

The chief moral of this story seems to be, "Never neglect any part of routine examination." I have always been impressed by the "fourteen points" of one of my most esteemed colleagues.

I suggest that here we had an example of a conditioned reflex and that the removal of the stimulus put out of action a series of complicated reflex arcs whose final activities were made manifest in the form of obsessions and fugues. Activity in the conscious levels gave rise to obsessional thoughts while a similar mechanism in the unconscious levels caused fugues. There must have been an underlying tendency for his thoughts to assume a sexual form—the paths most frequently used being the easiest to follow.

Application of the censor would have resulted in psycho-neurotic phenomena as exemplified by the production of anxiety neurosis following the stimulus of such toxins as those of dysentery. (In the consideration of psycho-neurotic cases all too often the practical work of Pavlov on conditioned reflexes is neglected and too great attention paid to Freudian theories which can, at best, be taken as explaining phenomena which have organic causes.)

This case is, further, an example of the interesting co-operation between the Legal and Medical branches of the Service.

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Echoes of the Past.

WAR EXPERIENCES OF A TERRITORIAL MEDICAL OFFICER.

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(Continued from page 354.)

CHAPTER XXIII.—MALARIA CAMPAIGN.

The other great work for medical administration during the summer of 1918 was the fight against malaria. This fight was entered upon with our eyes fully open. Palestine was well known to be an intensely malarial country. When it became so we do not know. There is little in the Bible to show that the inhabitants in those days suffered from malaria. There are good descriptions of many diseases, both contagious and epidemic, but no hint of the annually recurring, energy sapping one now so universal, which makes some parts of the country almost uninhabitable in the summer and autumn months, and which by its ravages undermines the

constitution and sucks out the energy of those who live in the badly affected parts. We know on the other hand that it was there in Crusading times. Our own King Richard the First obviously suffered from it and there can be little doubt that it played its part in breaking his determination to carry through his enterprise and made him long to get back to the more healthy climate of his own land just as so many of our own men did in the summer of 1918. Exactly when the disease settled there we do not know, but it is certain that its advent must have profoundly influenced the history of the land. Malaria is probably responsible even more than the bad government of the Turks for the impoverishment of the country, for the almost complete extermination or withdrawal of the better class of residents and the very considerable reduction in population that has taken place in the last two thousand years.

The history of the coming and going of malaria in localities is an interesting and difficult subject. Why a country like Mauritius, which was free from malaria until some fifty years ago, suddenly became badly infected, we know not. On the other hand, why the Fen country and the marshes of Essex, formerly malarious, without any definite campaign against the disease, gradually ceased to be so, is equally difficult to understand. Sir Ronald Ross has made a study of this and has endeavoured to reduce the rules under which malaria ebbs and flows to a mathematical formula, but there remains much mystery about the way in which the various factors produce their results.

On entering Palestine in the spring of 1917 the Egyptian Expeditionary Force as a whole had little experience in dealing with malaria. As has already been mentioned a good deal of experience was gained during the summer of that year on the Wadi Ghuzzeah which stood us in good stead in the bigger campaign of 1918. We were fortunate in having good advisers attached to the Force. In Major E. E. Austin, already referred to, of the British Museum, we had one of the best-known living authorities on mosquitoes. His knowledge of the habits of the malaria-carrying varieties and his untiring efforts in hunting them out proved of the most inestimable value to the Force. He was employed as a free lance working over the whole of the occupied area and by his periodic inspections was able to correlate and check the results of the work done to prevent the breeding of anopheles. We had also the benefit of the advice of Major Andrew Balfour (alas! no longer with us), later appointed Director of the London School of Hygiene, whose work on malaria prevention in Khartoum and the Soudan had brought him a world-wide reputation. In the Force itself we had also regular R.A.M.C. officers like Colonel C. P. Fowler, who had had great experience.

The work of malaria prevention has proceeded along several different lines. One method is, taking the mosquito for granted, to endeavour to prevent it conveying the poison to man by protecting him from its bite. Most of the damage is done at night for the anopheles are chiefly night

feeders. By billeting stationary troops in mosquito-proof huts and tents and providing those in the field with mosquito nets and making individuals anoint themselves with various essential oils' deterrent to the mosquito an attempt is made to ward off the enemy. Another method is to dose every individual as a matter of routine with sufficient quinine to prevent the development of the disease in the blood though the germ may have been introduced by the bite of the mosquito. The third method, that of carrying the war into the enemy's country—defence by attack—is to destroy the mosquito himself, or rather *herself*, for it is the lady alone that does the mischief.

