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PROPOSALS

FOR ANTIMALARIA WORK IN PALESTINE

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There is a certain amount of malaria in every part of Palestine though in some places its influence on the population is very small and does not constitute either a danger to life or a hindrance to regular work. In other parts it is truly a scourge, undermining health and preventing any productive labour. This is particularly the case in country districts, since malaria is especially a country disease and because the annual period of malaria recrudescence coincides almost exactly with the busiest agricultural season. New arrivals are speedily attacked and although they rarely suffer from the pernicious form, the disease is none the less a most important obstacle to the success of their work.

The abandonment of the country, the almost complete absence of rational cultivation and of any sanitary measures and the sparsity of the population contribute to the seriousness of the malaria problem. On the other hand Palestine is a land which offers marvellous opportunities for sanitation on account of its geographical formation with long mountain ranges and plains sloping either towards the sea or towards the deep valley of the Jordan. With malaria once under control it would become one of the healthiest countries in the world, for it has a mild climate, regular winds and no sudden changes of temperature.

I am convinced that apart from a well-planned, energetic and conscientious campaign against malaria it is useless to hope for a renaissance of Palestine, particularly while the most fertile districts and those most appropriate for intensive cultivation are precisely those which suffer most from the disease. There are numerous examples of districts from which malaria has disappeared spontaneously on account of the cultural development of the country and the improvement of communications.

After working for thirty years in different parts of Palestine and making a more or less systematic study of conditions in various districts, and after some personal attempts, isolated but systematic, at antimalaria work, I have ventured to formulate a scheme of control.

General Considerations.

It has been clearly shown that the efficiency of antimalaria measures increases in geometrical progression with the extent of the area over which these measures are effective; for the influence of the territory about the periphery of this area always makes itself felt through the infected mosquitoes which travel across the boundary. Large centres of infection are therefore to be selected for the application of sanitary measures.

Since in practice none of the classical methods can be applied with mathematical precision, nor be by itself absolutely successful, all known methods should be used in combination against the endemic. More important still are exactitude and uniformity in the execution of plans and careful oversight of practical work. In the course of this article the following classification of the degree of infection of different districts will be employed:

I. Fever rarely found.
II. Malaria occurs occasionally without hindering agriculture or necessitating special preventive measures.
III. Malaria varies in intensity from year to year, isolated families or individuals suffer, but in general more or less regular work is possible.
IV. Malaria incidence high. These regions being generally situated in the neighbourhood of large marshes where productive labour is impossible.
V. Maximum incidence of malaria. All agriculture or industrial enterprise should be forbidden.

This classification is based on data furnished by representatives of local medical services, the results of blood examinations of a certain proportion of school children and babies, and especially on the observation of enlarged spleens, particularly in the schools.[1]

Preparatory Survey.

The first stage in the campaign against malaria will be a survey of the following points:

(*a*) A study of the territory, levels, slopes, atmospheric conditions, soil and sub-soil, an estimate of the cost of drainage, and other studies on the relation between the requirements of sanitation and agriculture;

[1] See *Revue de Méd. et d'Hyg. Trop.*, 1920, No. 3.

(*b*) Mortality and morbidity statistics, the malaria index in different districts, examination of spleens and blood, determination of the species of malarial parasite;

(*c*) The discovery and registration of breeding places, of adult anopheles and their species, investigation of their habits and of their rôle in the production of malaria.

This survey, which is a large field of action in itself, should be commenced immediately. It may be said that it is begun already. Isolated but valuable information has been collected by English and German engineers and later by the engineers of Baron de Rothschild's colonies, and finally by the meticulous investigation of P. Rutenberg. The Jewish Health Bureau at Jerusalem possesses some sanitary statistics with regard to that town and the colony of Hedera. I myself have collected a somewhat interesting dossier on various districts in Palestine. I have made a more systematic study of the colonies of Zicron, Bathshlone, Athlit, Mischmar Hayarden and Yessode-Hamaalah on behalf of an antimalaria campaign which came to an untimely end. It is necessary, however, to obtain a general systematic and authoritative survey of the whole country.

A sanitary engineering service fully equipped and with appropriate personnel should be sent to investigate successively every district in which malaria is supposed to be severe. This service would assemble all the already existing information which it would classify, control and complete, and so establish a contour map of the different districts in Palestine, showing marshes, canals, ravines and the nature of the vegetation, etc., etc. The whole would be carried out in accordance with the requirements of the antimalaria sanitation service and also with the advice of a competent agricultural authority.

