

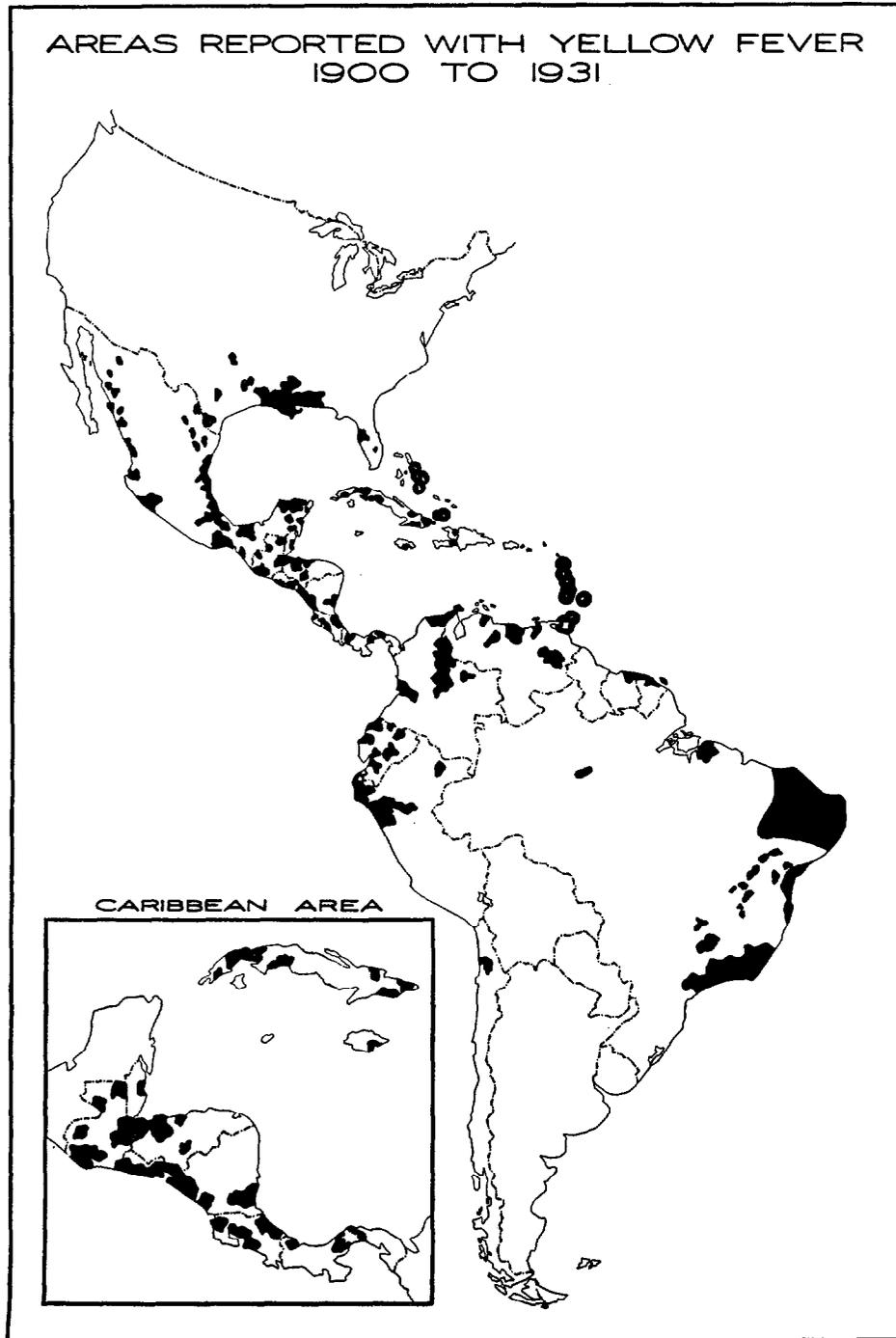
## THE UNFINISHED BUSINESS WITH YELLOW FEVER

