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TROPICAL SANITATION IN ITS RELATION TO GENERAL SANITATION *

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As this evening I am speaking to health officers, I shall dwell more particularly on matters which have forced themselves on my attention during a lifetime spent in most active health work. From long experience, certain convictions have been gradually forced upon me as basic in all health work. These basic facts have not been generally recognized, as far as my experience goes. To make my argument clear, I shall run briefly over my own experience in this field.

The great awakening in tropical sanitation which has taken place in the last twenty years began with the Spanish-American War. For the last three or four hundred years it has been known by Europeans that military expeditions involving any large bodies of white troops could not be undertaken in the tropics on account of the great loss from disease. In the many cases in which such campaigns had been undertaken, they had failed on account of the loss of life caused by, and the disability due to, tropical diseases. These tropical diseases in the Western hemisphere were chiefly yellow fever and malarial fever.●

It is astounding to the military sanitarian of the present day to read of the losses caused by yellow fever to military expeditions in the West Indies. One can hardly believe the loss reported as possible. The English Army in the Windward Islands in 1794 under Sir Charles Grey, out of a total strength of 12,000 men, lost 6,000. The French Army in Santo Domingo in 1798, out of a total strength of 25,000, lost over 22,000 from yellow fever. Again in 1802 the French Army in Santo Domingo, out of a total strength of 40,000, lost 20,000. Where it prevailed it was equally fatal to civil populations. Yellow fever has many times ravaged the United States, and still more severely affected Spain. In 1798 Philadelphia, out of a population of 20,000 inhabitants who remained in the city, lost 4,000. New York City, out of a population of 50,000 in 1798, lost 2,500. New Orleans, out of a population of 100,000, lost, in 1853, 8,000 of its citizens. Spain in 1800 lost 60,000 people from yellow fever, and again in 1804, 50,000. Barcelona in 1821, of a population of 70,000, lost 16,000. Gibraltar in 1804, with a population of 10,000, lost 6,000.

These figures give some idea of the disease in its bad form. Yellow fever, like syphilis, was an Ameri-

can disease and was not known to Europeans before the discovery of America by Columbus. The severity of yellow fever is such that it has prevented successful colonization by Europeans in countries where it can become endemic.

About the beginning of the nineteenth century it looked as if yellow fever was about to spread over the whole known world. If the manner in which yellow fever became epidemic in Spain is any measure of the manner in which it would affect China and India, some idea of these conditions can be imagined. About the middle of the nineteenth century the area affected by yellow fever began to decline, and it has since then continued to contract till at the present time it has almost become extinct.

All during the nineteenth century the United States was so frequently ravaged by epidemics of yellow fever, and so great loss of life and loss of wealth had been thereby brought about, that the people were willing to go to great expense or submit to drastic measures for the purpose of getting protection from the disease. It was very evident to sanitarians who had given any study to the matter that the epidemics which affected the United States were imported from the endemic focus, which had existed at Havana, Cuba, for the preceding 150 years. The United States was, therefore, very anxious to get rid of Havana as an endemic focus.

When we came into possession of this city in 1898, as a result of the Spanish-American War, every endeavor was made by the authorities to eradicate yellow fever. The whole attention and force of the government were centered on the effort to clean up the city. Yellow fever was then believed to be the best example of a disease caused by filth. In 1900, two years after our occupation, Havana was one of the cleanest cities in the world. But yellow fever was worse than it had been for several years. I, at this time, was health officer of the city under the military governor. The authorities were at their wits' ends and knew not what to try. The Cubans were very much inclined to poke fun at us and at our extraordinary ideas on the subject of sanitation.

I one day overheard a conversation on this subject between a Cuban man and his wife. A large tenement-house had been emptied of its inhabitants for the purpose of cleaning and disinfecting. The families were sitting around on their household goods in all degrees of discontent and irritation. Both husband and wife criticized the eccentric Americans very freely. The wife began to advance some extenuating circumstances—that after all the cranky Americans would leave their house clean and free from bugs. The husband took the ground that the Americans had a

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right to be as cranky and clean as they wished as long as they applied it to themselves, but when they attempted to force their crankiness and their cleanliness on free-born Cubans things had gone entirely too far.

The Havanese population as a whole were very patient under our rigid sanitary measures. I shall always remember with kindness and affection their good natured attitude toward the sanitary department during the four years I spent in their midst as health officer of the city.

A distinguished physician of Havana, Dr. Carlos Finlay, had been maintaining for the previous twenty years that yellow fever was conveyed from man to man by a certain species of mosquito, the *stegomyia*. From the known facts with regard to yellow fever and from the life history of this species of mosquito, Dr. Finlay had reached this conclusion by a most logical and interesting argument. Dr. Finlay has died in Havana within the last month at the ripe old age of 82. He is one of the great men in medicine who lived long enough to see his work recognized.