There would be also a second medical sanitary service independent of the first but always in close touch with it. It would be the duty of this service to classify the results of the various researches filed under the headings (*b*) and (*c*) above. There should also be a sanitary office, a statistical office, a laboratory and a secretariat. A second small laboratory might be furnished for etymological research. The whole unit should be under the direction of an acknowledged authority on malaria, well acquainted with local conditions and able to win the confidence of the inhabitants. One or more young physicians would be detailed for research work in different districts including the examination of spleens and of blood and the collecting of adult mosquitoes and larvae. All doctors established in the malarial districts or in their neighbourhood should be invited to assist in the research. Nurses and sanitary officials should be attached directly or indirectly

to the service and given special duties. Hand bills, circulars, questionnaires and reports would help to systematize the work.

We have found on a small scale that bands of young volunteers or school children may be of the greatest use in discovering breeding places, etc., especially if stimulated by the offer of prizes.

Drainage.

The following important principles should be kept in mind:

(*a*) In undertaking large and extensive schemes the agricultural interests as well as the purely sanitary point of view should be considered;

(*b*) Drainage works should be associated with other methods of combating malaria;

(*c*) No work should be undertaken without a preliminary study.

From the point of view of malaria Palestine may be roughly divided into four parallel zones stretched from North to South between the sea and the Desert of Hauran. The first zone consists of the coast from the Eastern Mediterranean shore to the first mountain range. Here numerous marshes are to be found, usually not extensive and often in relation to some water course. Fairly wide between Acre and Haifa where are the fertile fields of Djidro with its deadly climate, it narrows down to the point where Mount Carmel slopes almost to the sea and again broadens into the plain of Sharon, an interesting region whose development is prevented by another series of marshes.

Theoretically sanitation of this territory is relatively simple on account of the proximity of the sea and the natural slope thereto. At the present time, plans are projected for the basin of the Kishon near Haifa, and in connexion with the marshy territory of Djidro. It appears that there are some points which lie below sea level. However, the straightening and cleaning of the sinuous River Kishon, the cutting of a series of simple canals, the warping of those basins which are too deep to drain — a process which is rendered more practical by the presence of sand-dunes — form the sanitary scheme which, if carried out, would have a beneficent effect on the whole of the south-eastern portion of Haifa. Similar and perhaps more extensive surveys have been made for Athlit, Nezly, Sur and Hedera by Baron de Rothschild's engineers. In all these latter districts the water can be drained into the sea, land can be brought under cultivation and in the more important districts, such as Sur and Hedera, can be irrigated.

The second zone is a mountainous one cut by numerous valleys of which there is one of the greatest importance from many points

of view, and especially from that of health. It is the celebrated plain of Esdraelon, the richest in Palestine, known from time immemorial as its granary, where at the present time malaria rages with very great intensity. There are no true marshes here, nor extensive basins. There are numerous small breeding places, resulting especially from human neglect and the overgrowth of the ravines. Nearly everywhere it will be possible to establish a regular flow either towards the Kishon and the sea or towards the Jordan. Here also there would be a special advantage in combining measures of sanitation with irrigation work for intensive cultivation. The greater part of this zone is at a high level and in a good climate. In some districts malaria is, however, somewhat severe on account of the influence of neighbouring valleys.

The third zone is the Jordan basin. Here are found in deadly alliance the tropical climate, a very low level and extensive marshes. The situation is particularly serious in the North, where there is a vast marsh beginning below Mounts Lebanon and Hermon, with the sources of the Jordan, and occupying an area of 50 to 60 square kilometres. The rainfall assisted by the melting snow from the mountains of the North, East and West results in a formidable deposit of water which at the present time has no sufficient outflow and an irregular bottom, conditions which lead to the maximum intensity of malaria infection. This region, I am sure, exercises an influence on the health of the neighbourhood far beyond the sphere of influence defined in the text books.[1]

We are concerned here with an area of 50 square kilometres which must be redeemed for cultivation and almost double that area in which the deadly influence of malaria might be removed by a radical disinfection. There are here some remarkable conditions which must not be lost sight of. The river falls more than 400 metres in its 50 kilometres course. The collections of stagnant water are due to the lack of uniformity in the slope.