There has been much controversy in the past as to which is the best of these methods for the extermination or reduction of the disease. The continental schools for the most part believed in the two former methods. The British Modern school, following Ross, favoured the last; and though the Italians have done much to remove the terrors of malaria in the Campagna of Italy by their methods, the great triumphs of the work have been achieved by the third method—as in Ismailia and Port Said by the Ross brothers, and in Khartoum by Andrew Balfour, and finally in the Panama Isthmus. Gradually, therefore, a consensus of opinion had arisen that this was the right way to tackle the problem.

These results were, however, obtained under peace conditions. War introduces a totally different set of difficulties. It is a comparatively easy business to deal with the individuals of an army, but to undertake the destruction of mosquitoes over a wide area of country almost universally producing them is a big engineering undertaking and one which rather frightens the average commanding officer when it is proposed to him. It is not so many years since one of our greatest generals, Lord Wolseley, wrote:—

“The sanitary officer is the creation of recent years and as a general rule he is a very useless functionary. In the numerous campaigns where I have served with a sanitary officer, I can conscientiously state I have never known him make any useful suggestions, whereas I have known him make many silly ones. It is not his fault, for with an army moving it is impossible to drain a town, as I have known suggested, or carry out any other great sanitary measures. There is not time for any great sanitary works; and for the ordinary cleanliness of temporary camps or bivouacs the P.M.O. with each division can do all that is necessary. In future, as long as this fad continues, my recommendation is to leave him at the base, where he may find some useful occupation as a member of the Sanitary Board, which I think should have charge of all sanitary arrangements at the Base.”

I wonder how Lord Wolseley would have faced the proposition put before General Allenby in Palestine. Fortunately General Allenby was of a more open mind and belonged to a more enlightened age.

The problem confronting him at the beginning of 1918 was this: You
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are holding a line across a country which is known to be intensely malarious. Parts of it, for example the Jordan Valley and the plain of Sharon near the sea, are uninhabitable for Europeans during the late summer and autumn. If these areas are held during these periods without very active measures to deal with malaria, your army will be decimated with the disease.

It was a great problem. He decided that he must hold the line, but he did not send his sanitary officers to the Base. He trusted them and gave them a free hand—a great decision and characteristic of the man. Once the decision was made the medical authorities had no cause to complain of the backing they had from the executive. Work on anti-malaria schemes was given priority over all other work behind the lines. It was decided to employ both the first and third methods referred to. Quinine prophylaxis was not employed by compulsion, though units wishing to use it were given facilities to do so. Troops were served out with mosquito nets and huts were made mosquito proof as far as possible. An ointment containing essential oils was served out as a ration to all troops. But chief reliance was placed upon destruction of the mosquito, or rather on the prevention of its breeding. The fertilized mosquito lays her eggs on the surface of any available water where they remain until the larvæ hatch out and swim off. The essential, therefore, is to prevent the mosquito obtaining any access to suitable water.

The methods employed were:—

- (1) Reduction of water areas suitable for breeding by drainage of pools and marshes.
- (2) The cleansing of all streams of weed and the straightening and smoothing of their banks so as to remove all dead water, in which the mosquito prefers to lay her eggs.
- (3) The prevention of their access to wells or other drinking water supplies by sealing them with covers or gauze.
- (4) The oiling of all open water which could not be protected otherwise.

As long as there is a film or scum of oil on the surface of the water the mosquito is unable to lay her eggs on it. For this purpose a mixture of equal parts of heavy oil and ordinary paraffin oil was generally used—the former alone is too slow in forming a film and the film of the latter does not last long enough to be used by itself. Very careful surveys were made of the whole area and maps made showing clearly all possible breeding places. It must be remembered that no rain falls in Palestine from the beginning of April to October. The permanent springs and streams are comparatively few so that water has to be stored for use by the inhabitants for the whole of this period. This is done in innumerable wells and cisterns.

The magnitude of this part of the problem will be realized when it is stated that in Jerusalem alone there are many thousands of reservoirs and that every village has a proportionate number. Jerusalem itself we could

not tackle. It was decided in its case that discretion was the better part of valour and that the best method of dealing with it was to keep the troops out of the town. There were, however, large numbers of men in the town at various times and a considerable number of the cases of malaria which did occur, were acquired there during visits for sight-seeing or on duty for necessary purposes such as supply and transport work.