DR. FRED L. SOPER

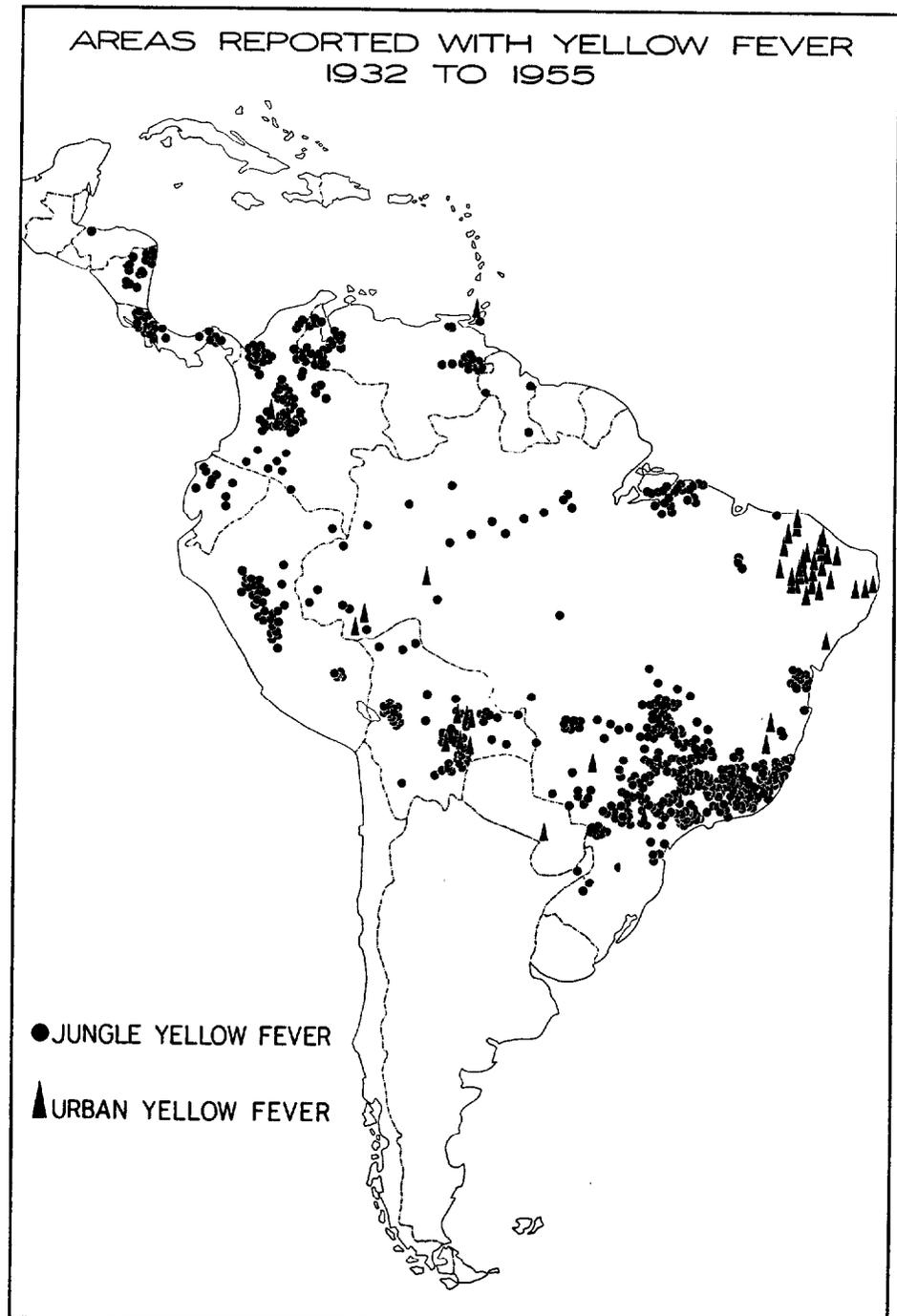
Director, Pan American Sanitary Bureau; Regional Director, World Health Organization for the Americas. Formerly Member of the Staff, International Health Division, The Rockefeller Foundation (1920-1950), formerly Director, Rockefeller Foundation Health Commission Typhus Team, Preeminent health administrator of our time. He is known for his vast and successful campaigns in species eradication of mosquitoes (*Anopheles gambiae* and *Aedes aegypti*) and for the execution of gigantic programs in the control of yellow fever, malaria, and typhus.