The Haleh marsh is nothing but an immense sponge soaked in water lying on an impermeable sub-soil. The question of draining this region has already been mooted, and Baron de Rothschild's engineers have already undertaken some levelling operations. German engineers had prepared a suitable scheme before the War based on a detailed survey, of which we have been able to discover and preserve some traces in the villages bordering Lake Merom, and without prejudice to the final conclusions which may be reached by further

[1] I have collected numerous data proving that it is important to fix an exact limit to the area of influence of breeding places on the intensity of malaria infection. Admitting Ross's law, that the number of anopheles is in inverse ratio to the square of the distance from the focus of development, it must be agreed that the influence will be felt at a very great distance when the breeding places are extensive and large in number, and also, it must be added, when there are favourable conditions for the emigration of mosquitoes.

research, we can already foresee the broad lines which this drainage must take. The feeding of this reservoir must be prevented by deep and fairly broad canals around its periphery, and the water so cut off as well as that coming from numerous individual springs must be conveyed towards the Jordan below Lake Merom. On its way the water may be used for rational irrigation. The basin itself would be drained by a network of pipes and canals, if necessary running into pools with cemented banks, which could be easily kept under survey and any larvae in them destroyed. The course of the Jordan itself would be straightened, Lake Merom dredged and probably greatly reduced, its banks being thoroughly trimmed and planted with appropriate vegetation. The neighbouring territory would be put under cultivation and by this means, together with the regular supervision of the canals, ravines and smaller basins at the edge of the Lake would certainly completely change the character of this neighbourhood.

Further to the South round the Lake of Tiberias are the little marshes of Capernaum, those of Tabha and Mejdel on the West side, of Wady es-Semakh and Samra on the East side, and the outflow of the Jordan from the Lake of Tiberias. There is a great deal of malaria in this district, but as in other parts there is a natural slope towards the lake, and since the problem is to deal with the sinuous torrents which overflow in the winter, unused springs, and the overgrown ravines, the drainage would be relatively simple. The neighbourhood of Beisan is important from our point of view, with the Yarmuk valley on the East and that of the River of Goliath, which is a deepening of the Plain of Esdraelon, on the West. There is here an extensive area of very rich soil, but a climate which at present is excessively unhealthy. Apart from the important question of the use of the Jordan for generating power, the scheme of drainage would appear to be both simple and practical. Simple canalization with extensive cultivation of the territory drained, and trimming the bed and the banks of the Jordan would be the basis of the necessary work. I shall not consider further the draining of the Jordan basin for two reasons. First because it is less well known to me, and secondly the excessive heat in the narrow valley between the Beisan region and Jericho makes its exploitation of less interest.

Other Methods of combating Malaria.

I now turn to the consideration of the methods which can be applied here and throughout Palestine in places where extensive engineering work would not be justified, or where the more exten-

sive undertakings have been decided on but have had to be postponed. The five degrees of intensity of malaria infection in Palestine indicated on page 479 above are clearly only approximate. Seasonal variations may cause a given district to appear in different categories during consecutive years. Malaria may be endemic and of little importance for a long time and then an intense epidemic may suddenly break out. Usually in this case we find one or more of the three following factors at work: (*a*) a year of heavy rain-fall and especially of early rain; (*b*) the arrival in the district of a large number of parasite carriers; (*c*) the clearing of a large area of land. A common factor seems to be necessary, and that is the influence of extensive marshes at perhaps several kilometres distance. This influence is insufficient under ordinary conditions to make itself felt but becomes of deadly import in association with other powerful factors. It is under these conditions that the minor sanitary measures are important. In my opinion they should be applied in all those districts which can be classified, as above, under III, IV, or V, but in the last two categories they must be considered as insufficient in themselves and only applicable as a temporary measure until radical sanitation can be undertaken. Without going into details I propose to sketch briefly certain of the main features of this kind of anti-malarial campaign.

Intensive treatment of reservoirs of the virus. — The treatment of malaria is undergoing at the present time a painful crisis. We see our classic creed overthrown. It is now many years since the pernicious form of the disease was attributed to *Plasmodium praecox*, but detailed scientific research only tends to show that *P. vivax* is much more difficult to eradicate by the use of quinine than is *P. praecox*.[1]

From my own experience in some parts of Palestine, where malaria is very severe and where I have been able to practise for twelve years among a stable population, I conclude that small doses often result in a complete cure, though re-infection is always possible. Large doses of quinine are to be feared on account of the comparative frequency of attacks of haemoglobinuria. Intramuscular injection of quinine is valuable where ingestion is ineffective. Intravenous injection of colloidal quinine is a valuable method of treatment in those cases where high dosage is indicated and haemoglobinuria is to be feared. I consider that intensive treatment should be interrupted from time to time in order to obtain more energetic action on the asexual forms of the parasites Provocative treatment[2] has been

