

## NOTES ON SOME TROPICAL DISEASES OF PALESTINE.

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*Jerusalem.*

(With 1 Chart.)

### *Introduction.*

JERUSALEM is the resort of so many tourists and pilgrims who chiefly visit the country in the healthy spring season and see little of the conditions in which the poor of the land live, that it may be difficult for them to realize that it is a city where malaria is exceedingly rife and where the most elementary sanitary regulations are utterly neglected. There is no proper public water supply, no sewers worth the name, vaccination is not enforced even when small-pox is epidemic and there is no attempt to isolate those suffering from infectious diseases. This state of things is undoubtedly largely due to remissness and ignorance on the part of the Turkish Government, but the situation is made very complicated and difficult on account of the "Capitulations" by which all foreign subjects are practically independent of the Local Authority and accept no orders except through their own Consuls. It is easy to see that any government in the world would find it exceedingly difficult to enforce measures of public health—which are often in our own lands obstructed as far as possible by lay persons—under circumstances like these. The inhabitants of a single Jewish tenement-house may be representatives of perhaps half a dozen nations and not one step can be taken by the Local Authorities to get rid of any public nuisance until the assent of the Consuls of all six "powers" concerned is obtained. To those who have had experience of human nature, it will not be surprising to learn that unanimity in such a case has so far been almost impossible to obtain. Undoubtedly one of the reasons has been that

hitherto there has been no authority of sufficient standing to give confidence to the Consular Authorities. Until the local Turkish Authorities and the consular representatives of the "Powers" can agree to work together loyally under the guidance of some authority in Public Health, acceptable to all, nothing can be done, for Jerusalem is a city of which the majority of the inhabitants are foreign subjects; these are of all nations, but especially Russian, Austrian, German and English or American. Some German societies, Christian and Jewish, have been recently looking into this question, and last September they sent Prof. Mühlens, of the School of Tropical Medicine at Hamburg, with three assistants to see what was the real state of things here especially with respect to malaria. Some account of what he has found I am giving below. As a result of his report Geheimrat Pannwitz, M.D., Secretary of the "International Association for the study of Tuberculosis," was commissioned to come out to Jerusalem and look into the question of Public Health here from the administrative side. He came in November 1912 and conferred with the Turkish local authorities and the various Consuls, and at a meeting of local medical men, representatives of the various national- and religious-community interests here, he laid before us the following proposal. He in the first place sought the co-operation of all the leading medical men here in the working of a Bacteriological and Public Health Laboratory which is now being established. This Laboratory will afford all the medical men here opportunities for examination of blood, sputum, urine, faeces and other bacteriological material; Widal's and Wassermann's tests will be done, whenever needed. The work will not only be done gratuitously but every facility will be given of allowing those medical men interested in such work to participate in any department in which they wish to specialize. A house has been engaged for the Laboratory—conveniently enough for me almost opposite my hospital—and Prof. Mühlens with two fully qualified medical men and some of the lay assistants, are now at work. Another bacteriologist from Germany is shortly coming. It is intended that as far as possible the staff should eventually be international and it is hoped, though the initiation has come from Germany, that those interested in Palestine in other lands will come forward and help to support the Institute. Probably, if the scheme is fully developed, the Laboratory will have three or four distinct departments each with a specialist in charge. Malaria and allied tropical diseases, tubercle, syphilis and rabies are some of the chief subjects for specialization. One of the most important objects at this

stage is the education of the public by lectures as to what are the outstanding sanitary needs of Jerusalem and Palestine generally. Meanwhile Dr Pannwitz is hoping, through negotiations carried on in conjunction with the world-wide Anti-Tuberculosis Association, to get the various foreign governments concerned interested, so that eventually a general recognition may be given to the Public Health Institute, a step leading it is hoped to co-operation of all concerned in the improvement of the lamentable state of the city.

