plato referred to in the last section may mean that Attica had become infected even more recently.

(3) Immunity, and comparative immunity,

[1] *Loc. cit.* γνώσῃ δὲ ἐν τῷδε ὅτι οἱ τεταρταῖοι πυρετοὶ μετέχουσι τοῦ μελαγχολικοῦ. φθινοπώρῳ γὰρ μάλιστα οἱ ἄνθρωποι ἁλίσκονται ὑπὸ τῶν τεταρταίων καὶ ἐν τῇ ἡλικίῃ ἀπὸ πέντε καὶ εἴκοσιν ἐτέων ἕως τῶν πέντε καὶ τεσσαράκοντα, ὅτι καὶ ἡ ἡλικίη αὕτη ὑπὸ μελαίνης χολῆς κατέχεται μάλιστα πασέων τῶν ἡλικιῶν, ἥ τε φθινοπωρινὴ ὥρη μάλιστα πασέων τῶν ὡρέων ἐπιτηδειοτάτη. ὁκόσοι δ' ἂν ἁλῶσιν ἔξω τῆς ὥρης ταύτης καὶ τῆς ἡλικίης ὑπὸ τοῦ τεταρταίου, εὖ χρὴ εἰδέναι μὴ χρόνιον ἐσόμενον τὸν πυρετὸν ἢν μὴ ἄλλο τι κακουργῆται ὁ ἄνθρωπος.

did not escape the notice of the ancient doctors. The Hippocratic author states plainly that if quartans occurred outside the given period 25-45 the attack was slight; in modern medical language, after 45 a man became partially immune, before 25 the disease did not assume a marked form.

(4) The silence of the Hippocratic author about tertians and quotidians suggests that in young persons malaria was usually tertian or quotidian, or at least that it appeared to be of these types. See Galen, quoted on p. 60.

Effect of malaria upon the Greek character.

Before any attempt is made to treat this question from the modern scientific standpoint, it will be interesting to inquire whether the Greeks themselves ever traced psychological states to the influence of malaria.

The word μελαγχολία with its cognates μελαγχολικὸς and μελαγχολῶ occur for the first time in Greek literature very soon after the word πυρετὸς becomes common (p. 22). μελαγχολῶ is used by Aristophanes in the *Birds*[1] (415 B.C.), and in the *Plutus*.[2] Plato uses the word μελαγχολικός, in conjunction with μεθυστικὸς and ἐρωτικός, to characterise the tyrant.[3] The last reference shows that the meaning of the words has

[1] Line 14. μελάγχολος occurs in Soph. *Tr.* 573.
[2] Ll. 12, 366, and 903. [3] *Republic*, 573 C.

little to do with what we call "melancholy." Burnet, in his note on Aristotle's *Ethics*, 1150 b, translates μελαγχολικὸς "excitable," "hot-headed." He goes on to say that in Aristophanes μελαγχολᾶν means "to be crazy," and that the modern word which approaches nearest to the meaning of μελαγχολικὸς in Aristotle is "nervous." Now the derivation of these words is obvious. The μελαγχολικὸς is the man who is afflicted with ἡ μέλαινα χολή. Furthermore, in the medical writers, tertian fevers are said to be caused by yellow bile, and quartan fevers by black bile. Of the many references which could be given, Oribasius, VI. 12,[1] may be taken as typical. Quartan fever, says the passage, has its γένεσις in μέλαινα χολή. In other words the Greeks, with their usual acuteness, noticed that malaria made a patient neurotic, and when they said that a man was μελαγχολικός, they meant, when the word was first employed, that he was like one who had had malaria. If this association be kept in mind, many passages, especially in the medical writers, become full of new meaning. Large spleens are caused by excess of the "melancholy" humour, says Galen.[2] Even more striking is the aphorism of Hippocrates, that long-continued fear and depression are a

[1] Quoted above. See especially p. 44, note.

[2] περὶ χυμῶν, Kühn, XVI. 385: σπλῆνες μεγάλοι διὰ τὴν τοῦ μελαγχολικοῦ χυμοῦ περιουσίαν.

sign of "melancholy,"[1] *i.e.* of malarial cachexia. In another place the same writer says that in autumn (the malarial season) occur cases of "melancholy."[2] And so one of the most striking symptoms of malaria, and of the anaemia which follows it, is said by modern observers to be nervousness, resulting in crossness of temper and mental depression. In short, the three cognates *μελαγχολία*, *μελαγχολικὸς* and *μελαγχολῶ* show that malaria was common, that it was supposed to influence the character, and, incidentally, that it probably became endemic during the last quarter of the fifth century. And it must be carefully remembered that the main point to prove is, not when malaria was first introduced, but when it first took a firm hold of the inhabitants.

Since the bilious complexion which suggested the term *μελαγχολία* is a more obvious symptom than splenic enlargement, it is not unnatural that the former, rather than the latter, gave a new word to the Greek language. Nevertheless, the works of the medical writers do suggest that *σπλὴν* and its derivatives hovered on the verge of becoming part and parcel of the popular speech. It is interesting to note that we still call a hot-tempered person "splenetic," although the derivation is seldom present to the consciousness. In any case the

[1] *ἀφορισμοί*, Kühn, III. 752: *ἢν φόβος καὶ δυσθυμίη πουλὺν χρόνον διατελέῃ, μελαγχολικὸν τὸ τοιοῦτον.*

[2] *Ibid.* 724, *τοῦ δὲ φθινοπώρου ... τὰ μελαγχολικά.*

way in which σπλῆνες, σπληνιῶ and the like are employed, suggests that enlargement of the spleen was a very common ailment.

The utmost caution is necessary in connecting the change in the Greek character with the increase of malaria. In the first place, a royal battle has been waged over the question whether the Greeks did decline in morality during the fourth century. The fact that such a heated discussion has taken place is sure proof that the problem is intricate; it is equally sure proof that some change at least was in progress. But it must be remembered that even if decline is not very obvious by the year 300, it is so a few years later, and there is no reason for supposing that a treacherous disease like malaria, which, moreover, shows itself in a series of slight attacks, would produce striking results all at once. Its effect is rather a gradual but sure weakening of a people's powers. However, the present writer is convinced that the effects of malaria are quite discernible even before the year 300. The change during the fourth century is just that which malaria would produce. When making a special study of Greek morality some years ago, the present writer could not find that immorality grew during the century under discussion.[1] On the contrary, the moral sense

[1] See Jones, *Greek Morality in Relation to Institutions*, pp. 59 and 152.

seems to have developed and become more sensitive. The terms "conscience" and "duty" received a fuller and deeper meaning. The people certainly became more humane. On the other hand, they lost much of their brilliancy. Patriotism was still an honoured virtue at Athens, but her citizens no longer showed the initiative, spirit and determination without which patriotism is but a hollow name. Pessimism in philosophy, sentimentalism in literature, morbid brooding over death—an inevitable contingency which in the great age was accepted with a noble resignation—complete the picture of the change. The above conclusions were reached by one who had not yet entertained the idea that malaria existed in ancient Greece, and so attributed the phenomena to psychological causes.

Of course it is not pretended that malaria was the only factor in the change. The Greek outgrew his small city-state, and became discontented with his institutions. He lost, not indeed his religion, but his living religious faith. History shows conclusively that without such faith no nation can survive for long. The means of gratifying luxurious tastes were afforded by a highly developed mercantile system. It may be that the unnatural vice in which the Greeks habitually indulged, to an extent which seems almost incredible, sapped their powers and energies. And

finally, the suicidal Peloponnesian War, with the deadly plague which smote Athens, must have produced weakness and hastened decay. But the effect of all these forces would be increased if there were present a more insidious enemy, weakening the nerves and rendering its victims more likely to succumb to the disintegrating influences of their environment.

Let due weight be given to the usually accepted causes of the decline of the Greeks. But two facts must never be forgotten:

(1) Malaria was prevalent, apparently increasingly prevalent, during the fourth century.

(2) The effect of malaria is always disastrous. As one reads the terrible accounts given by those who have made a special study of the disease, the conclusion is forced upon the mind that no nation deeply infected with malaria could have achieved the triumphs of the fifth century; and that its certain prevalence in the fourth century must have caused a decline. Major Ross writes to say that "the disease affects all young children, and remains in them until about the age of fifteen, when they become partially immunised. It causes intermittent and remittent fever, with enlargement of spleen and anaemia, which makes the patient thoroughly ill, with the accompanying loss of temper and perhaps of character." He adds that in adults the effects are more marked still, and that when children are affected they either

die, or, on recovery, show few symptoms which can be recognised by the ignorant populace. Incidentally, this latter remark shows how malaria may have been far more prevalent in ancient Greece than the extant evidence can possibly prove.

At the present day there are nearly 1,000,000 people in Greece, out of a population of some 2,500,000, who are infected with malaria. All these have been weakened, physically and intellectually, by attacks which usually recur again and again. Statistics are available only because modern science has such perfect means of diagnosis; in ancient times the majority of cases would have passed unnoticed. Who can say that ancient Greece was not equally plague-stricken? Be it noticed that owing to the imperfect state of the science of medicine it was impossible that testimony should be transmitted to us; so surely it is a just inference that Greece must have been infected far more than can be proved.