The contributors to this symposium, with an accumulated experience in the study and control of yellow fever of well over a century, are glorifying the victories over yellow fever since Carlos J. Finlay first expounded the theory of mosquito transmission. But during this year, 1955, fatal yellow fever cases have been reported from four American nations and from five to eight countries have reported outbreaks each year during the past decade. The experiences of Trinidad and of Central America already discussed show that a year or even a decade is not an adequate period of negative observation on which to discount the possibility of the reappearance of yellow fever, especially in the absence of careful, continuing epidemiological studies.

In Map 1 the areas of the Americas known to have had yellow fever during the period 1900 to 1931 are indicated. It must be assumed that all of the observed outbreaks reported during this period were *aegypti*-transmitted urban yellow fever, since jungle yellow fever was first definitely identified in 1932. It will be noted that reported yellow fever previous to 1932 was mostly coastal in its distribution and largely around the peripheries of South America and of the Caribbean. Map 2 shows the recognized distribution of yellow fever from 1932 to 1955, classified as urban *aegypti*-transmitted yellow fever and as jungle yellow fever. It will be noted that during this period the general distribution of yellow fever is more central than peripheral and that, except for a cluster of *aegypti*-transmitted outbreaks in North East Brazil, *aegypti*-transmission was reported only at isolated, individual points lying close to infected jungle areas. The cluster of *aegypti*-transmitted outbreaks in North East Brazil, together formed the last manifestation of endemic *aegypti*-transmitted yellow fever in the Americas which disappeared in 1934, following the organization of a rural *aegypti* eradication campaign. Had it not been for the existence of jungle yellow fever as a source of reinfection of cities and towns, the Gorgas-Rose dream of yellow fever eradication in the Americas would have come true two decades ago.



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Special emphasis should be given to the scattered *aegypti* outbreaks shown, since *aegypti*-transmitted yellow fever always constitutes a threat to such towns and cities as still harbor this mosquito. *Aegypti*-transmitted yellow fever tends to spread along the routes of human travel, whereas jungle yellow fever generally moves from place to place independently of human passengers. When yellow fever comes to town, its danger is greatly increased, especially if the town be a travel center or a port city.