In the plain of Sharon there is only one prominent river, the Auja. It rises suddenly out of the ground by a number of springs about the middle of the plain just behind our front line and runs by a wandering course of about ten miles to the sea. The banks of the river were everywhere overgrown with vegetation which, choking the edges of the stream, produced still water in which *Anopheles* could breed. These banks were cleaned and smoothed off for the whole length of the river, and so rapid was the growth of the vegetation that the whole work had to be done a second time a few months later.

In the plain there were also several fair-sized marshes containing stagnant pools which formed ideal breeding grounds. These marshes were drained away into the Auja by the construction of long dykes.

It must be borne in mind that much of this area was in direct view of the Turks so that the work had to be done under artillery fire from the Turkish lines. So much so that only very small parties could be employed at a time in some places.

The Jordan Valley area contained several permanent streams and much marshy ground, all of which had to be dealt with. Our own 20th Corps area was different. We held the Judæan hills. Here the problem was one of small streams running in deep valleys, interrupted in their course from time to time by disappearing underneath stones. All these were found to be breeding places, and all had to be cleared of weed and trained in their course. We had also many villages, each with its usual quota of wells and tanks, all breeding mosquitoes. The wells were visited and oiled once a fortnight. The work on the streams was continuous, for the level of the water was constantly changing, thereby forming new banks and the edges were constantly being broken down by the trampling of animals and the natural destructiveness of man.

The organization employed in the 20th Corps was as follows:—

Each division was responsible for the work in its own area. The Divisional Sanitary Section was responsible for carrying out all the bigger pieces of work under the direction of the D.A.D.M.S. of the division who acted as Inspector for the area. At the same time each unit was supposed to have a malaria squad, acting under its own regimental medical officer, which undertook minor work in the vicinity of its own unit. The D.A.D.M.S. of the Corps, Major Steadman, kept an eye on the work of the whole Corps, co-ordinating it and by regular and frequent inspections keeping up its standard. The divisions were frequently changing their areas so that his work in maintaining continuity of policy was most

important. Much of the actual manual labour was done by gangs of the Egyptian Labour Corps, placed at the disposal of the O.C. of the Sanitary Section, his own men acting chiefly as foremen. Many of the personnel of the sanitary sections became great experts. They took the keenest interest in the work and acquired a real scientific knowledge of the life and habits of the mosquito.

On a large scale map in my office we kept record of all the places where mosquitoes had been found, and of the work that was being done to destroy them. Those divisions that were slack in their work had to be stimulated. New and successful methods of oiling and of retvetting the edges of streams originated by individual workers of one division were passed on to other divisions. As an example of what the work meant I will refer to what was done at Corps Headquarters.

In the immediate neighbourhood of the German Hospice on the Mount of Olives within a radius of about half a mile there were about 50 wells and cisterns. Each of these was visited, examined and oiled, once a fortnight—half one week and the other half the next. If left longer than a fortnight breeding was almost sure to have recommenced and *Anopheles* larvæ would be found. It must be remembered that these wells and reservoirs supplied all the local inhabitants with drinking water. The addition of paraffin does not improve the flavour of the water, in fact, makes it undrinkable for some days. It was found by experiment that the evil taste passes off before the end of the week, so that by oiling alternate wells each week half were usable for drinking at a given time and at the same time breeding was entirely kept in check. Though Jerusalem is a hot-bed of malaria, we, on the Mount of Olives, only three-quarters of a mile away, were free and had practically no cases during the summer.

The reservoirs of the Hospice itself, constructed on scientific lines by our German hosts, were supposed to be mosquito proof. They were all sealed with fine wire netting in a way which appeared to human vision quite secure, but Nature is wonderfully persistent in her effort to secure the survival of the species and the lady mosquito is not easily defeated in her endeavour to find a suitable spot in which to lay her eggs. At any rate, one morning the Corps Commander announced at breakfast that he had found some funny little wriggly things in his bath! Investigation showed that they were larvæ, not fortunately of the true mosquito, but of their nearest relation, the gnat, proving that all the skill of the German scientists had been defeated by the maternal instinct of the insect. However, this was an isolated occurrence, and we saw very few mosquitoes or gnats during the months we spent on the Mount of Olives.

