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REPORT OF AN OUTBREAK OF MALARIA IN SALINAS, PORTO RICO

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Early in February of this year a malaria epidemic occurred in Salinas, a town situated on the southern coast of Porto Rico.

The Malaria Unit of the Department of Health under my direction, moved at once to the place to take charge of the situation. We stayed there for one month, during which time I had the opportunity to observe and to treat 510 cases. The measures adopted promptly checked the spread of the epidemic with the result that not a single death was registered.

Blood samples of 472 of these patients were examined by the microscopist, and the parasites found were classified as follows: Vivax, 192; Falciparum, 173; Falciparum and Vivax, 5; Quartan, 3. The percentage of Falciparum found was 36.6 which is much higher than that observed in Fajardo, the zone of control, during the same month. Many of the cases of pernicious malaria which occurred in this town may be attributed to Falciparum parasites. It was found, moreover, that twenty-six of these patients were Gamete carriers, thus demonstrating that there is a considerable number of infected persons in this town who are carriers and who are in a condition to transmit the malarial infection through the *Anopheles* mosquito. It was also proved that the majority of the cases were, without doubt, suffering relapses from previous, rather than from recent infections. Usually these patients do not receive adequate treatment and for this reason suffer frequent relapses.

In spite of the terrific drought which has been felt in this region for a long time, we found many *Anopheles* mosquito breeding places in spots favorable to their development: irrigation canals, wells, ditches and swamps. All the breeding places that were found within one kilometer, more or less, from the city were petrolled.

A great many of the *Anopheles albimanus* specie were found in the stations established for the extermination of mosquitoes which are marked on the accompanying map with a cross. This specie we know, is the most important vector of the malaria parasite.

Desiring to obtain a more exact idea of the malaria situation in Salinas, I decided to take a census in the three indices: Historical, splenic, parasitic. First of all, 647 school children were examined. As yet I am not ready to submit a final report, but it may be of interest to note that about thirty-two per cent of these children were found to have enlargement of the spleen; some to very extreme dimensions. These children are suffering from chronic malaria.

It is obvious that if success is to be obtained in curing these children as well as the other patients, an active, systematic and prolonged curative and preventive campaign is absolutely necessary. At the same time the extermination of the *Anopheles* mosquito is imperative. This work involves a long and consecutive period of time and in addition to the help that the Insular Government can give, it requires the decided cooperation on the part of the patients in carrying out the plan of treatment, as well as that of landowners in observing our indications as to the drainage of their lands. This last, being of vital importance, should not be overlooked.

As a fundamental step to insure a successful anti-malarial campaign in this town, I believe that the people who are now living in the settlements known as "Playita", and "Arenales" should be moved to a healthy region. These settlements are situated in zones where the drainage of the land is impracticable from an economic standpoint, and unless this change is effected we cannot expect our work to be successful, for though the persons living in these places are treated and cured they remain exposed to new infections which cannot be prevented due to the limited funds with which we have to work.

I submit below an extract from the report of the engineer Pedro M. Otero, as to the topography and sanitary conditions existent in Salinas. The map which accompanies the statement, demonstrates clearly that besides the mangrove swamps and strips of sand, there is a flat, marshy section (marked on the map by a dotted line). In this region great quantities of water accumulate during the rainy season which remain stagnant weeks and months. After this swampy section, there is a strip of rich alluvial soil, wider in some parts than in others, and following these lowlands are hills of increasing altitude that finally form the highest point of the Island.

The Lapa river flows from north to south into the Caribbean Sea, crossing the rich alluvial soil, and passing along the west side of the town of Salinas. This river is usually dry and its bed may be seen. In fact, at times it is hard to believe that during the ordinary heavy

rains it has a depth of ten feet and is fifty feet wide, with a velocity of five feet per second.