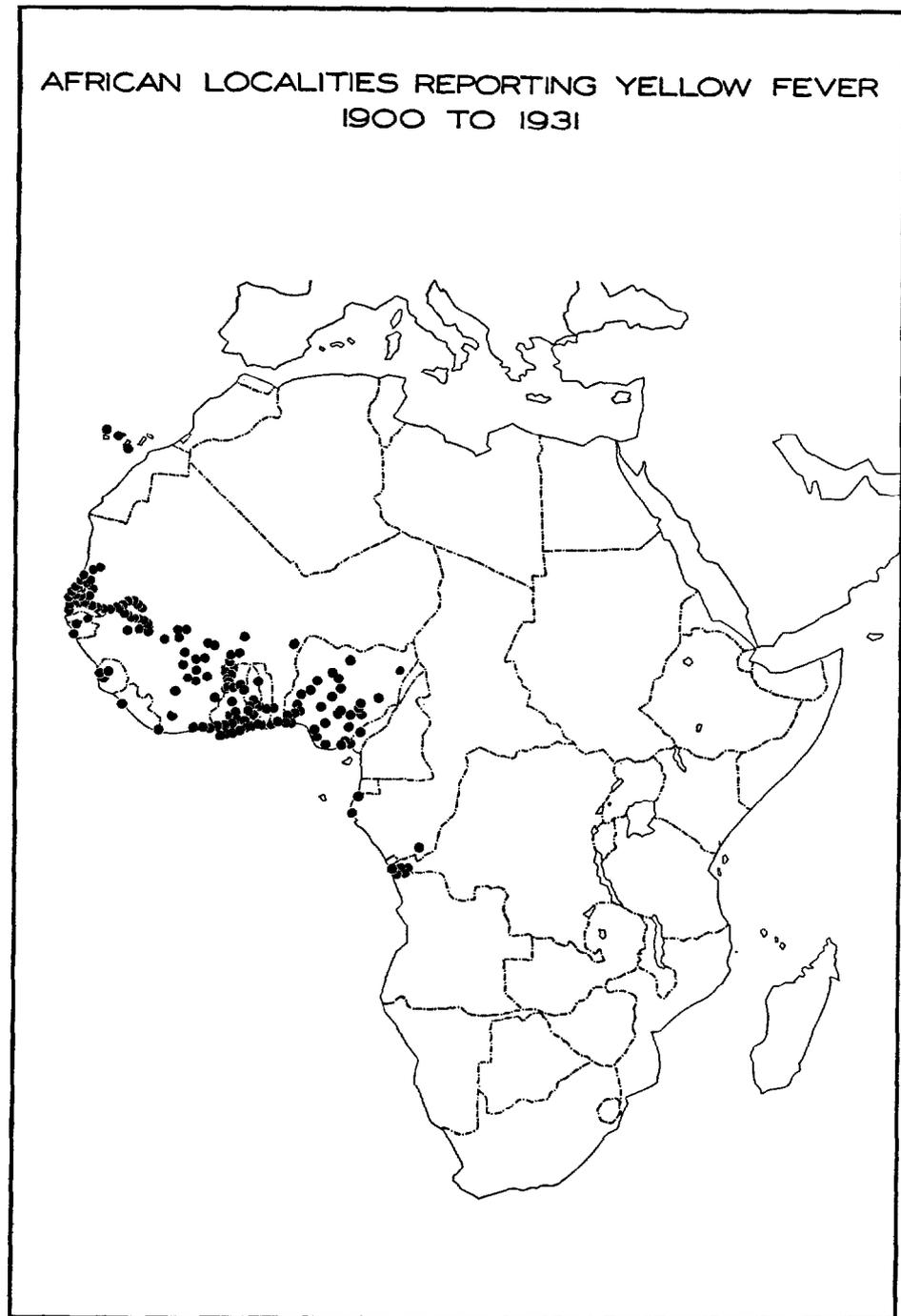
Only part of the yellow fever problem is in the Americas; Map 3 shows the reported occurrence of yellow fever in Africa from 1900 to 1931. It will be noted that this distribution is very limited and is essentially coastal — West coastal in fact. Map 4 shows the reported occurrence of yellow fever in Africa from 1932 to 1955. In Africa, as in America, the introduction of modern methods of study and diagnosis of yellow fever has opened up a whole continent-wide distribution of unrecognized yellow fever. I would point out that there is one basic difference in the information available from Africa and that in the Americas. In South America and in Central America there have been organized routine viscerotomy services for the collection of liver specimens from people dying after less than eleven days of illness, people who were not suspected of yellow fever, with the result that a great deal of otherwise silent yellow fever has been uncovered in the Americas, a type of yellow fever which is very seldom being diagnosed in Africa. The maps are not exactly comparable but the important thing is that the yellow fever area of Africa was much more extensive and continues to be much more extensive than was realized previous to the investigation on jungle yellow fever.