Ever since Prof. Mühlens came to Jerusalem it has been my privilege to be closely associated with this scheme and with the details of the work. Those who are abroad, far from bacteriological laboratories, and who in the busy round of routine work have been unable to pursue, despite often the keenest interest, the bacteriological work which becomes routine work to many a medical man in the large cities of England, will fully appreciate what a boon some of us feel this new laboratory to be. We have already had opportunities of obtaining a positive diagnosis in many cases which has been most helpful to treatment, and it is unnecessary to say in a medical journal for fellow medical men how much this daily assistance along the more strictly scientific side of our work means to us. I am proposing to publish a few short papers, chiefly of a clinical nature, upon the prevailing diseases of Jerusalem and Palestine. The absence of a scientific basis for diagnosis has in the past always made me hesitate when tempted to write but now, thanks to Prof. Mühlens' kind co-operation and encouragement, our clinical observations are being placed upon a surer footing.

### I. *The malarial fevers of Palestine.*

It is probably largely the result of the great prevalence of malaria in Palestine that the indigenous population are so wanting in moral energy, and that all efforts at the permanent settlement of Europeans in this land have, till very recent times, proved a failure. The climate of Palestine, in all the mountain regions at any rate, is salubrious. On the higher ground the mean temperature in February, the coolest month, is about 46° F. and the mean during the four hottest months—July to October—varies between 68° F. and 75° F. It is exceptional for the summer maximum temperatures in the shade to be above 100° F. Although the long dry season when not a drop of rain falls from the beginning of May to the middle of September is trying to some people, to others it is enjoyable and all are braced up by the cooler winter months.

Almost all the heavy rain falls during December, January and February—March sometimes replacing one of these as one of the wetter months. The rain is not however excessive; the average in Jerusalem is a little over 26 inches in the season and the spells of rain are interspersed by days, and sometimes weeks, of brilliant sunshine. The one drawback to all these healthful climatic conditions is malaria. It is always in our midst and it is widely distributed all over the land. In the low-lying maritime plain, inland from Jaffa, Caesarea and Haifa, many districts are very malarious; the low-lying Jordan Valley, below sea level for two-thirds of its extent and descending to nearly 1300 feet below the Mediterranean at the Dead Sea shores, is so malarious, on account of its sustained tropical climate, that much of it is no better suited for settlement by Europeans than the most unhealthy parts of tropical West Africa. But even in mountain regions where, as at Jerusalem, we are 2500 feet above sea level, malaria is exceedingly common. I suppose it may safely be said that taking all its effects—immediate and remote—there is no disease in the land which does so much harm. The evil results fall particularly upon the poorer classes and of course especially upon the children. Among the classes more comfortably off where care is taken, mosquito curtains being the rule and mosquito-proof houses increasingly common and where slight attacks of malaria are at once treated with quinine, severe malaria is exceptional. In my own household we all use mosquito curtains, although the windows and doors are supposed to be mosquito proof, but I also give all my children small doses of quinine throughout the summer and autumn as a further precaution. Before I did this I found their education constantly interrupted by slight attacks of malaria.

As things are Jerusalem and most of Palestine are quite unfit for any kind of "colonization"—as is being attempted by Jews from many lands—and a large percentage of the indigenous inhabitants suffer for many weeks every year, while many of them are chronically anaemic from these annual attacks.

This to us medical men is the more exasperating because we know that most, if not all, the malaria at a city like Jerusalem could be eradicated by measures which are comparatively simple and require for their enforcement merely that a certain amount of authority be conferred upon an intelligent staff of health officers. That a city of so much interest to so many well-to-do people, Christians, Moslems and Jews, should continue from year to year to be an ever increasing mass of malarial infection—a danger both to visitors and residents—is a

standing disgrace. An international Board of Health such as is now suggested with a medical officer (not in practice) giving his whole time to the question might, if supported by the Government and the various Consuls, do very much to improve things.

A few years ago it was a mystery how malaria could be prevalent in Jerusalem. Before the discovery of the malaria-bearing properties of the *Anopheles*, Jerusalem was certainly not the kind of site one would expect to be ague-haunted. Such sites were usually described as low-lying, marshy, etc., and the "ague miasma" was supposed to rise from the soaking lands at sunset and carry the disease which was at that period described as of "telluric" origin. But when the mosquito theory was first promulgated it seemed again a mystery how we could have *Anopheles* here. These mosquitoes were described by the earlier observers as passing their larval existence in slow moving, semi-stagnant streams where green algae abounded, and indeed in such places they (*Anopheles maculipennis*) are plentifully found in the lowlands of Palestine. It was only slowly that we found that the source of all the mischief lay in our numberless cisterns where the *Anopheles*, even more readily than the *Culex*, delights to dwell. Dr Cropper<sup>1</sup> showed that four species of Anophelidae were to be found in Palestine, viz. *Anopheles maculipennis*, *Pyretophorus palestinensis*, *Myzorhynchus pseudopictus* and *Cellia pharoensis*. Prof. Mühlens now finds that the common *Anopheles* of our cisterns is an unspotted winged mosquito—common all over Europe—*Anopheles bifurcatus*.