In the present inquiry stress has been laid only upon those diseases which were undoubtedly malaria. There is, however, a vast amount of evidence which has been purposely suppressed. Page after page of the medical writers is devoted to diseases which may have been—nay, almost certainly were—malarial. The probability that symptoms of malaria are combined with those of typhoid

makes all such evidence treacherous. It seemed better to disregard it altogether, so as not to introduce into the inquiry more doubt than is absolutely necessary.

Many attacks of malaria are mild in character. The Greeks themselves observed that quartans were generally not severe. This fact explains why we have no definite mention in ancient writers of a time when it first came, or when it first assumed endemic form. Many a Greek must have been smitten with malaria without feeling any symptoms other than those he could express by the term πυρέσσω. But the permanent influence of malaria is not to be estimated by its mildness. A severe epidemic, such as one of small-pox, creates much stir at the time and causes many deaths. But it does not last long, and its victims are comparatively few. In all probability such epidemics do not lower the physical efficiency of a people. Even endemic diseases like measles, which cause such trouble to modern children, are transient, and in the great majority of cases do not permanently injure the health. But with malaria the case is different. Often not at all severe, it recurs again and again. Childhood may be one long sickness, the effects of which the adult carries to his grave. His faculties are dulled and he is less efficient generally. Experience proves that if malaria be endemic

among a people, there must be a decline, physical, intellectual and moral.

Conclusion.

Malaria was certainly prevalent in many parts of Greece, including Attica, during the fourth century B.C., though Greece was not "highly infected" in the technical sense of the words as used by Sir Patrick Manson. The evidence of language, and the fact that older people were frequently attacked, suggest that the disease had been but recently introduced. The use of the word μελαγχολία and its cognates shows that the Greeks themselves noticed the effect of malaria upon character. The change which gradually came over the Greek character from 400 B.C. onwards, was one which would certainly have been aided, and was in all probability at least partially caused, by the same disease.

The evidence given in the preceding pages is, from the nature of the case, chiefly cumulative. Many, but certainly not all, of the arguments brought forward might be attacked by a clever opponent. But taken together they are very strong. And it must not be forgotten that a vast amount of testimony, far exceeding that which has been offered, might have been cited if the writer had not wished to exclude as far as possible all cases

and symptoms which might imply either malaria or diseases of the typhoid type. It is probable that many, it is certain that some of these were malaria. All this should be borne in mind in passing a judgment upon the question. If any one is still in doubt as to the devastating effects of malaria upon character, he should consult a specialist in tropical diseases, or have a few words with one who has himself suffered from the disease. His doubts will then vanish. Scepticism on the point is only possible in a land in which, happily, malaria is no longer prevalent.

Appendix.

Now that the evidence for the prevalence of malaria in ancient Greece has been brought forward, and a case stated, it will be useful to cite other testimony which should be read in the light of what has already been said. Only in this way will its full meaning become apparent. Much of it would have been out of place in the preceding inquiry. What follows must be regarded as a series of side-lights upon the question.

(1) There seems to be no hint in the ancient writings that malaria was caused by mosquitoes.[1] But Mr. P. Giles writes to say

[1] Koch states that an African tribe use the same word, Mbu, for *fever* and for *fly* (Note by Major Ross).

that "a Norse scholar has suggested that ⟨ἠπίαλος⟩ is the same word as ἠπίολος, a moth which annoys bees, in Aristotle's *Natural History*, VIII. 154, pointing out that in Lithuanian and Lettish there is a word which means both fever and moth, and arguing that there is also in Albanian the same kind of relationship between two words." It is well known that in late geological times the family Culicidae, to which *Anopheles* belongs, was widely spread throughout the world; and although there is no direct proof that *Anopheles* lived in Greece in ancient times there is the strongest possible presumption that it did. Unfortunately amber, in which so many delicate insects have been preserved, did not occur so far south as Greece.

(2) It would be interesting to discuss whether the Athenian water-supply was such that a favourable opportunity was afforded to the malaria mosquito. Aqueducts and running streams may be neglected,[1] but it is probable that the φρέατα would be good breeding-places. They probably often contained stagnant, or partially stagnant, water. Thucydides (II. 48) contrasts them with κρῆναι "springs." καὶ τὸ πρῶτον ⟨ἡ νόσος⟩ ἐν τῷ Πειραιεῖ ἥψατο τῶν ἀνθρώπων, ὥστε καὶ ἐλέχθη ὑπ' αὐτῶν ὡς οἱ Πελο-

[1] This is perhaps doubtful. Dr. Savas of Athens writes to say that malaria at Marathoy (40 kilometres from Athens) is caused by a torrent which dries up in summer.

ποννήσιοι φάρμακα ἐσβεβλήκοιεν ἐς τὰ φρέατα· κρῆναι γὰρ οὔπω ἦσαν αὐτόθι. Cf. Athen. III. 124.

(3) There are several places in the medical writers where eye-diseases are mentioned in connection with fever and enlarged spleens.

Hippocrates, *ἀφορισμοί*, Kühn, III. 722: *ἢν δὲ βόρειον ᾖ ⟨τὸ θέρος⟩ καὶ ἄνυδρον, τοῖσι μὲν ὑγροῖσιν ἐοῦσι τὰς φύσιας καὶ τῇσι γυναιξὶ ξύμφορον, τοῖσι δὲ λοιποῖσιν ὀφθαλμίαι ἔσονται ξηραὶ καὶ πυρετοὶ ὀξέες καὶ κόρυζαι, ἐνίοισι δὲ καὶ μελαγχολίαι.*

Id. προρρητικά, Kühn, I. 228: *οἷσι δὲ τὰ ὑπὸ τοὺς ὀφθαλμοὺς ἐπαίρεται ἰσχυρῶς, τούτους σπλῆνας μεγάλους εὑρήσεις ἔχοντας.*

It is said on very good authority that malaria and ophthalmia, although they have no co-relationship, often exist together. There are also certain eye-diseases which may be complications of malaria. Compare with this Rouse, *Greek Votive Offerings*, p. 212: "The favourite disease at Athens during the fourth century seems to have been bad eyes."

(4) Attacks of fever are often attributed by the ancient writers to over-exertion. Passages have been quoted above where *καῦσος* and *ἠπίαλος* are ascribed to this cause. With this should be compared Aristotle, *Parva Naturalia*, 462 b: *λέγω δ' αἴτιον μὲν οἷον τὴν σελήνην τοῦ ἐκλείπειν τὸν ἥλιον καὶ τὸν κόπον τοῦ πυρετοῦ.*

"And I use 'cause' in the sense in which it is said that the moon is the cause of a solar eclipse and fatigue the cause of fever."

Now when a man is the subject of latent malaria, that is, has parasites or spores inside him, over-exertion will certainly precipitate an attack of rigor, fever, etc. This accounts for many of the cases of potential and uncured malaria breaking out in a non-endemic country such as England. The quotation from Aristotle is enough by itself to show that malaria was common in Greece. The malaria parasite will live for years, and fatigue will usually bring about a relapse. Only in a malarious country could it be said, without qualification, that "fatigue causes fever."

(5) The Great Plague of Athens, like any other weakening illness, would predispose an individual to suffer from malaria, provided that malaria was endemic in the district.

(6) Owing to the curious way in which malaria spreads, no great importance is to be attached to the regions where malaria is now prevalent. But it is interesting to note that Greece, especially Boeotia and Sphacteria, Macedonia and Asia Minor are all badly infected. In all probability they have been so from classical times. Cases from Macedonia, Asia Minor and the Aegean islands would fall under the notice of the members of the Hippocratic school. Many of the cases noticed in the *Epidemics* of Hippocrates occurred in Thasos, an island off the Macedonian coast which caused Athens much trouble in the

Peloponnesian War. Very probably cases returned to Athens among the troops.

(7) The following quotations are of some importance:

(*a*) Oribasius, *περὶ ἀποσκημμάτων* (*ed.* Bussemaker and Daremberg), vol. IV. 85:

σπασμὸς δὲ ἄρα καὶ ἡ ἐπιληψία· ταύτης οὖν τεταρταῖος πυρετὸς ἰαμά ἐστιν, ὥστε ἤν τε ὕστερον ἐπιγένηται, λύεται ἡ ἐπιληψία, ἤν τε πρόσθεν, οὐκ ἂν ἔτι τούτῳ τῷ ἀνθρώπῳ γένοιτο.

"Epilepsy also is a convulsion. A quartan, then, cures epilepsy, so that if the quartan comes after the epilepsy, the epilepsy comes to an end, while epilepsy never supervenes upon a quartan."

Ibid. 87: *ὅτι γε μὴν καὶ πυρετοῖς, τὰ ἄλλα οὐκ ἀσφαλέσιν, ἐπιγενόμενος* (sc. *ὁ τεταρταῖος*) *ἐξέωσεν, πᾶς τις οἶδεν.*

"Everybody knows that a quartan, supervening upon fevers which are otherwise dangerous (?), drives them out."