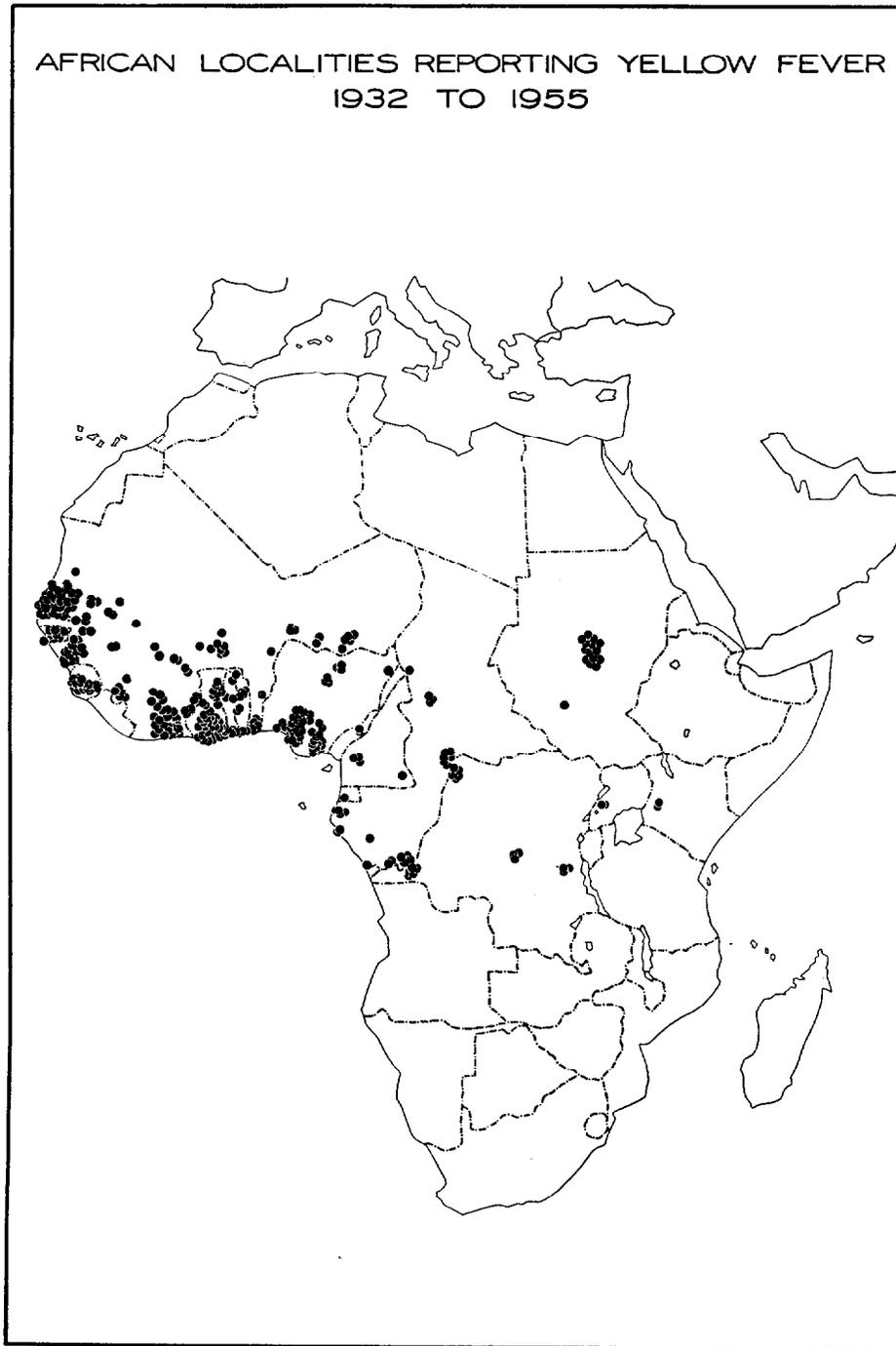
In Africa, as in the Americas, this widespread infection is a jungle infection in which man plays only a secondary role. Although there are differences in the jungle yellow fever of Africa and of the Americas, they are alike in that they were not recognized previous to the development of precision tools such as the neutralization test and viscerotomy for the certain diagnosis of past and actual present infections of yellow fever virus. Only in the general area of West Africa have *aegypti*-transmitted outbreaks occurred and to date yellow fever has never caused urban outbreaks in Central or East Africa, nor has it shown any tendency to spread to Asia.