The lowlands are very rich in nitrates and contain a large quantity of vegetable mould (humus). The earth is porous and receives great quantities of water before it becomes well saturated. This state of porosity is due largely to the fact that rains are not frequent in this section of the Island. Nearly all the months of the year are warm and there is little moisture and much evaporation so that the land filters all the water it receives. The top soil is generally calcareous, composed of carbonate of lime with other mineral substances. There is no doubt that the entire strip of land to which we refer is crossed by undercurrents of water more or less potable, at a profundity of thirty feet. Therefore, a large number of powerful pumps have been installed on this strip of land, which operate hundreds of artesian wells and in this way supply millions of gallons of water for agricultural purposes. Nearly all the cultivable soil is devoted to sugar cane.

In the accompanying map it may be noted that in addition to the town of Salinas, the villages of Borinquen, Caño Verde, Las Marías and other settlements near Salinas which are situated on dry land, there are other places such as Arenales, La Playa, La Playita and Las Mareas which are established upon swampy land. The shacks in these settlements are built of cocoanut-palm branches (with a few exceptions) and do not meet a single requirement as set forth in Sanitary Regulation No. 14, which deals with the construction and maintenance of dwellings in a hygienic condition. The four last-named places should be completely destroyed as soon as possible, as they are located in very unhealthful regions; and the inhabitants should be moved to a place where they could have more hygienic homes and live less exposed to infection.

As has been said, the topography of Salinas and its surroundings is flat. It has depressions here and there, and during the rainy season these depressions are filled with stagnant water and as they take weeks and months to filter or evaporate, they thus form ideal breeding places for the *Anophele mosquito*. Were rains abundant here it would be impossible to live in this part of the Island. Fortunately, droughts occur frequently and are prolonged; consequently the breeding places are comparatively scarce, the only important ones being the irrigation canals, the mangrove swamps, some pools found here and there, and the last 800 or 1,000 meters of the Lapa river in which water is to be found all the year.

The settlements alluded to are groups of huts with the exception of a house or two among them. This being the case, it is still easier to consider moving their inhabitants. Each settlement has about seventy huts and they are situated about one and a half kilometers from the town. This fact leads us to believe that the careful consideration of establishing a workmen's settlement with all the necessary hygienic conditions such as have already been established in other towns of the Island would be desirable. If this project could be carried out those living in Las Mareas, a settlement six or seven kilometers from the town, could also be moved, for these people as well as those already mentioned live in regions which would be economically impracticable to drain.

It is also necessary to prohibit further construction in these regions. If these settlements increase in size the number of cases of malaria will also increase; therefore the construction of huts near the marsh lands should be prohibited. Taking into account this fact and realizing that radical steps must be taken to improve conditions, the Chief of Sanitation at Salinas has been instructed to prohibit all construction, reconstruction or repairs.

The problem of moving the settlements is somewhat serious. In considering the cost of establishing a workmen's district in a locality which would be separated from the unhealthy regions under discussion, we must take into account that each settlement has seventy shacks, and that as there are four such groups the total number of shacks is 280. Supposing that three hundred houses were constructed, each house should have a lot of no less than ten by twelve meters or 120 square meters for each house, with an additional twenty-five per cent of land for the streets, which makes a total of 45,000 square meters for three hundred houses which is equivalent to 11.25 acres of land.

In addition to the cost of land, an expenditure of \$10,000 would be needed for the construction of streets, installation of an aqueduct and for other matters. The cost of each house would be \$200, which would make a total cost of \$60,000 for three hundred houses.



Within this line numerous anopheline Mosquito breeding places were destroyed by oiling.

C A R I B B E A N
S E A

LEGEND

- Public Schools
- X Stations where numerous Adult Anopheline Mosquitoes were caught.
- A Railroad Station.

Land between this line and Mangrove Swamp is very low and swampy.

GOVERNMENT OF PORTO RICO
 DEPARTMENT OF HEALTH
 BUREAU OF MALARIA

SKETCH MAP OF SALINAS CITY AND SURROUNDINGS

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