The autumn months (Sept. Oct. and Nov.) are emphatically the "fever" months and the spring-season is by far the healthiest, but malaria, among the poorer classes, is never absent.

Among our out-patients the percentage of fever cases, which from January to June (inclusive) varies from 16% to 21%, runs up, during August, September, October and November to 40% and over, falling again in December to 26%.

In the same way among our in-patients out of a total of 1078 cases 289 or 27% (excluding children) were fever cases (20% in females and 36% in males). Among the children in the childrens' ward the percentage was 50%. During January to June the percentage (adults only) is 20% and under 10% in April, whereas during September, October and November the percentage runs 43%, 50% and 50% respectively. If the children are included the percentage will be 18%

<sup>1</sup> Cropper, J. (1902), The Geographical distribution of *Anopheles* and Malarial Fever in Upper Palestine, *Journal of Hygiene*, 11, p. 465.

in April and 55% in October and 56% in November. The three very malarious months are thus September, October and November, and with the commencement of winter there is a sudden drop.

I append a chart which shows graphically the percentage of *all* malaria cases (in- and out-patients, adults and children) in the different months and also the mean atmospheric temperature. The contrast of the two curves is very striking.

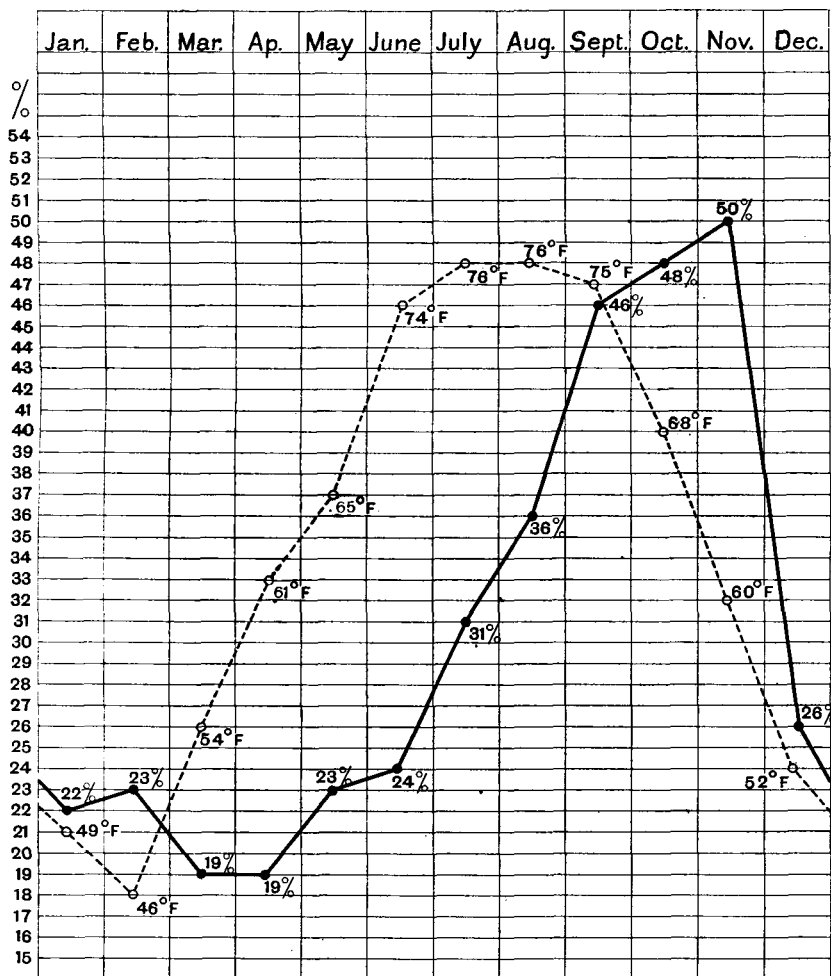
For many years these facts have been familiar to us but now, thanks to Prof. Mühlens, we have a great deal of new information which is of the utmost importance. Prof. Mühlens has examined schools and hospitals during the autumn months. In some of the Jewish day-schools he finds the astonishing percentage of 29% to 30% infected with malaria among the children actually attending the schools. If the absentees had been also counted the percentage would have been nearer 50%. One such school at the time of the investigation had one-third of its scholars away—mostly for “fever.” In the boarding schools it is very much less. The larger number of these cases are “tropical” or “subtertian” fever, but there is a considerable quantity of quartan malaria also. Quartan fevers are very common and reach a high percentage of all cases in the winter months because of their persistence.