Ibid. 88: *μάλιστα μὲν οὖν εἰς ἀμφημερινὸν τοῦτο τρέπεται . . . εἰς τριταῖον δὲ οὐ μάλα τρέπεται.*

"Now a quartan frequently turns into a quotidian; rarely into a tertian."

The last quotation is interesting in relation to the question of "mixed" and "double" infections. A quartan might easily become a quotidian; but it could rarely become a tertian.

(*b*) Aristophanes, *Wasps*, 812:

τοῦτ' αὖ δεξιόν·
κἂν γὰρ πυρέττω, τόν γε μισθὸν λήψομαι.

"That too is clever, for even if I have a fever, I shall at least get my pay."

Theophrastus, *Characters*, XII. : ὁ δὲ ἄκαιρος τοιοῦτός τις, οἷος . . . καὶ πρὸς τὴν αὐτοῦ ἐρωμένην κωμάζειν πυρέττουσαν.

"The unseasonable man is one who serenades his mistress when she has a fever."

Instances of πυρέσσω used in such a way as to show how common fevers became in Greece.

(*c*) Quotations from Aristotle's *Problemata*:

I. 8. διὰ τί τοῦ χειμῶνος βορείου γενομένου, ἐὰν τὸ ἔαρ ἔπομβρον γένηται καὶ νότιον, τὸ θέρος νοσώδες γίνεται πυρετοῖς καὶ ὀφθαλμίαις;

"Why is it that, when the winter has had northerly winds, should the spring be rainy and damp, the summer is unhealthy with fevers and eye-diseases?"

Note the connection of fevers and eye-diseases.

I. 19. διὰ τί, ἐὰν τοῦ χειμῶνος γενομένου βορείου, καὶ τοῦ ἔαρος νοτίου καὶ ἐπόμβρου, τὸ θέρος λίαν αὐχμηρὸν γένηται, θανατώδες γίνεται τὸ μετόπωρον πᾶσι, μάλιστα δὲ τοῖς παιδίοις· καὶ τοῖς ἄλλοις δὲ δυσεντερίαι καὶ τεταρταῖοι χρόνιοι γίνονται ἐν αὐτῷ;

"Why is it that, when the winter has had northerly winds, the spring has been damp and rainy, and the summer very dry, the autumn is deadly for all, especially for little children, while for others dysenteries and protracted quartans occur at that time?"

This suggests that infants were attacked by malaria.

I. 22. διὰ τί γίνεται τὰ ἔτη νοσώδη ὅταν γένηται φορὰ τῶν μικρῶν βατράχων τῶν φρυνοειδῶν;

"Why is it that years are unhealthy when there occurs a plague of small toad-shaped frogs?"

The plague of toads would mean a plague of mosquitoes.

(8) *Additional references.* Sophocles, fr. 466 (Nauck): κρυμὸν φέρων γνάθοισιν ἐξ ἀμφημέρου, "teeth chattering with a quotidian" (?). Date uncertain; possibly the earliest reference to malaria in Attic writers. Hesiod, *Works*, 584; Alcaeus, fr. 43; Pindar, *Pyth.* III. 50 (Christ), do not, I think, refer to disease. Phrynicus (com.) in Athen. II. 44: (μουσικὸς) ἀηδόνων ἠπίαλος—he gave the nightingales an ague. Demosthenes, 118. 20: περίοδος πυρετοῦ, and Alexis in Athen. III. 118: ὥσπερ πυρετὸς ἀνῆκεν, are good instances of πυρετὸς equivalent to malaria. The medical writers Aretaeus, Dioscorides (Kühn, II. 233-238), Paulus Aegineta (bk. II. §§ 19-26), Oribasius, Aëtius (bk. v. pp. 87-89 of the Aldine 1534 edition), and Palladius, are chiefly compilers, as far as malaria is concerned, and are evidence only for Roman times. In Aretaeus, Kühn, 112, we are told that young people are sufferers from splenic disease. Cf. with this Scribonius Largus (1st cent. A.D.), ch. CXXXII.: infantibus lienosis (in this writer splenic diseases are often mentioned). The following remarks of Galen show how highly malarious was the Graeco-Roman world in his time. Quotidians attack mostly very young children (παῖδες δὲ καὶ μάλιστα οἱ μικρότεροι . . . ἀμφημερινοῖς εὐάλωτοι, Kühn, XI. 23), tertians mostly young men (τοῖς νεανίσκοις, Kühn, XVII. B. 642) and semi-tertians men in the prime of life (Kühn, VII. 468). Cf. what I say on pp. 41, 42, 45, 71, 72. He also says that large, inflamed spleens follow quartans (Kühn, VII. 469 and XI. 18). Quartans "cured" fevers (p. 58) because, being long though mild, they survived their companions in mixed infections.

CHAPTER III.

MALARIA IN ANCIENT ITALY.

THE introduction of malaria into Italy is a more complicated question than its introduction into Greece. The disease spread more slowly, because the natural features of Italy, except in a few parts, are not so adapted to the growth of the mosquito. The effect upon the national character was not so profound as in the case of Greece, the most noticeable change being the evolution of savage brutality from sternness or cruelty. Unfortunately also, the earliest evidence of the existence of malaria is supported by no contemporary medical testimony. In Greek literature the Hippocratic writings belong to the same epoch as the early allusions to malaria in non-medical authors; but the first Roman physician to leave us a treatise is Celsus (*fl.* 50 A.D.), and malaria certainly existed in Italy long before that date. On the other hand, the modern inquirer is greatly helped by the many works on Italian malaria which have appeared within the last forty years. In spite of the

fact that the majority of these were written before the final demonstration of the mosquito-theory, and that many are hopelessly confusing because it is not very long since true malaria was sharply distinguished from a number of other diseases which used to be called by the same name, the writers have collected and classified much of the ancient evidence. The reader will find North's *Roman Fever* extremely useful in this respect.

Whenever it was that malaria appeared in Italy, and whatever be the period when it became endemic, it is quite certain that the numerous cases of pestilence referred to in early Roman history were not malarial. The writer reached this conclusion independently, but the words of North are well worth quoting: "Some recent writers on the subject would have us believe that many of the great pestilences of which we have record were malarial. There is, however, but slight justification for this view. For the most part, they followed upon wars and times of scarcity; the mortality, as a rule, was great, and the disease communicable from one individual to another; more than this, it is recorded in many cases that the cattle suffered as much as human beings, if not more. Altogether, in the absence of all proof to the contrary, it would seem more just to assume that these visitations were not malarial, but rather of the nature of malignant typhus,

or plague, so-called. At any rate, there is no proof whatsoever that they *were* malarial, and not only so, but it is highly improbable that such was the case; for, as far as our experience goes, epidemic malaria of a grave type is chiefly confined to the tropics, and even there is not common."[1] It is likely enough that the worship of Febris as a goddess at Rome has reference to these pestilential epidemics rather than to malaria.[2] This conclusion is supported by the inscription which is quoted in all the *lexica*, "Febri divae, Febri sanctae, Febri magnae, Camilla pro filio amato."[3] The epithet *magnae* may, of course, mean simply "mighty," but it is possible that it has reference to the distinction, condemned by Galen[4] as unscientific, between "great" and "small" fevers, the former being in most cases typhus or enteric.

It is not surprising that we find but few references to malaria in early Roman writers. The disease spreads in an insidious manner,

[1] North, *Roman Fever*, p. 73.

[2] The references are Cicero, *Nat. deor.* III. 25, 63; *de legibus* II. 11, 28: araque vetusta in Palatio Febri; Pliny, II. 7, 5, § 16. The date when the cult was introduced is unknown. The conclusion reached is not at variance with the statement of Theodorus Priscianus (a late medical writer) in *Physica*, I.: hinc est quod et Romani Febri aedem statuerunt, et quod certanas (*sic*: tertianas? quartanas?) Saturni filias affirmavit antiquitas. The writer is merely giving two illustrations of the fact that in early times disease and religion were closely connected. Cf. Cicero, *Nat. deor.* III. 10: ne tertianas quidem febres et quartanas divinas esse.

[3] *Insc. Grut.* p. 97, 1.

[4] Kühn, VII. 275. See S. Luke, IV. 38.

and is often unnoticed until it has a firm hold on a district.[1] Fortunately, however, evidence is not wanting that malaria made its appearance, and perhaps became common, about the year 200 B.C. If this be so, the facts usually cited to prove the prevalence of malaria in ancient times—the hill-built cities, the thick woollen toga, the carefully preserved fire in the temple of Vesta—must receive another interpretation. It is so easy to explain them in other ways that they would certainly not have been brought forward if better testimony were forthcoming.

Perhaps the earliest reference to malaria occurs in the comedian Plautus (died 184 B.C.), *Curculio*, I. i. 17:

> caruitne febris te heri vel nudius tertius?
> "Did a fever leave you yesterday or the day before?"

This is certainly not a definite allusion, but the line becomes most full of meaning if the reference be to an intermittent. Terence (died 159 B.C.) uses more explicit language in *Hecyra*, III. ii. 22:

> *So.* Quid morbi est? *Pam.* Febris. *So.* Cotidiana?
> *Pam.* Ita aiunt.
> *So.* What kind of disease is it? *Pam.* Fever.
> *So.* Quotidian? *Pam.* So they say.