The attention of the medical service was not directed solely to the prevention of malaria. Every endeavour was made to ensure prompt and efficient treatment of the cases as they occurred. It is not easy to diagnose malaria in its initial stages. It does not show the typical temperature

chart which is so diagnostic in the later stages. In its outward symptoms it differs in its milder forms very little from any other febrile disease such as influenza and sandfly fever and in some of its more severe forms is easily mistaken for heat apoplexy, meningitis, and acute dysentery. The only certain means of diagnosis is the discovery of the germ in the blood. On the initiation of Captain Philip Bahr, a son-in-law of Sir Patrick Manson, and himself already a well-known authority on tropical diseases, a system was inaugurated by which the blood of all doubtful cases was tested at once, before they left their units or the field ambulances. A small unit was brought into being called a Malaria Diagnosis Station. It consisted of a medical officer and two men of the R.A.M.C., all specially trained in bacteriological laboratory work. They were equipped with two microscopes and the necessary apparatus for blood examination and a special tent to do their work in. They were also provided with their own transport, consisting of a wagon and pair of mules, so that they could move about to any part of the line where their services were most useful. Slides for the preparation of blood-films were issued to all medical officers so that they could send off specimens of blood of suspected cases and get a report back the same day from the diagnosis station.

The patient was not evacuated from the field ambulance until a report was received so that his treatment with quinine could be commenced if the result proved positive. A card showing the type of organism found and an account of the treatment he had received accompanied each man down the line. There is no doubt that this early diagnosis obtained on the lines by this organization saved many severe lung cases which are so difficult to diagnose by symptoms and which if not treated in the initial stages with heavy doses of quinine are often fatal.

The result of the anti-malaria work was evident. Mosquito breeding in the areas dealt with was greatly reduced, and in many places temporarily stamped out. As the summer went on a good many cases occurred in the Force, but the source of infection could generally be traced to some failure in organization or to the temporary occupation by troops of some area which had not previously come within the sphere of anti-malaria operations.

The worst infection of our divisions occurred when the 60th Division went down into the Jordan Valley to assist Desert Corps in the second raid across the Jordan.

The result of all our efforts was that though there were many cases occurring throughout the Force all through the summer and early autumn, the disease never became an epidemic. The stamina and morale of the general body of the troops was never affected by it, and when the time came for the great advance in October, the general health was good, the units were at good strength, and the hospitals in Egypt and on the lines of Communication were not unduly full.

The proof of the usefulness of the work came after the advance. The

incubation of malaria is about a fortnight. Within a fortnight of the day on which the divisions left their carefully treated lines and passed into that of the Turks which had not been treated at all, the number of malaria cases began to assume a very alarming proportion. Fortunately by that time the Turks were beaten, and a large majority of the infantry could be withdrawn into the old healthy areas, and though the troops used in the pursuit continued to suffer for some weeks, the total numbers infected formed only a comparatively small proportion of the whole force.

(To be continued.)

Current Literature.

CATHCART, E. P., and MURRAY, A. H. F. **A Dietary Survey in Terms of the Actual Food Consumed.** Medical Research Council—Special Report Series, No. 218.

This is the third account of special inquiries made by Professor Cathcart and Mrs. Murray. The two earlier reports were published in 1931 and 1932, dealing with the diet of families at St. Andrews and of families in Reading and Cardiff: these were fully described in Editorials in the *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS*. In the earlier reports attention was drawn to food consumption in terms of protein, fat and carbohydrates. In the present report the data have been interpreted in terms of the principal foodstuffs purchased by these families.

In the earlier reports there was a marked constancy in the distribution of calories between fat, protein and carbohydrates eaten by people in the different towns. The constancy of the percentage of the protein was remarkable in view of the wide difference in the foodstuffs eaten by the communities, and seems to be the result of a kind of instinct. The purchasers of food were untutored housewives with a varied selection of materials to choose from: the purchases did not remain constant from day to day, nor did the housewives have a similar sum to expend on food, nor did they expend it alike.

As regards mineral requirements of the body, and Sherman's figures of 0.68 g. of calcium, 1.2 to 1.5 g. of phosphorus and 15 mg. of iron per day in a satisfactory diet, all the groups at St. Andrews, with the exception of one, were definitely above the accepted standards. The second investigation made at St. Andrews in the autumn gave identical results as regards protein, calories, etc. The authors then re-stated the results of the investigation in terms of foodstuffs eaten. The man values and expenditure of food per man per week were practically the same at the two periods, and as might be expected, the same types of food were consumed by more or less the same number of families in both periods. Moreover, the general impression was that there is little real difference in the consumption