Prof. Mühlens will doubtless make a full report later on with regard to his general results based on the examination of several thousand cases, but I venture to give with his full permission my personal experience with my own cases. Altogether he has examined blood films which I have taken from over 700 of my out- and in-patients, and of these from September 26 to the end of November, I have through his kindness a full report on 666 cases. (It must be remembered that this by no means represents all the cases attending the out-patient department. Many have latent malaria and many were taking quinine regularly. Only scarcity of time limited my film-taking to likely cases.) Of these 317 were subtertian (tropical) malarial alone, 75 were quartan, 55 tertian, 9 were double infections of tertian and tropical, 4 quartan and tropical and 2 tertian and quartan. Of the total cases 69.3% proved to have parasites and of these 71% had tropical or subtertian malaria. This shows a terrible infection. Of the cases with gametocytes 116 were tropical (with crescents), 66 quartan and 52 tertian. Many of these cases had their blood literally crammed with parasites.

Seeing that we have in Jerusalem a very large percentage of human beings peculiarly liable to malaria—young European children and old

enfeebled European Jews just arrived with but little resistance to a tropical disease—a large percentage of gametocyte bearers and plenty of *Anopheles*, it is not surprising that we have abundance of malaria.

*Percentage of cases diagnosed as "fever" cases among the in-patients and the out-patients at the English Mission Hospital, Jerusalem.*



The black dots mark the percentage of "fever" cases in each month and the circles the mean atmospheric temperature for each month in Jerusalem. The "fever curve" is very characteristic and I have obtained the same taking out- and in-patients separately and with totals instead of percentages.

The infection of new cases with subtertian malarial parasites can hardly take place after the middle of November when the cooler weather sets in. The temperature is too low for the development of the sexual generation in the stomach of the mosquito, but the gametocytes die hard and with 36 % of all the subtertian cases with crescents in the blood, there is certainty that with the first return of the sustained warmth of summer the disease will be re-propagated.

With regard to the quartan and tertian cases there may still be re-infections during the winter. An investigation is being made during all the cooler months of this winter to see what forms of fever there occur and how many attacks are recrudescences of fever in cases of latent malaria. During December out of a total of 48 of my cases showing parasites 23 (or nearly 50 %) were quartan, 8 (14 %) were tertian, and only 20 (42 %) were subtertian; of these last 5 (25 %) had crescents only.

That there is an immense amount of latent malaria is shown by the large proportion of patients who, though exhibiting no outward manifestation of malaria, get a severe attack of ague immediately after an operation or after child-birth.

I have found much interest since this investigation was begun in comparing the clinical symptoms with the verdict of the microscope and certainly the latter upsets all the ordinary ideas of clinical experience. Scarcely one of the quartan or tertian cases could have been diagnosed from their charts—morning and evening temperatures only—even before any quinine was given: indeed the only quartan case which I had in the last two months with what might be called a “typical” chart was one which showed no parasites at all in the blood in the apyrexial stage. The subtertian cases had many of them no rise of temperature at all, or very little, although the blood was sometimes crammed with parasites: in the case of some infants the only clinical symptoms are anaemia, enlarged spleen and diarrhoea. High temperatures occurred with no parasites and normal temperatures with many parasites. Doubtless some of this latter class would be found to have rises of temperature if it were taken as is done, according to Prof. Mühlens, with such cases in Hamburg, every two hours day and night. It is true that in most of the subtertian malarial cases the spleen was enlarged, often markedly so, but on the other hand I have notes of a number of cases—during these two months alone—when from the spleen and the general anaemia a diagnosis of malaria seemed probable but no malarial parasites could be found, in some cases after two or three independent examinations.