[1] See North, *Roman Fever*, p. 66. "It slowly saps the energy and vitality of a people, until at last there are none left to continue the struggle. . . . The whole process goes on so slowly, that perhaps for several generations it may not attract attention."

This line is unintelligible unless it be assumed that the writer was acquainted with periodic fevers other than quotidians. It may be objected that Plautus and Terence, who imitated Greek comedy, are here copying their originals so closely that no inference as to the existence of intermittents in Italy may fairly be drawn. It might be replied to this that in all probability both writers would have avoided references which were unintelligible to their audience, but it so happens that other testimony confirms the impression given by the comedians that the Romans of this period had some personal experience of malaria.

The famous censor M. Porcius Cato (died 149 B.C.) has left a treatise on agriculture (*de re rustica*). North refers to two passages in this book, but is not disposed to believe that they point to malaria. The first occurs in Chapter I., where Cato advises him who would purchase a farm to see to it that it be "loco salubri," and that it have "bonum caelum." Again, in Chapter CXLI. there is a prayer to Mars that he may keep away "morbos visos invisosque." Vague as these allusions are, a flood of light is thrown upon them by another passage to which North does not refer. This occurs in Chapter CLVII.:

et si atra bilis est et si lienes turgent.
"In cases of black bile and swollen spleen."

The conjunction of enlarged spleen and black bile, as has been shown in the discussion on Greek malaria, is almost proof positive that Cato knew the symptoms of malarial cachexia, and makes it more probable that malaria is referred to in the passages quoted above.

From Cato to Cicero (106-43 B.C.) is a long interval, and one which has left us but a few fragments of literature. It may, however, be noticed that the Q. Fabius Maximus who was consul in B.C. 121 suffered from malaria, if we may trust the story told by the elder Pliny.[1] But in Cicero is found frequent mention of tertians and quartans, and his contemporary Varro (118-29 B.C.) declares that in marshy places "crescunt animalia quaedam minuta, quae non possunt oculi consequi," and that these minute creatures, entering the body by the mouth and nostrils, produce "difficiles morbos." From the time of Cicero most writers mention malaria in unmistakable language, and it certainly had become, by the Christian era, a disease with which the Romans were perfectly familiar. The physician Celsus (*fl.* 50 A.D.) almost confines his discussion of fevers to the intermittents, so that in his book *febris* is practically equivalent to malaria.

[1] Q. Fabius Maximus apud flumen Isaram proelio commisso adversus Allobrogum Arvernorumque gentes . . . febri quartana liberatus est in acie. Pliny, VII. 50, 51.

An opponent will perhaps inquire why it is inferred that malaria did not exist in Italy much before 200 B.C. As in the case of Greece, so in this case also, it is impossible to prove that there was no malaria in early times. But it is most improbable that the disease was endemic, and there is none but the flimsiest testimony that it was there at all.

The following points have been urged:

(1) The epidemics of fever in early times, and the worship of Febris.

(2) The woollen toga, the fire of Vesta, and the hill-built cities.

Now there is absolutely no reason for thinking the early epidemics to have been malarial. Periodicity and enlarged spleens are not mentioned in connection with them. The same remark applies to the *morbus sonticus* of the Twelve Tables, and to the *lues* of the Arval Hymn.

The other arguments are equally thin. The fire in the temple of Vesta was kept alight owing to the custom, common among primitive peoples, of never letting the hearth die out. The reasons for this are purely utilitarian, and would be more obvious to us if we did not possess lucifer matches. Cities were in ancient times built on hills, not only because mountain air is more healthy, even in a non-malarious country, but also because they were more easily defended against an enemy. The

argument from the use of the heavy woollen toga is a little stronger. Such a garment is undoubtedly a protection against mosquito-bites, as the insect cannot pierce thick woollen stuff. But it is at least very strange that the hygienic value of the toga was not a matter of tradition, and that its use gradually diminished even when malaria was, by universal consent, a fairly common disease. Surely the shape and quality of the toga were due to its being the best garment that could be designed to meet all emergencies. In the earliest times it was, with the exception of the *subligaculum*, the only garment worn by both rich and poor. That it would have afforded protection against malaria had it existed is an accident. The arguments which have just been attacked would have had some weight had there been independent evidence of malaria in early times. In the absence of that evidence they are of no value at all.

There is, then, every reason for supposing that malaria was unknown in early times, was well known at the beginning of the second century B.C., and that it gradually became more common during the next two hundred years. If this be so, it is at least a plausible conjecture that it was introduced by Hannibal's Carthaginian mercenaries. Africa seems to have been the original home of the disease, and it is probable that some

of his troops were infected. The constantly repeated devastation of Italy in the Second Punic War would be sure to turn a large part of it into marshy land, thus affording a convenient breeding-place to the mosquitoes which were infected by the malaria patients among the Carthaginians. The similar condition of Attica during the closing years of the fifth century B.C. offers a striking parallel. This opinion does not rest on mere conjecture. We are told by Livy[1] that in the year 208 a severe epidemic attacked Italy. It did not cause many deaths, but resulted in much lingering disease, that is, most probably, chronic malaria.

Where was malaria most prevalent?

The existence (and even the prevalence) of malaria in Italy from 50 B.C. is an undisputed fact, and there is no need to prove what is universally admitted. But it will be useful to show that it was common, not only in certain country districts, but in Rome itself.

Malaria in Rome.

The evidence for the existence of malaria in the city is copious, and of different kinds.

[1] Livy, XXVII. 23: eo anno pestilentia gravis incidit in urbem agrosque, quae tamen magis in longos morbos quam in perniciabiles evasit. The epidemic which attacked the army in Sicily in the year 212 (Livy, XXV. 26), although picturesquely described, is without any mention of such symptoms as would enable us to determine its character.

Galen (*fl.* 164 A.D.) distinctly states that the most virulent form of it, the semi-tertian, was of every-day occurrence in Rome.[1] The physician Celsus (50 A.D.) says nothing to lead the reader to suppose that Rome was less frequently visited than the country districts. Martial (died 102 A.D.) bids the schoolmaster close his school in summer, because

aestate pueri si valent, satis discunt.[2]

Juvenal (died 130 A.D.) refers to a sick old man with a quartan fever,[3] and Horace tells of a mother who promises Jupiter that her son shall stand naked in the Tiber on the day his quartan leaves him.[4]

The works of Horace are by themselves sufficient to prove that in his time (he died B.C. 8) malaria was endemic in Rome, and, incidentally, that many country districts were free from the disease. It will be worth while to quote the chief passages in full. In *Odes*, II. 14 occurs the stanza:

frustra cruento Marte carebimus
fractisque rauci fluctibus Hadriae,
frustra per auctumnos nocentem
corporibus metuemus Austrum.

[1] Kühn, VII. 435. The testimony of Galen has been dealt with more fully in the preceding chapter. It seems unnecessary to allude to it again.

[2] *Ep.* X. 62. [3] *Sat.* IX. 16, 17. See also IV. 57.

[4] *Sat.* II. iii. 288:

"Iuppiter ingentes qui das adimisque dolores,"
mater ait pueri menses iam quinque cubantis,
"frigida si puerum quartana reliquerit, illo
mane die, quo tu indicis ieiunia, nudus
in Tiberi stabit."

Auster brought in the autumn rains,[1] and so helped to produce the malarial season. Even more appropriate is the passage in *Satires*, II. vi. 16 foll., where the poet says that on his highland estate he need not fear the unhealthy autumn, during which the goddess of death reaped so rich a harvest in Rome:

> ergo ubi me in montes et in arcem ex Urbe removi,
> quid prius illustrem satiris musaque pedestri?
> nec mala me ambitio perdit, nec plumbeus Auster
> auctumnusque gravis, Libitinae quaestus acerbae.

In fact it seems to have been not unusual for those who could afford it to leave Rome during the unhealthy season. So we find Horace advising his friend and patron Maecenas to leave Rome in July.[2]

Here and there, as in the ninth satire of Juvenal, where the poet seems to be poking fun at an old man attacked by a quartan, it is clear that the young were among the chief victims.[3] Another instance occurs in Horace, *Satires*, II. iii., which has been quoted above.

[1] See Vergil, *Georgics*, I. 462, where it is called *umidus*, and Ovid, *Meta.* I. 66, where the adjective *pluvius* is applied to it.

[2] *Odes*, III. 29. See also *Epistles*, I. xvi. 15:

> hae latebrae dulces etiam, si credis, amoenae
> incolumem tibi me praestant Septembribus horis.

Compare with this Juvenal, *Sat.* X. 221: quot Themison aegros autumno occiderit uno.

[3] Professor E. V. Arnold calls my attention to the health-problems in Seneca. See *Ep.* 54, 1; 65, 1; 78, 1-4; 104, 1. "The circle in which Seneca lived consisted of small families of valetudinarians. He says to Marcia, 'with your huge family' (she had four children) 'you must expect a proportion of early deaths.'" *Dial.* VI. 16, 5.

Is it not, then, just possible that, although *alumni* in *Odes*, III. 23 refers primarily to the young of the flocks, there may be also a reminder of the fact that "darling children" had every reason to fear "the sickly season when the year brings forth fruit"?