The army board, consisting of Reed, Lazear, Carroll and Agramonte, took up in 1900 the investigation of the question of the transmission of yellow fever by the mosquito. They carried to conclusion one of the most mathematical demonstrations ever accomplished in medicine. They placed men out in the country near Havana, so guarded that it was impossible for them to contract yellow fever from their surroundings. They then took the female *stegomyia* mosquito, allowed her to sting men sick with yellow fever, and then bite the men in this camp. The men bitten developed yellow fever. They then took material soiled by yellow fever patients in every possible manner; had men sleep in rooms filled with this material for weeks at a time. No one contracted yellow fever in this way. They took the blood of yellow fever patients and injected it into well men. They developed yellow fever. They took the blood of a yellow fever patient and passed it through a filter that would stop any particle large enough to be seen by a microscope of the highest power. This filtered blood, when injected into the circulation of a well man, still gave yellow fever. They heated the blood of a yellow fever patient and then injected it into the circulation of a well man. The man did not develop yellow fever. They took the blood of a yellow fever patient who had developed yellow fever as the result of the hypodermic injection of blood from a preceding yellow fever case. This blood caused yellow fever in the man into whose circulation it had been injected. This board, as the result of their labors, published the following very important conclusions:

Yellow fever is conveyed from man to man by the bite of the female *stegomyia* mosquito, and, in Nature, is probably conveyed in no other way. The disease is not conveyed by fomites of any kind. The disease is transferred by a parasite circulating in the blood and not by a toxin. This parasite is too small to be seen by the highest powered microscope then in use, and is killed by being heated. The parasite lives in the blood of the patient only during the first three days of the disease, and, therefore, the mosquito can be infected only during that time. It takes from twelve to twenty days for the parasite to go through its development in the mosquito and pass from the stomach to the salivary glands of the insect. Therefore, the mos-

quito is harmless for the first twelve days after biting the man sick of yellow fever.

The sanitary department of Havana took these important announcements of this board, and worked out the measures whereby they might be made of practicable effect in our fight against yellow fever. We established a quarantine whereby all infected ships or persons coming into the harbor of Havana were cared for, and a system of inspection whereby all such persons coming in by land were looked after. Our inspectors also saw daily at Panama every individual liable to yellow fever. A yellow fever patient was so screened and cared for that the *stegomyia* could not bite him. The attempt was made to kill by fumigating all mosquitoes that might have become infected from each case. And, finally, the attempt was made to destroy all mosquito larvae breeding anywhere within the city limits.

In the long run we found the destruction of the larvae to be a measure of more importance than all the other measures put together.

We commenced our antimosquito work at Havana in February, 1901. The last case of yellow fever in the city occurred in September of the same year. Havana had been the great endemic focus of yellow fever for all the Northern hemisphere during the preceding 150 years. Since the extinction of yellow fever in Havana, fourteen years ago, this disease has practically disappeared from the Northern hemisphere.

In 1898 Sir Ronald Ross of the English army had demonstrated that malaria was conveyed from man to man by another species of mosquito, the *anopheles*. He and other workers had established much the same condition as to the transfer of malaria as I have just described with regard to yellow fever. It was evident to the sanitary authorities, therefore, that a very slight extension of the work against yellow fever ought to cover work against malaria. This has turned out to be the case. Malaria rapidly decreased with the inauguration of the antimosquito work, and has since become practically extinct.

In 1904 our government undertook the construction of the Panama Canal. On account of the success of the work at Havana, I was placed in charge of sanitation at Panama. I succeeded in getting a good many of the men who had acquired experience in the work at Havana to come to Panama. These men were of inestimable value not only in the active organization of the work, but also in stemming the tide of fear, discouragement and hopelessness which existed on the isthmus during the first two years of our work there. Many of you here can understand what a moral support it is to a health officer to have twenty-five or thirty loyal men behind him. These men had been through similar work at Havana and knew that we were bound to succeed if we could only hold on long enough and convince our superiors that we were on the right track. But for a period in 1905, when yellow fever was at its height, we found ourselves working among a panic-stricken population who believed that we were cranks and fools. Our superiors on the isthmus at this time had become affected by the prevailing panic and were reporting to the authorities at Washington that our work had failed and were asking that we be relieved, and that men more practical and sane replace us.

This report would have ended sanitary work at Panama along the lines of modern tropical sanitation had it been acted upon.

For two years succeeding this time we were given the loyal support of our superiors, and by the middle of 1907 the work was accomplished. The request for our dismissal was made by the commission in June, 1905. In September, 1905, the last case of yellow fever occurred in the city of Panama, and only one case has occurred in the Republic of Panama since that time. All health conditions rapidly improved, and soon the isthmus, as to health, would compare favorably with many parts of the United States.