Many of such cases have a perfectly normal temperature. It seems to me that many of these cases of pernicious anaemia, occurring not uncommonly in pregnant women, with very large spleens, but no malarial parasites, call for further investigation. There is a strong suspicion, on clinical grounds, that kala-azar is endemic in Palestine, but so far we have no pathological evidence.

Haemoglobinuria (blackwater) fever is now well known in Palestine. I believe one of my cases which I reported<sup>1</sup> was the first to be recorded in the land but it is now recognised everywhere. It cannot be called common in Jerusalem, but every autumn a few cases occur, and that too among patients who have not been outside the city for years. In the maritime plain, around Jaffa and in the malarious regions near Caesarea, it is far from uncommon. The worst region of all is the Jordan Valley near Lake Huleh and south of the Sea of Galilee, in both of which places many of the Jewish colonists have succumbed and others have been reduced to states of extreme anaemia.

A few words may not be out of place regarding Prof. Mühlen's methods, even at the risk of describing what must to some be very familiar. From all our patients we take blood from the lobe of the ear: I have myself found the best instrument to be a bayonet-pointed surgical needle, kept, fixed to the cork, in a small bottle of alcohol. From all the cases we make two slides—Slide *A* is an ordinary thin spread film, Slide *B* is a thick film, two or more large drops being collected and allowed to dry towards each end of the slide. All the slides are numbered by means of a diamond glass cutter, and the numbers are recorded, in the first instance, against the names in my out-patient register. Slide *B* is stained *unfixed* with Giemsa's stain, one drop of the liquid stain to 1 c.c. of pure water; the solution is allowed to lie upon the slide for 20 minutes and is then washed off, after tilting off the excess, by gently dipping the slide two or three times in a beaker of pure water. The slide is then stood almost upright and allowed to dry: no cover glasses are used. The leucocytes and the malaria plasmodia take the stain, but the erythrocytes, if normal, are transparent; polychromatophilia is however so common that in a large percentage of the slides the erythrocytes show granular and faintly bluish. Slide *A*, if needed for more detailed examination of the blood-cells or parasites, is *fixed* in a mixture of alcohol and ether and then stained as above. As a result of the fixing the erythrocytes become sensitive to the blue stain.

To me the method of working with thick films has been a revelation: the examination of cases of suspected malaria, which by the old method of thin films often took hours, is now made with certainty and accuracy in a few minutes.

<sup>1</sup> Masterman, E. W. G. (1906), Haemoglobinuric Fever in Syria and some notes on the occurrence of the disease in Palestine, *Brit. Med. Journ.* 1. 314.

II. *Dengue.*

During the autumn months of 1912 a severe epidemic of dengue fever visited Syria. So far as I can gather it reached its height in Beirut and Haifa early in the past summer; it crept down the coast to Jaffa and later on to Gaza. From Haifa it passed inland to Nazareth and Tiberias and from Jaffa it spread into the mountains, devastating Jerusalem and its environs, spreading thence to Hebron, and, passing across the Jordan Valley where at least one large Bedoin tribe suffered severely, to *es Salt*. It would indeed appear to have visited all the large centres of population in turn. The disease reached Jerusalem somewhat late in the season; it was not very prevalent until the latter part of September, and it reached its full height in the city within-the-old-walls during the middle of October; during November it slowly diminished and now in the first week of December it has almost disappeared, though occasional new infections still occur.