> nec pestilentem sentiet Africum
> fecunda vitis nec sterilem seges
> robiginem aut dulces alumni
> pomifero grave tempus anno.

The most pertinent passage of all is *Epistles*, I. vii. 5-9, where Horace says that all parents fear for their children in autumn:

> dum ficus prima calorque
> dissignatorem decorat lictoribus atris,
> dum pueris omnis pater et matercula pallet,
> officiosaque sedulitas et opella forensis
> adducit febres et testamenta resignat.

Martial too, as has been pointed out already, believed that "boys learnt enough in summer if they kept well." All this evidence points to the conclusion that malaria had been long endemic in Rome itself, since on its first introduction the sufferers who attract most notice are the adults.

Modern Rome, on the contrary, is comparatively free from malaria, although of course the immediate neighbourhood is highly infected. How has this striking change come about? Improved sanitation has nothing to do with the

question, for malaria is not a filth disease. The modern Ghetto at Rome, although it was the foulest quarter of the city, was nevertheless even less infected with malaria than other quarters.[1] The cause is probably to be found in the form of the *atrium*. The hole in the centre of the roof, which let out the smoke from the fire, also let in the rain, and this collected in the small cistern underneath (*compluvium*, *impluvium*). Each Roman house contained a pool of stagnant water admirably adapted to serve as a breeding-ground for the mosquito. Another cause was the Tiber, with its frequent inundations. These gave much trouble. See Tacitus, *An.* I. 76; *Hist.* I. 86; Suetonius, *Div. Aug.* 30; *Otho*, 8. The banks of the river were unhealthy: Tacitus, *Hist.* II. 93: "adiacente Tiberi Germanorum Gallorumque obnoxia morbis corpora fluminis aviditas et aestus impatientia labefecit."

Malaria in the rest of Italy.

The prevalence of malaria in Rome will prove of importance when we discuss the influence of malaria upon the national character. But it is time to turn to the other part of the question, and to inquire whether the country districts were also afflicted. A large area seems to have been untouched. The words

[1] North, *op. cit.* p. 240.

of Horace imply that his mountain farm was healthy enough, and rich Romans would hardly have built their villas[1] in highly malarious regions.

On the other hand, the reference to malaria in Cato shows that some parts of the country were infected quite early, and Silius Italicus (*circa* 25-101 A.D.) distinctly states how unhealthy were the Pomptine marshes in his time:

> et quos pestifera Pomptini uligine campi
> qua Saturae nebulosa palus restagnat, et atro
> liventes coeno per squalida turbidus arva
> cogit aquas Ufens atque inficit aequora limo.[2]

It is clear from Horace, *Sat.* I. v. 14 ("mali culices"), that this district was infested with mosquitoes. The great country houses were not always healthy, for Lucullus had a villa in a region which was probably malarious.[3] Vitruvius (*fl.* 15 B.C.) remarks that marshy districts were pestilential: "quibus autem insidentes sunt paludes, et non habent publicos exitus profluentes, neque per flumina, neque per fossas, uti Pomptinae, stando putrescunt, et humores graves et pestilentes in iis locis

[1] See Pliny, *Ep.* II. 17 and III. 14. The site mentioned in the latter reference is now called the "Field of Death."

[2] Sil. Ital. VIII. 381. Cf. Juvenal, *Sat.* X. 283: Pompeio dederat Campania febres.

[3] Cicero, *de or.* II. 71: neque amoenum neque salubrem locum.

emittunt."[1] Cicero[2] mentions unhealthy districts, and a Roman army was apparently attacked by malaria in the neighbourhood of Brundisium after spending some time in the healthy regions of Gaul and Spain.[3]

Besides these direct statements there are frequent references to districts passing out of cultivation. Examples are Juvenal, *Sat.* x. 102, "vacuis Ulubris";[4] Horace, *Ep.* I. xi. 7. "Gabiis desertior"; Lucan VII. 391, and Horace *Odes*, II. 15. How far this depopulation was due to malaria is a difficult question to answer. Lucan lays the blame upon the great civil war between Cæsar and Pompey, and its continuation after the death of the former.[5] The probability is that civil war made a district desolate, and then malaria entered and rendered it uninhabitable. Certain it is that southern Latium must once have been healthy and prosperous. Later on it was a waste bog with scarcely an inhabitant. When

[1] Vitruvius, I. 4.

[2] *de lege agraria*, II. 26: alterum genus agrorum propter sterilitatem incultum, propter pestilentiam vastum atque desertum; and *ibid.* 27: in Salpinorum pestilentiae finibus.

[3] Caesar, *de bello civili*, III. 2: gravis autumnus in Apulia circumque Brundusium ex saluberrimis Galliae et Hispaniae regionibus omnem exercitum valetudine temptaverat. Cf. Celsus, I. iii: neque ex salubri loco in gravem . . . transitus satis tutus est.

[4] See Mayor's note *ad loc.* It is clear from Cicero, *Ep. ad fam.* VII. 18, that there was a villa here.

[5] Lucan, VII. 398: crimen civile videmus tot vacuas urbes. Etruria was certainly malarious. See Tibullus, III. v. 1: vos tenet Etruscis manat quae fontibus unda, unda sub aestivum non adeunda canem.

it is remembered how easily land becomes marshy if left to itself, and how certainly mosquitoes which carry malaria will, if they have the chance, utilise these conditions to the full, the conclusion reached above is at least not unreasonable.

It may, then, be inferred that some country districts, especially those in the modern province of Rome, were highly malarious; and that others, perhaps the majority, were comparatively healthy. Rome itself suffered from the disease in an endemic form.[1]

Celsus.

It will be convenient to discuss separately the evidence of the physician Celsus. In this way it becomes plain that non-medical evidence by itself is sufficient to demonstrate how

[1] Other interesting passages are Suetonius, *Divus Iulius*, I. (Caesar suffered from a quartan in his youth); Suetonius, *Div. Aug.* 81: sub natalem suum (23*rd Sept.*) plerumque languebat; Vergil, *Eclogues*, X. 75 (danger of shade, where mosquitoes congregate); Aulus Gellius, XVII. 12; Pliny, XX. 6, 23; XXII. 25, 72; XXVIII. 7, 23; *ibid.* 8, 25; Columella, I. 5 ("noxium virus" of marshes); Tacitus, *Annals*, II. 85 (Sardinia malarious—a possible centre of infection); Cicero, *ad fam.* X. 21: qui ex labore in febriculam incidit assiduam et satis molestam (fatigue precipitates malaria); Martial, X. 77: saeva nocens febris saltem quartana fuisses! (quartans not serious); Pliny, XXIV. 19, 107: herba adalligata brachio tertianas arcere traditur; Cicero, *ad fam.* XVI. 11: cum in quartanam conversa vis est morbi spero te firmiorem fore (quartans not serious); Pliny, VII. 170: quadrini circuitus febrem nunquam bruma nunquam hibernis mensibus incipere; Juvenal, *Sat.* IV. 56: iam letifero cedente pruinis autumno, iam quartanam sperantibus aegris; Juv. VI. 517; Persius, III. 90. I cannot find out the disease referred to in "morbus solstitialis" (Plautus, *Trin.* II. iv. 143), but it looks like malaria.

prevalent malaria was at Rome during the late Republic and the early Empire. But there is another reason why especial care is necessary in dealing with this particular author. Celsus was a scientific inquirer rather than a practitioner. Law, oratory, tactics, and agriculture claimed his attention as well as medicine. His object in writing seems to have been, not so much to put on record his own experience, as to rescue the art from the ill repute in which it was held by the majority of the Romans. It is therefore not unlikely that no small part of his work is second-hand information borrowed from his Greek predecessors. His discussion of malaria, its symptoms and treatment, is careful and full, but it is not certain how far it proves that malaria was prevalent in Italy. Of course the work of Celsus would have been different if malaria had not been an Italian disease, but does the extent to which malaria occupies the treatise correspond to the extent of the infection? The point may be illustrated from the history of medicine in our own country.

Everybody knows how common the terms "tertian ague," "quartan ague," and "ague" used to be, both in literature and in the common speech. But it would be a great mistake to suppose that all these agues were malaria.[1]

[1] Creighton, *History of Epidemics in Britain*, vol. II. p. 303: "But the malarious parts of England have been tolerably well defined

Some of them certainly were; but very many, probably most, were not true tertians or quartans at all. The reason for this misuse of terms is as curious as it is important.

Any reader who looks up a catalogue of the editions of Galen will be struck by the number which appeared in the sixteenth century, and, to a less extent, the seventeenth. Independently of this fact, it is known that Galen formed a text-book for doctors of the period, although afterwards a Hippocratic tradition grew up. Now both Galen and Hippocrates discuss intermittents more fully than other fevers. So much is this the case, that doctors trained in the ordinary medical school of the sixteenth century would be apt to assign a periodicity to a fever which was not really an intermittent. Creighton is very clear on this point. "Ague in early English meant any sharp fever, and most commonly a continued fever. The special limitation to intermittents appears to have followed the revival of the study of the Graeco-Roman writers on medicine, Galen above all, in the sixteenth century."[1] "In the Tudor period there were in this country actual experiences of strange fevers, which were interpreted

at all times; and at all times the greater part of the country was as little malarious as it is now."