[1] Acton. H. W., *Lancet*, 1920, I, 1257.
[2] Grundmann, *Archiv für Schiffs- und Tropenhygiene*, 1918, Nos. 4-5, p. 55.

found useful. Finally I have great confidence in combining quinine therapy with the use of organic preparations of arsenic and even methylene blue, this combined treatment being employed after the first stage of treatment with quinine.[1]

Quinine Prophylaxis. — This powerful weapon is, sad to say, much neglected at the present time. Even Professor Grassi and Dr. Sella did not use it in their antimalaria campaign in Fiumicino.[2]

In my opinion the prophylactic use of quinine is one of the most important means of combating malaria and one of the first that should be used. Only there are certain circumstances which compromise the results and which ought to be recognized. Such are the existence of a large number of old malaria patients who have not treated themselves for a long time, and again the frequent negligence in taking the drug, the bad quality of the quinine, and failure to secure the co-operation of the whole population. The tables given by Celli showing the fall in malaria incidence in Italy after the commencement of general quinine prophylaxis must not be forgotten. I myself have obtained extremely favourable results in certain highly malarial districts in Palestine in which, within a few months after the commencement of quinine prophylaxis, fever cases diminished by 80 per cent. Spleens were reduced in volume in a most remarkable way and regular work could be undertaken, and in many cases without any other measures.[3] It is essential, however, that the taking of quinine be compulsory, general and free.

General Hygiene. — I consider it worth while to recall an interesting article by P. Johnson and K. Gilchrist[4] in which the writers show the great differences in the action of quinine on the malaria parasite according as to whether it is taken under good or bad conditions of general hygiene. I wish particularly to draw attention to the value of cold shower baths as an important addition to other hygienic methods in the control of malaria. My considerable experience on this subject, which unfortunately cannot be placed in tabular form, gives me confidence in this method which is as simple as it is beneficial. Except in cases complicated by nephritis or heart disease this measure may always be recommended on account of the increased resistance to malaria infection which it gives to the body. If sometimes the cold douche may provoke an open crisis of latent malaria, so much the better, for it is easier to fight against the former than the latter.

[1] Vernier, *Ibid.*, Oct. 1914, p. 679.
[2] Seconda Relazione della lotta antimalarica a Fiumicino. Roma, 1920, Ministero dell'Interno, See also INTERNATIONAL JOURNAL OF PUBLIC HEALTH, 1920, I, 316.
[3] *Revue de Méd. et d'Hyg. trop.*, 1912, No. 1; 1914, No. 2; 1920, No. 3.
[4] *Lancet*, 1921, I, 108.

Destruction of Anopheles. — Numerous observations made in Palestine show the attraction of dwelling places for the anopheles. It is therefore rational to destroy these even if the destruction cannot be complete. Detailed methods may be found in the work of Dr. Sella already quoted.

Larvicidal measures constitute the strategical centre of the fight against malaria. They must be carried out very methodically and controlled with great care. The following practical propositions have been found of value in my experience: (*a*) A mixture of ordinary with crude paraffin should be used, not only to avoid too rapid evaporation, but also to ensure its being used for the purpose intended. (*b*) Paraffin should be used in larger quantities and less frequently than is usual. In this way a considerable saving both of money and time can be effected. Oiling should be carried out every 15 days in the spring and every 12 days in the summer. Further research is necessary on the oiling of hibernating larvae in the autumn. (*c*) The clearing of vegetation is a valuable aid in the destruction of larvae. (*d*) The employee in charge of the antilarval measures should be held responsible for their efficiency. (*e*) It is necessary not only to oil those places where larvae have been found, but also all similar places.

Mechanical Protection. — In my opinion this measure will never become of general use in our country. Excepting in the best educated families mechanical protection is badly contrived, inefficiently applied, and carelessly carried out.

Propaganda. — I am surprised how little this method has been used, especially in such an intelligent population as that of our country, where there is a touching confidence in medicine and in doctors. This confidence must be justified, and the instinctive resistance to every governmental measure which developed, not without reason, during the Turkish regime, must be transformed into useful co-operation. Illustrated brochures should be circulated, and special lessons given in all the schools with demonstrations of the transformation of the mosquito's egg into larva and imago. Finally special prizes (they need not be of great value) for the discovery of breeding places afford valuable assistance. I have said nothing of lantern lectures, etc., which are only occasionally applicable, but which have given great satisfaction amongst the Jewish colonies in Palestine.