The characteristic points of this disease have been briefly as follows:

A sudden onset—although this is not constant. In at least a considerable proportion of cases the patients describe the chill with which the fever commenced as being similar to an ague attack; it is often prolonged to three or four hours and some patients say they have had an actual shivering attack. Even when the cold stage is not so marked the patient becomes acutely prostrated in a very few hours and looks most alarmingly ill. From the onset headache and severe pain in the loins and in the hepatic and splenic areas are marked. Vertigo is common. The rheumatic pains in the limbs seem to be situated in the muscular and tendonous structures and not in the synovial membranes. Many cases have marked pain in the occipital region and the back of the neck. The eyes are congested and the eye-balls painful. Epigastric distress, ascribed to the heart, is very marked. There have been, particularly in this epidemic, marked gastric disturbances. Vomiting has been very common and often very severe indeed. The tongue, gums, fauces and pharynx are all congested. The tongue is usually found completely coated, from edge to edge, with an almost even, whitish, fur, which turns brown later. Constipation, often very obstinate, is very common. A good many cases have diarrhoea, which, often no doubt, is a result of a succession of purges taken one on the top of another for the relief of the constipation; some cases have had dysenteric attacks. The pyrexial stage seems to be anything from

three days in the mildest cases, to eight or ten in the severe. In the latter temperatures of 104° to 105° F. are common. I have not followed enough cases with the clinical thermometer to witness the regular relapse and recrudescence of pyrexia which is certainly characteristic of many cases. The final termination of pyrexia is frequently accompanied by profuse and prolonged perspirations. Epistaxis is so common at this stage as to be rather a symptom than a complication. In several cases it has, in my experience, been severe. I have also seen cases with haemorrhage from the throat, stomach, rectum or uterus. Abortions are said to be common but I have not met with one. After the fall in the temperature the pains, diminished in violence as a rule, often continue for many days or even weeks. The patient is much debilitated; perspirations may continue to be very troublesome. Two forms of rashes occur in the disease—(1) a severe congestion of the skin very noticeable in the face, which occurs at the onset of the disease in many severe cases, and (2) a much more frequent morbiliform or scarlatiniform eruption which appears at the end of the acute stage. Even this characteristic rash is not constant but will be seen in most cases if looked for. Its onset and sometimes its disappearance is frequently accompanied by an intolerable itching. Although during the period of the epidemic I must have attended many hundreds of cases I did not see one where death could be ascribed to this disease itself, but severe nervous prostration and neuralgia were very common, and some of my colleagues said they had seen old people succumb to the after effects. In one case I saw a severe attack was followed by a peripheral neuritis for which there was no other evident cause. The disease is not only often greatly prolonged, but relapses have been common, and from the experience of those who have lived long in Jaffa I gather that the occurrence of the disease gives little or no immunity. The epidemic simply dies out with the onset of cooler weather. One point worth noticing is that in the experience of most medical men here very young children, under, say, five, were seldom attacked, and in the doubtful cases when the mother had the disease the baby also had a temperature, the latter was found on microscopic investigation to have subtertian malaria and not dengue.

Dengue fever, or *Abu rikab*, has been more or less endemic upon the Syrian coast for some years, Manson<sup>1</sup> states since 1861. I understand that the last epidemic in Jerusalem was in 1889, but in Jaffa and along

<sup>1</sup> Manson, Sir P., Article "Dengue" in Allbutt's *System of Medicine*, Vol. II. Pt. II p. 345.

the coast dengue is a frequent visitor. In 1909 there was a severe epidemic and some cases coming from there at that time developed the disease in Jerusalem. Dr Keith of Jaffa says he has seen four epidemics, the usual season being September and October. The present epidemic began there about the end of August. Dr Torrance of Tiberias tells me that the fever visited that town in October and November and that probably quite 50% of the population were affected. In diagnosing our cases some of us had the co-operation and assistance of Prof. Mühlens, and through this we were able to eliminate the malarial cases. In the blood films from the cases which we clinically diagnosed as dengue marked leucopenia was usually present.

In making the diagnosis of dengue two other diseases, besides malaria, have to be excluded, viz. influenza and three-days fever. The differentiation may be difficult and in the beginning of an epidemic may be impossible in isolated cases. In influenza the onset is usually more insidious, the pains, on the whole, more severe, the respiratory organs are more frequently involved. In this dengue epidemic I did not meet with one case of pneumonia directly traceable to this disease. The heart and nervous complications are more marked and lasting in influenza; recurrence is less common, the relapses, in mild cases, less marked and the rash is absent. I confess that I called my earlier cases "influenza" (which is a common visitant in Jerusalem) because I was inclined to suppose that dengue, which I knew was raging at Jaffa, was a disease of the low land and that the only cases we were likely to get in the mountains (2500 feet above sea level) would be importations; then seeing the rash I suspected two concurrent diseases, influenza and dengue, but I am now sure that we have had an epidemic of pure dengue.