[1] Creighton, *op. cit.* p. 301. The whole chapter is important, and well repays careful study.

according to the Greek teaching of quotidians, tertians, and quartans, with their several bastard or hybrid or larval forms. These, as I have said, were certainly not the endemic fever of malarious districts."[1]

It is impossible to be quite sure that something of the same kind has not caused the prominence of malaria in the treatise of Celsus. For this reason it is better to state the case for Italy without relying upon his testimony. But since non-medical evidence has shown that malaria existed and was common, the book *de medicina* may be used as confirmatory evidence.

The pathology of various diseases occupies the whole of the third book. Fevers are discussed in Chapters III.-XVII. Of this portion practically the whole, except Chapters VII. and IX.,[2] deals with malaria. Indeed, the treatment of non-malarial fevers is slight and unsatisfactory, and tends to show, either that diseases of the typhus and typhoid groups were rare in Italy, or that their symptoms have been confused, as the Greeks confused them, with those of the intermittents. Malaria is by far the most common equivalent of *febris*. To show this it will only be necessary to quote the opening words of the third chapter. "The

[1] *Ibid.* p. 302. Incidentally this transference of Greek nomenclature to English practice proves how common malaria was in Greece.

[2] Some part of this chapter also is not without reference to malaria. It is hard to explain the use of *horror* and *frigus* on any other hypothesis.

next point is the healing of fevers; these both affect the whole body, and form a class of disorders which are especially common. One kind is the quotidian, another the tertian, another the quartan; sometimes, but rarely, the periodicity exhibits a longer interval."[1] The description of these maladies is the same as that in the Hippocratic writings, and is only interesting because it proves, unless indeed Celsus is a mere plagiarist (a most unlikely assumption), that malaria has remained as an unchanged type ever since the period when it first made its appearance in history. It will be sufficient to give a brief abstract. Quartans begin with shivering (*horror*); then there follows an outburst of heat. Of tertians there are two kinds, one like the quartan in character, only exhibiting a different periodicity, the other being far more malignant. It returns every third day, but of the forty-eight hours it occupies thirty-six, more or less, so that although the fever grows lighter it never disappears entirely. Most physicians call this the semi-tertian (ἡμιτριταῖον). Quotidians are of various kinds. Some begin with heat, some with chill, some with shivering. Sometimes the fever disappears altogether, at other times it simply diminishes, thus giving the appear-

[1] Sequitur vero curatio febrium, quod et in toto corpore, et vulgare maxime morbi genus est. ex his una quotidiana, altera tertiana, altera quartana est: interdum etiam longiore circumitu quaedam redeunt; sed id raro fit.

ance of a continuous fever. They also differ much in severity, and occasionally the fever is high on one day but less severe on the next, or occurs at one time one day and at another on the next. Sweating often occurs at the end of the attack, but not always. More than one access, with a corresponding number of remissions, sometimes occur every day.[1]

It is interesting to note the stress laid upon the malignant tertian (semi-tertian), which Galen tells us was very prevalent in Rome. The fact that in quotidians the accesses sometimes ran in two series, one series occurring every third day, the other on the alternate days, seems to refer to double tertian infection. Mixed infection is also apparently implied, although it is not recognised as the true cause of certain phenomena of periodicity.

The treatment of fever is much more detailed than its diagnosis. Celsus was writing in order to enhance the dignity of the science, and the Romans were always more ready to listen to anything which promised to be of practical use than to discussions of less obvious utility. Unlike the Greeks, they did not want to be told that tertians came from yellow, quartans from black bile; their great desire was to know a cure for both.

[1] Taken from *de medicina*, III. iii.

Accordingly, Celsus gives much instruction as to the proper times of administering food and drink to the patient, and enters into a detailed account of the cures for semi-tertians, (which are treated early, possibly because of their great malignity), for feverish symptoms, chill preceding fever, shivering in fever, quotidians, tertians, quartans, two quartans, and quotidians following on quartans.

Apart from the elaborate treatment, which is much fuller than that given to any other disease, there is but little that is worthy of notice for the present inquiry. The care taken in administering food and drink, and the recommendations that the patient should have exercise, if possible, when free from fever, are indications of the extreme weakness which accompanies or follows malaria. The quartan, however serious its after-effects may be, was apparently regarded as a petty ailment. See especially III. xv. "nam quartana neminem iugulat." This gives some point to Juvenal's sneer at "the old man with a quartan." There is a reference to the existence of fever (probably malaria) in Egypt and Asia[1] (*i.e.* the Roman province), while the fact that Heraclides of Tarentum is twice[2] mentioned seems to show he paid particular attention to malaria. If so, Tarentum and its neighbourhood may have been as

[1] III. iv. [2] III. vi. and xv.

badly infected as the coast-line of southern Italy is now.

Enlargement of the spleen is not mentioned very often in the work of Celsus. Here again the cause is to be found in the purely utilitarian object of the author. Few Romans would be interested to know that large spleens and μελαγχολία often occur together. But they did want to know how enlarged spleen might be cured, and so there is a whole chapter (IV. xvi.) devoted to that question.

It may be inferred, then, that Celsus was perfectly familiar with malaria, although the tradition of Greek medicine may have led him to dilate unduly upon it to the exclusion of other fevers. The utilitarian character of his treatise accounts for the few interesting remarks he makes about the origin and symptoms of the disease.

Influence of malaria upon the Roman character.

Modern science has pronounced with no uncertain voice its judgment upon malaria as a factor in morality. "The effect of the disease on the people is to unfit them for labour, to cause loss of time, loss of money, and generally to diminish their producing powers, whilst at the same time the race, if left to itself, tends towards moral and physical

degradation";[1] "perhaps the most incapacitating disease to which man is liable."[2] Now it has been shown that malaria was endemic in Rome, probably from the time of Plautus and Terence. Hence it is practically certain that the city-population was gradually deteriorating. But from economic causes Rome was growing more and more congested ever since the Second Punic War. The results were a sparsely populated country and a degraded rabble in the metropolis. Statesmen, perceiving the effect but not the cause, did all they could to bring back the people to the land. But economic causes were against them; the deterioration in the national character was against them; and the continuous civil wars of the first century B.C. were against them. The waste land increased, in spite of ineffectual attempts to reclaim it.[3] The Roman people became a tainted and debased folk, penned up within the walls of the city. New blood was constantly being introduced, during the early Empire, from healthier and sounder races.[4] Lucan, Seneca, Martial, and Quintilian

[1] North, *op. cit.* pp. 2, 3. [2] *Ibid.* p. 6.

[3] Florus *Epitome of Livy* (XLVI.) Pomptinae paludes a Cornelio Cethego consule . . . siccatae, agerque ex iis factus.

[4] Gauls, Germans and Spaniards became infected with malaria when they lived in Italy. See Caesar, *de bello civ.* III. 2, and Tacitus, *Hist.* II. 93. This tends to show that Gaul, Germany and Spain were non-malarious. On the other hand, Greeks and Asiatics, being more immune, probably ousted the native Romans. Juvenal, *Sat.* III. 62: iam pridem Syrus in Tiberim defluxit Orontes.

were all Spaniards. This fresh infusion was itself infected in time, and the Roman Empire at last fell to pieces. It is not pretended that malaria was the sole cause; but it is certain that the disease gave full scope to other disintegrating factors.

Every now and then the modern world is shocked by atrocities committed by white men in tropical regions. Humanity and justice seem to be forgotten; civilisation and education are powerless to prevent furious outbursts of savagery. How much of this is due to the baleful influence of malaria is known only to those who have an intimate acquaintance with the disease. Something of the same kind happened in Rome. Malaria made the Greek weak and inefficient; it turned the sterner Roman into a bloodthirsty brute. If μελαγχολία produced crossness, *atra bilis* made its victims mad.[1] The terrible pictures of life in the first century A.D., as painted by Tacitus and Juvenal, show that Roman society was not only wicked but diseased. The extravagant cruelty, the wild desire for excitement, the absence of soberness and self-control, all point clearly to some physical defect. That

[1] The connotation of *atra bilis* certainly seems stronger than that of its Greek equivalent. See Cicero, *Ep. ad Att.* II. 7; Horace, *Sat.* II. iii. 140; I. ix. 66; *Odes*, I. 13; Juvenal, V. 159; Persius, III. 9; IV. 6 (commota fervet plebecula bile). Note especially Cicero, *Tusc.* IV. 24: bene igitur nostri, cum omnia essent in morbis vitia, quod nullum erat iracundia foedius, iracundos solos morbosos nominaverunt.

malaria was endemic in Rome is an undoubted fact, and the result of several generations being subject to its influence would certainly be a change of national temper. The particular form in which the change manifested itself would depend upon the prominent national characteristics and upon environment. In Rome all these tended to produce excited savagery. Malaria will do this now, even in the case of Europeans, and yet moderns have the advantage of the one drug—quinine—which deserves the name of "specific," inasmuch as it alone can be relied upon to cure the disease for which it is a remedy. Surely in ancient times, when no specific was known, the disease must have produced far more dreadful results than it does now.