Conclusions.

Organization. — (1) An antimalaria service should be established in Galilee with offices for engineering and for sanitary research. (2) Minor measures should immediately be put in practice, beginning

with quinine prophylaxis and the use of larvicides in the various regions where malaria is more serious. (3) As soon as the appropriate investigations of engineers and health officers are completed and a practical scheme for sanitation has been drawn up, a contract would be made for the carrying out of the scheme, account being taken of the Turkish law by which unused land of a marshy nature may be allotted to those who have drained it. (4) A central antimalaria office should be founded in Palestine with a medical council and the assistance of engineers and agriculturists, and with an appropriate and competent personnel. (5) The malaria work must be distinct from the ordinary work of the department of health, having its own budget and personnel, though naturally the final control of the campaign would be the responsibility of the Government Health Department.

Finance — Where is the money to be found for such an extensive campaign ? In the first place it must be fairly understood that the money expended will be placed in a safe and profitable investment. The enormous impetus which this programme will give to agriculture, industry and commerce, to the whole social life of the country, especially by encouraging immigration, cannot be doubted. The value of labour and of land will greatly increase, especially in those districts where at present regular labour is made impossible by the climate. New companies will be formed and new communications opened up. The burden of the expenditure might be distributed as follows:

1. The extensive engineering work should be contracted for on the basis outlined above of payment in land for the labour of drainage.

2. The quinine will be provided by the State on the plan formulated by Celli for the Italian campaign. Wherever the antimalaria unit shall consider necessary, the quinine will be distributed free, but will be paid for by the owners of the land, who will be the first to profit from the effects of the distribution.

3. For the remainder of the expense necessary to this campaign may we not rely upon the help and good-will of those societies which are interested in the future of Palestine or in the public health of all countries of the world ? *Fiat !*

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This is a piece of reasoned and reasonable special pleading by one whose thirty years' work in Palestine has left him with the certainty that his country has a great future if malaria can be eliminated. He formulates a scheme of control, of which the essential elements are (1) a trigonometrical, malarial and geological survey aimed at correlating the requirements of sanitation and agriculture; (2) the collection of morbidity and mortality statistics; and (3) an Anopheline survey in all its phases. A sanitary engineering and a sanitary medical service, adequately equipped and working with agricultural authorities, could utilize the favourable natural drainage of the country. By taking advantage of the Turkish law that unused marsh land becomes the property of him who drains it, there would be strong inducement for the finding of the funds necessary for this purpose. Those who own the land should pay for the free distribution of quinine by the State, the drug having in the writer's experience, proved to be an effective prophylactic. For the rest of the requisite funds an appeal is made to those who have at heart the welfare of Palestine and of the human race generally.

C. L.

i. LÓPEZ (J. A.). [Malaria and Tuberculosis.]—*Semana Médica.* Buenos Aires. 1921. May 12. Vol. 28. No. 19. p. 550. [Summarized in *Jl. Amer. Med. Assoc.* 1921. July 30. Vol. 77. No. 5. p. 412.]

ii. SUGIYAMA (S.). On Nervous Otalgia preceding the Paroxysm of Malaria.—*Taiwan Igakkai Zasshi (Jl. of the Med. Assoc. of Formosa).* 1921. May 31. No. 216. (English summary, p. 2.) [In Japanese.]

iii. JIMÉNEZ (R.) & PITTALUGA (G.). [Malaria recurs after Splenectomy.]—*Arch. de Cardiología y Hematología.* Madrid. 1921. June. Vol. 2. No. 6. p. 233. [Summarized in *Jl. Amer. Med. Assoc.* 1921. Sept. 10. Vol. 77. No. 11. p. 896.]

i. "López relates that in his experience with three generations of army recruits, he has frequently found that young men with a history of old malaria did not respond properly to quinin, and certain minor signs suggested superposed tuberculosis. Applying Vitón's tuberculin therapy with the minutest doses, supplemented with an antituberculosis vaccine, these men recovered, throwing off both the symptoms suspicious of tuberculosis and the malaria as well."

ii. "The author . . . . describes in detail two cases of his latest experience who had severe ear-ache as a prodrome to malaria, that disappeared together with the paroxysm upon chinin treatment."

iii. "The woman of 31 had been apparently long cured of the tertian malaria but it flared up anew after removal of the enlarged spleen."

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