From three-days fever<sup>1</sup>, dengue may be fairly clearly distinguished by the following points: (1) The former is rather a disease of summer, the latter of autumn. (2) The range of temperature is usually lower in three-days fever (100°–101° F.). (3) Three-days fever is characteristically of "three days" duration; relapses are uncommon. (4) Rashes are at least exceedingly rare, though they are described in three-days fever. (5) Vomiting, so common in this epidemic of dengue, is uncommon in three-days fever, while cough with a thick muco-purulent expectoration is frequent in the latter and is not naturally a symptom of the former. (6) Three-days fever confers an immunity after a time,

<sup>1</sup> Castellani and Chalmers (1910), "Three-days fever" in *Manual of Tropical Medicine*, p. 796.

second attacks are rare, third attacks are said to be unknown. It is a disease which attacks new comers to a district infested with sand-flies. Many tourists here get a slight attack after a visit to Jericho and some may also acquire it in Jerusalem where the *Phlebotomus pappatasi* is common. It never spreads through a community, attacking almost every adult, as this epidemic of dengue has done.

With regard to the ultimate cause of dengue fever we know little. It has been found by Ashburn and Craig<sup>1</sup> of the Philippine Islands that the organism must be smaller than even that of Malta fever, for infected blood can be filtered through a Berkefeld filter and still give rise to an attack of the disease if injected into a patient. It must be some organism comparable in minuteness to that of measles, small-pox, etc. There is a strong consensus of opinion that the bodies described originally by Dr Graham<sup>2</sup> of Beirut—"small hyaline, unstained dots or rods in the red corpuscles"—are not the cause of the disease. Dr Ardati, Dr Graham's pathological assistant, claimed to have stained them. "In specimens stained according to Giemsa-Romanowsky I was able to find in the erythrocytes, small, usually round, but sometimes elongated fine granulated, from purple to blue bodies of the size of  $\frac{1}{3}$  to  $\frac{1}{2}$  of a normal erythrocyte, occupying the margin but also at times the centre of the blood corpuscle<sup>3</sup>." Whatever these bodies may be they cannot be, if Ashburn and Craig's observations be correct, the real cause of dengue. One is strongly tempted to believe that Dr Graham's bodies are the same as those shown me some years ago by Dr Cropper, which he found in great numbers in many fever cases and which he then considered were the cause of a new disease, "Syrian fever," but which, I understand, he subsequently considered to be merely due to physical changes in the erythrocytes. Where stained bodies were found they may have been malarial parasites. Prof. Mühlens after carefully examining a great many of our blood films from a series of cases of dengue fever, in all stages, was unable to find anything answering to the description of Dr Ardati, *i.e.* any stainable bodies in the erythrocytes other than malarial organisms.

There is a general consensus of opinion that Dr Graham is right in his idea that the carrier of the disease is a mosquito, but I know of no evidence which proves that the *Culex fatigans* is necessarily the only carrier. If it is a minute organism of which the insect is the mere

<sup>1</sup> Ashburn and Craig (1907), *Philippine Journ. of Science*, II. 9.

<sup>2</sup> Graham, *Journ. of Tropical Med.* VI. 209.

<sup>3</sup> Ardati (1910), *Medical Record*, Sept. 3.

carrier and there is no special development inside the mosquito—as with the malaria plasmodium in the stomach of the *Anopheles*—I do not see why *Anopheles*, sand-flies and even bugs may not carry the infection equally well. As culicine mosquitoes are by far the most conspicuous and generally diffused of such insects they may well be the chief and most frequent cause of infection with dengue in Syria. Persons living in mosquito-proof houses here appear to have escaped infection. Certainly all experience here points against infection by mere propinquity. If it is true, as our clinical experience seems to indicate, that very young children are much less liable to the disease than adults, then there must be another unknown factor in operation which needs investigation.