The writer's task is now concluded. One object has been before him throughout—to encourage a more thorough investigation into those diseases which, instead of acting as Nature's pruning-hooks, sap a people's strength and ruin its character. It is a task which concerns our own nation very nearly. In many of the British possessions, notably India, malaria is an ever-present enemy. Within our own shores there is to be found an endemic disease which, though perhaps less distressing to the individual, may be equally fatal to the race when a few more generations have come and gone. For it must be remem-

bered that the effects of a disease are often greatly increased by the mode of life and the general environment of its victims. The whole tendency of modern life, with its excitement, high-pressure, intellectual strain—even its adulterated foods—is an encouragement to influenza to exact its penalty to the utmost. Often epidemic in the past, it now appears to be endemic. The strain it puts upon the nervous system is a commonplace. Whether it is fated to cause deterioration of the race is a question which only the future can decide.[1]

Be this as it may. At any rate there is food for thought in the possibility that it was an unostentatious malady which dimmed the blaze of glory that shines round early Greece until it finally fades away into the dark degradation of Hellenistic times.

[1] I venture to quote a few sentences out of a letter from Dr. Withington: "I remember that my oldest medical teacher used to tell us that the influenza epidemics of 'the thirties' in the last century formed a physiological epoch. Before them men could drink three bottles without injury when in health, and could be bled with profit in acute disease, but after them the 'three-bottle men' disappeared, and venesection became anathema. Had he survived he would doubtless have predicted the age of teetotalism and rest cures which is now coming upon us."

[He also warns me that the early autumnal fevers at Rome in the seventeenth century were typhoid, but admits that the evidence points to malaria in the case of the early Empire.]

CHAPTER IV.

CONCLUSION.

By G. G. ELLETT, M.B.

The decline and ultimate downfall of a great nation form a theme at once so tragic and full of interest that it must not be lightly passed by. Down through the history of the world nations have risen and fallen, empires have grown and attained such extent of territory and power that it has seemed they must be unassailable. But then has come the fall; not always suddenly and swiftly, but as if it were by the agency of some slow disease undermining the whole vital and moral power of the nation. Broadly speaking it may be said that a nation's prosperity is measured by the social and commercial morality of her citizens: and no nation can long continue to prosper economically whose standard of morality is declining. Between the years 500 B.C. and 300 B.C. there had come over Greece a great change, which has as yet been insufficiently explained. There is no doubt that between these years the whole

moral tenour of Greece, and more especially of Athens, degenerated. This had been raised to a very high pitch of excellence. Art and philosophy both reached a standard which the world, though it may have equalled, has never surpassed. In the year 450 B.C. the citizens of the various city-states of Greece were manly, patriotic, and religious. They were brought up to, and it was their pride to maintain, that ideal of citizenship, which demanded of every individual that he should willingly perform his allotted part in upholding the honour of the state, whether as magistrate or soldier or in some less conspicuous capacity. After that year a change set in. This change was not indicated by an increase of immorality. But the virtues of courage and patriotism, which had up till then dominated in the Greek character, gave way to a sentimentalism, a kindness and domesticity, which eventually proved disastrous. For though it may appear that these characteristics are not such as to encompass the downfall of a nation nowadays, it must be remembered that at the time when the Greek states were declining, the small and weakly nation was not protected from the strong and powerful neighbour by any consideration of international self-respect on the part of the latter. Nay, rather was a nation's self-respect, and that in which she was held by her neighbours, in direct proportion to her strength and her

preparedness to repel the attacks of those neighbours.

There must have been, then, some agent, which in the fourth century B.C. was at work on the character of the Greeks, causing them to give up their belief in religion, in a future life, and in the value of patriotism. For these changes undoubtedly occurred, and were as undoubtedly largely instrumental in bringing about the decline of the Greek nation. The day is long past when such changes could be accepted as the inevitable and inscrutable workings of Providence, into which it would be not only useless, but even wicked and dangerous, to probe. What, then, was that agent? The Greek writers, medical and non-medical, make frequent mention of fevers. And perhaps there is no word which has been used so indiscriminately or with such indefinite and varied meaning as the word "fever." Even to-day in England the term is employed with the utmost looseness, and is applied to nearly every disease contracted beyond the bounds of our sea-girt isle. In the foregoing pages the various words used by the Greek authors to indicate fever have been critically examined and compared. And it has been noted that the word πυρετός was from the year 400 B.C. somewhat restricted in its sense, and applied, at all events by some authors, chiefly to those fevers which were distinguished by

a periodicity of access. Now, there exists very little doubt that by far the most common of that category of diseases which is designated by the word "fever" is malaria. This disease, which has within the last two decades been so thoroughly investigated, has an enormous area of distribution. That it is endemic in many parts of Greece is well known. Hirsch[1] says, "As regards Greece, we are assured of the endemic occurrence of malarial disease at many points in Boeotia and (Attica, Levadia, Locris, the swampy shores of Lake Topolias, Thebes, the country round Athens) Zeituni, Naupantos, and Vonitza (Acarnania and Aetolia), at Chalcis in Euboea, in the Peloponese at Corinth and neighbourhood, Vostiza (the ancient Aegion), Tripolitza, Mistra, Navarino, Modon, and many other places on the coast. In Crete endemic malaria is very common, as it is also in several of the Ionian Islands, particularly Cephalonia, St. Maura, and Corfu." And quite recently the Liverpool School of Tropical Medicine has been carrying out an inquiry into the disease in Greece, and a League has been founded to combat it.

It seems, then, that while the Greeks, like all other nations, were attacked by sharp epidemics of a deadly nature, such as the

[1] Hirsch's *Handbook of Geographical and Historical Pathology*, vol. I. p. 213.

plague of Athens, there were known to them, and were described by their medical writers, other diseases of a less fatal nature, which were more or less constantly present, and which were designated "fevers." And moreover, among these fevers were recognised some types having a marked and regular periodicity of attack. There was a distinct difference noted between the plague and the fevers. Galen, in his commentary on Hippocrates, explains the plague as an epidemical fever of a fatal nature. Thucydides, in his description of the plague of Athens, mentions that the disease was very acute, with much vomiting of bile, and, towards the end, diarrhoea, ulceration of the bowels, and various symptoms of putrefaction. The transient character of the plague was well known, and its advent was believed to be connected with the appearance of extraordinary phenomena in earth and sky. From Thucydides downwards most Greek writers, medical and non-medical, who make mention of the plague, draw attention to its contagiousness; while Alexander Aphrodisiensis goes so far as to say that pestilential fevers are contagious, but common fevers not so.

There is no doubt, then, that the Greeks were perfectly able to discriminate between the plague, which seems from the symptoms mentioned to have been some type of intestinal disease, and the intermittent fevers, which

were more commonly present and less fatal, and which were looked upon with a degree of toleration; to which perhaps a parallel may be found in the way in which, some two thousand years after, an epidemic of influenza is regarded in the present day compared with an epidemic of typhoid fever or of small-pox.

Now, in the foregoing pages reference has been made to various passages from the Greek medical writers, and not a few from the non-medical authors, to show that the Greeks were well acquainted with intermittent fevers, which they called quartans and tertians (τεταρταῖοι, τριταῖοι); and the references given above to Galen's works περὶ τύπων and περὶ περιόδων prove almost beyond a doubt that Galen, as also his predecessor, from whom he quoted largely, had acquired a knowledge of the various types of intermittent fever, such as could only be gained from an extensive acquaintance with this type of disease. And Galen, be it remembered, besides being skilled in all the sciences of his day, was a most accomplished clinician. He, like his prototype and model, the great master of medicine, Hippocrates, belonged to the Rational sect, who looked upon disease and its treatment from the broadest point of view, and availed themselves of the knowledge to be gained from a close study of the causes of disease. It seems therefore legitimate to conclude that the intermittent fevers, the

quotidians, tertians, and quartans, were of frequent occurrence among the ancient Greeks. And this view is rendered more probable by the following facts. Splenic enlargement is frequently mentioned by Hippocrates and other medical writers; and a syndrome of symptoms is mentioned as being very commonly met with, which bears an undoubted resemblance to the symptoms of malarial cachexia. And this splenic enlargement, which was of common occurrence, is greatly in favour of a prevalence of malaria in Greece both before and during the time when Hippocrates lived and wrote. For, although the spleen becomes enlarged through other causes, and notably during an attack of typhoid fever, it is to be remembered that the typhoidal spleen usually resumes its normal size on the subsidence of the fever, whereas the malarial spleen most frequently remains enlarged for years; this is due, no doubt, to the length of time that the malarial parasite remains domiciled in its human host.

Is it possible, too, that the frequency with which the votive offerings of the Greeks, after illness, took the form of a representation of the abdomen[1] is due to the splenic enlargement? It may be so; and undoubtedly the malarial spleen, which not infrequently reaches the weight of 70 or 80 ounces (a normal spleen

[1] Rouse, *Greek Votive Offerings*, p. 212.

weighs 5-7 ounces), would be very noticeable ; and the consequent enlargement of the abdomen would most certainly make a great impression on the non-medical mind.