The eradication of yellow fever and the control of certain other diseases was undoubtedly due to the special sanitary measures taken against these diseases. But these special measures could have had no effect on the general health conditions. For the last fifteen years I have given a great deal of thought to this matter. What did we do at Havana and Panama to cause the great general improvement in health conditions which took place shortly after our arrival at both places, and has since continued?

At Panama shortly after our arrival we increased the wages of the common laborers from 11 cents an hour to 20 cents an hour. This was nearly four times the wages of the laborers in the surrounding countries. He knew that every fourth man would die each year of diseases prevalent on the isthmus, and it took strong inducements to get him to come at all.

If we paid the citizen of a foreign country four times the wages he got at home, we naturally had to increase largely the pay of American citizens whom we wished to get to come to the isthmus. This caused a steady increase in wages all along the line. During 1904 and 1905 this increase of wages was going on all the time. Every time a prominent official died of yellow fever it would cause a stampede in the force. We would have to offer inducements to get the old men to come back and to get new men to come in the places of those who would not come back for any inducements. If yellow fever had continued, we would still be raising wages on the isthmus. This large increase in wages caused a great general improvement in all living conditions—more room to live in, better food and better clothing. I am satisfied that to this improvement in social conditions, caused by our high wages, we owe principally our extraordinary improvement in general health conditions. It is a health officer's duty to urge forward those measures in his community which will control individual diseases; but my long experience has taught me that it is still more his duty to take that broader view of life which goes to the root of bad hygiene, and do what he can to elevate the general social conditions of his community. This, my experience has taught me, can best be accomplished by increasing wages. Such measures tend at the same time to alleviate the poverty, misery and suffering which are occurring among the poorest classes everywhere in modern communities. At Panama we increased wages by edict of the government. But our government got this money by taxing the people of the United States. It would have been of little benefit to our laborers if we had increased their wages by 10 cents an hour and then taxed them by 10 cents an hour in order to raise this money.

Such would be the result in the United States if we attempted to increase wages here by edict of the government as we did in Panama. Such increase would be of no benefit to the laborer.

Natural, just and proper wages are just what each man produces, not a cent more or a cent less. We can

look back in the history of our own country and see that this condition of affairs was approximated in the early settlement of the country. A man coming to this country would take up land for which he paid nothing, and his wages were all he produced on that land. After a while all the land is taken up and the next man who comes has to work for some one else. Later a great many more men come, and these men bid against each other for work, and thus force down wages. This has gone on in the United States, and in all other civilized countries, till at the present time all producers get much less than natural wages, that is, what they produce.

Can this unfortunate and undesirable condition of wages be rectified?

Suppose an area of land as great in extent, and as fertile in production as the present Mississippi Valley, should tomorrow rise from the bottom of the Atlantic Ocean off the coast of Long Island. Suppose the United States should own this island and offer it to its citizens under our present homestead laws. Thousands of the citizens of New York would flock there and take up this land. These wages would be natural wages. Each man would get all that he produced: this would be very much in excess of the wages now given in New York. All the poverty, sickness and degradation caused at present by low wages would be rapidly ameliorated. The man who was so fortunate as to be appointed health officer for this island would in a few years be able to publish the most astounding health reports.

It is entirely possible for us to raise from the bottom of the sea just such an island as I have described. In every town and county in New York a large part of the lands are unused or only partially used. If this large body of unused land could be brought into use, the effect on the health conditions of New York would be exactly the same as would be produced by raising the island I have described.

Can these unused lands be brought into use? If these unused lands were taxed to such an extent that the owners would have to use them to the fullest extent in order that they might pay the taxes, is there any doubt as to what the result would be? All unused lands would soon be utilized to their fullest extent. The only way of making any profit from them would be to so use them. It would be a very losing venture not to use them to their fullest extent.

I have been fortunate enough to labor as health officer in a field in which very great health results have been produced; but they would be small as compared with the health results which will be produced by securing for mankind natural wages. It stirs my enthusiasm to think of what glorious opportunities are before the young health officer just commencing life. I have spent my sanitary life killing tropical mosquitoes, and I hope have thereby benefited my fellow-man. I would give a good deal to spend another sanitary life in the ranks of the coming generation of health officers doing my share in the fight that is on us, the fight for the greatest of all sanitary measures, natural wages.

Health, Social Service and Government.—The higher ethical standards and the broad humanitarianism which have developed among large masses of the people, in these recent years, demand that the health and social service activities of the government shall be absolutely divorced from politics.—Governor Charles S. Whitman of New York.