Now, there is very little doubt that Greece does at the present time afford excellent soil for the growth of the malaria mosquito. And this is largely due to the configuration of the country. As is known, Greece is a very mountainous country, but between the mountains are numerous small valleys, with abundance of stagnant water during certain parts of the year. One of these valleys, that of Lake Kopais, has been visited and examined by Major Ross, who has found malaria very prevalent, and of a very severe type, especially among the children. "Infecting the child one or two years after birth, it persecutes him until puberty with a long succession of febrile attacks, accompanied by much splenomegaly and anaemia."

In these words does Major Ross talk of the scourge which at present undermines the whole of the life of Greece. And he asks what must be the effect of this ubiquitous and everlasting incubus of disease on the people of modern Greece. What, indeed ? For it would seem that this disease, with its constant drain upon the resources of the growing body, must put a check upon the development, physical and mental, of each successive rising generation. Viewed from an entirely medical stand-

point, the question can admit of no doubt. The succession of febrile attacks would alone be a serious tax upon the growing child; while the consequent anaemia, which so soon makes its appearance, at a time of great educational importance, must make the child incapable of prolonged application, and rob him to a large extent of his powers of mental receptivity. It is only too evident that in a few generations a type of man possessing extraordinary mental and physical prowess, may become under this scourge of malaria greatly altered and debased. If it be that the malarial parasite was introduced into Greece during the fifth century B.C., it is quite possible for the disease, running a practically unchecked course, to have produced the profound deterioration which occurred in the Greek character during the next century and a half.

Mention has already been made of the enlarged spleen and the anaemia which are so often the results of repeated malarial attacks. The anaemia is frequently very extreme, the red blood cells being reduced to $\frac{1}{4}$ their normal number. In addition to this there may be quickened respiratory movements, the heart's action may be weak, and the pulse weak; while such may be the general condition of the tissues that the slightest wound may become gangrenous. Dropsy, diarrhoea, vomiting, loss of appetite, and all kinds of neuralgic and

muscular pains are some of the troubles to which the subjects of chronic malaria are liable. They are, too, more susceptible to any other infections with which they come in contact. It appears, from a study of the foregoing pages, highly probable that malaria was introduced into Greece during the fifth century B.C. It is well known that malaria, when introduced into a new region which it finds suitable to its growth, will make very rapid and very serious ravages among the inhabitants of that region, especially in the absence of prophylaxis. But prophylaxis, as it is known to-day, was not practised in the fifth century B.C.; and it seems legitimate to conclude that the malaria probably ran a more or less unchecked course among the Greeks, such a course, in fact, as would be liable to carry in its train all the more serious consequences of the disease which have been recounted above. And a perusal of these consequences will not leave the reader any doubt that in a very few generations such influences must, both by transmitted hereditary diathesis and by direct infection of the children, have very marked and very baneful effects upon the physical and mental powers of a nation.

The moral effects of disease are felt in several ways. A sharp epidemic with an accompanying high mortality has a very different moral effect upon a people to that produced by a disease

which has changed its character from epidemic to endemic. Such a scene, for instance, as was presented in Europe during the fourteenth century by the "Brotherhood of Flagellants," due undoubtedly to the reaction of fear upon the minds of people who were both ignorant and superstitious, was only likely to be caused by a sharp and fatal epidemic, such as was the "Black Death" in that century. And it must be remembered, in assigning its proper value from a modern standpoint to that and like episodes, that imagination, which played so prominent a part in the life and thought of the ancients, has to a large extent been destroyed by the flood of materialisation in which the superstitions of the past have been buried.

But a temporary state of frenzy following on an epidemic of a malignant nature is not likely to cause any permanent degeneration in the physical and mental characteristics of the nation attacked. Besides, be it remembered, the ancient Greeks, though highly imaginative, were not superstitious to the same degree and in the same sense as were the people of the middle ages.

It is a disease which is only slightly fatal, and on that account perhaps somewhat neglected, which will exert its harmful effects upon individuals, and through them insidiously upon the life and energies of the State which is

peopled by these individuals. And especially will a disease which leaves serious after-effects tend to act thus. For the individual may be weakened by the hereditary transmission of the morbid taint from his parents, or by actual infection after birth: he may suffer from an inherited diathesis, or he may acquire some definite pathological changes in his tissues from direct infection. And this pernicious process, carried on practically unchecked for a generation or two, must tend to produce a type of man very inferior to the original.

Is there then any example of a disease at the present time which, having become practically endemic, causes serious after-effects, though the primary infection itself is but rarely fatal? No one to-day is unacquainted with the very serious conditions produced by the various sequelae of influenza. Many and strange they are, and they attack nearly every system of the human body. Perhaps the post-influenzal state has been best described by Dr. Gowers (quoted by Prof. Clifford Allbutt[1]): "It is an intense feeling of inertia. Every action, physical and mental, requires an effort of the will to initiate and maintain it that is almost painful. Immobility of mind and body alone seem possible, and yet even rest has to be endured, for it brings no freedom from the sense of prostration. So strange and unfamiliar is the

[1] *System of Medicine*, 1906, vol. I. p. 687.

state that it seems at first as if it would only be transient, and would be gone tomorrow: but the mistake is realised when day after day, week after week, passes without relief. In perhaps the majority it is only after some months that the natural freedom of untrammelled effort is regained." This is no exaggeration. And to descend to details, influenza is a more prolific producer than any other infection of hypochondriasis, mental aberration, melancholia, mania, and general paralysis. Neuralgia, neuritis, and many nervous degenerations, temporary and permanent, have followed influenza: and many signs of disturbed nerve-centres have persisted long after the initial infection has disappeared.

Hirsch[1] says that the geographical distribution of influenza extends, without doubt, over the whole inhabited globe: and he questions the endemicity of influenza in certain countries situated in the cold zone. But it is generally agreed that the epidemic of 1889-90, as well as former epidemics, had its origin in Russia, whence in a few months it had spread westwards across Europe, finally reaching North America, and only attacking tropical countries late in its course, when it had exhausted the countries of the cold zone. This disease has been dealt with at some length, because the writer has wished, using it as an example, to emphasise the manner in which such a

[1] *Geographical and Historical Pathology*, p. 25.

disease, which has almost established for itself the character of endemicity, by the serious after-effects which it causes, may in time bring about moral and physical degeneration in the inhabitants of a country, although but few fatal issues are recorded from the disease itself, and it is in consequence of this very fact regarded with considerable toleration.

Now, the geographical distribution of endemic malaria may be roughly said to include all tropical and sub-tropical countries. Covering a broad area on either side of the equator, malaria continues to be endemic for some distance into the temperate zone, its frequency and severity diminishing towards the higher latitudes. In Europe, England, France, and Germany are the countries most exempt from malaria. In Africa the disease is very widespread and very severe. "South Africa," comprising Cape Colony, Orange River Colony, the Transvaal, Natal and Rhodesia, is that part in which the disease is least prevalent. Throughout the continent of Asia malaria has long been endemic, with the exception of the group of islands forming Japan. Here the disease is very rare, and when it does occur it is mild in type.

Australia and New Zealand, in fact all Oceania, enjoy a marked immunity from malaria. In the Western Hemisphere malaria is very severe in the West Indies, the east coast of the

Gulf of Mexico and in Brazil. In Southern Brazil, however, Uruguay, and some parts of the Argentine Republic there is a comparative immunity from the disease. The Pacific coasts of Central America and Mexico enjoy a larger degree of freedom from malaria than do the coasts facing the Atlantic Ocean. In North America, in general terms, the disease may be said to be endemic in the Southern States, decreasing both in frequency and severity northwards, so that endemic malaria is practically unknown in Canada, though as an epidemic disease it has on rare occasions made its appearance.

Perhaps the most striking fact, in the light of recent events, which this brief and rough sketch of the topography of endemic malaria brings out, is the almost absolute immunity of Japan. It is no place here to discuss the probable reasons for Japan's somewhat sudden leap into the position of a first-rate power. Suffice it that she has assumed that position and shows every prospect of maintaining it. And the most prejudiced observer will be bound to admit that the Japanese have displayed a patriotism and fearlessness such as was displayed by the Greeks at the height of their military and naval glory, before the moral decline, which ultimately proved their ruin, had as yet set its mark upon them. It may be objected that it is unfair to argue

from the case of one small portion of the globe. But the case of Japan is so very striking, more especially when looked at in contrast with her gigantic but unprogressive neighbour China, where malaria of a very severe type is constantly present. But in the other continents there is no lack of evidence that the districts and countries which enjoy a total or partial immunity from malaria are those whose inhabitants to-day exhibit the greatest activity. For has not South America fallen far behind North America? And Spain, which once bid fair to be the mistress of all Europe, nay of all the known world, has fallen from her high estate, and has for long years been unable to keep pace with the more northern countries of Europe. And lastly, what a contrast is there between the malarial and the non-malarial parts of Africa, between South Africa and West and Central Africa!

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GREEK AUTHORS

[Aretaeus, Dioscorides, Galen and Hippocrates in Kühn's edition.]

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