In the Americas the early reports of jungle yellow fever were met with a great deal of skepticism. In an exchange of correspondence with Dr. C. E. Finlay some years ago, I said that I, better than most, could appreciate the difficulty his father had faced in convincing the world that yellow fever is transmitted by the *aegypti* mosquito because of the difficulty I had in convincing the same world that yellow fever is at times not transmitted by the same mosquito but transmitted by others.

Now that the existence of non-*aegypti* transmitted yellow fever is freely admitted by all, there continues great difficulty in getting recognition of the

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fact that although jungle yellow fever is clinically, etiologically, pathologically and serologically indistinguishable from urban yellow fever, epidemiologically the two diseases are quite distinct and constitute entirely different problems from the standpoint of local prevention and international sanitary regulations. It is scarcely an exaggeration to say that urban and jungle yellow fever are as definitely distinct problems as are maritime-port plague and the so-called sylvatic plague of the Western United States.

The failure to recognize this difference between urban and jungle yellow fever is largely responsible for the persisting fear of the invasion of Asia by yellow fever, which has caused so much difficulty in recent years in getting full agreement on the WHO International Sanitary Regulations.

The fear of the possible invasion of Asia by yellow fever following the opening of the Panama Canal to interocean traffic in 1914, influenced the then newly incorporated Rockefeller Foundation to undertake the eradication of yellow fever in the Americas.

When, forty years ago this year, Wickliffe Rose, the first Director of the International Health Board, and William Gorgas, the Surgeon-General of the United States Army, joined hands in the program to eradicate yellow fever from the Americas, a new concept in international health was born. This concept calls for the coordination of the measures against a communicable disease wherever it may occur in a region until the seedbeds of infection have been eliminated and the infective agent itself has disappeared for the benefit not only of the infected and uninfected countries of the region but also for the protection of exposed regions which may lie on the other side of the world.

The eradication concept which was developed to meet the situation created by improvement of steamship movement from the Atlantic to the Pacific through the Panama Canal, is much more important in relation to the development of rapid air travel than it is in relation to shipping. More and more emphasis will be given to the solution of most international health problems at their source as time goes by.

The discovery of jungle yellow fever as a source of reinfection of cities with yellow fever virus dissipated the dream of eradicating yellow fever as an infection but the eradication concept remained. With the demonstration, in 1933, that the urban and maritime vector of yellow fever, the *Aedes aegypti* mosquito, can be eradicated, there began the development of nation-wide campaigns for the eradication of this vector in various countries of South America. The initial skepticism with which reports of the species eradication of *aegypti* was received, was largely dispelled by the dramatic eradication of *Anopheles gambiae* from North East Brazil in 1939-40 and species-eradication became a respectable term in public health circles.

The eradication concept has forced the public health worker to reorient the evaluation of his success in handling preventable disease. Once he admits

that a disease is preventable and takes credit for such reduction as may have occurred from previously higher levels, he must be ready to explain the remaining incidence and the failure to bring that incidence down to zero.

In the light of the eradication concept, let us look at what unfinished business remains before the cities and towns of the Americas are guaranteed against invasion by yellow fever, before rural and jungle populations are protected, and before all danger of spread to presently noninfected areas of the world has disappeared.

The unfinished business of protecting permanently all cities and towns and certain limited rural areas in Brazil, Colombia and Mexico can be accomplished by completing the present program for the eradication of the *Aedes aegypti* mosquito in the Americas. Already well advanced or terminated in most countries, the campaign for the eradication of *aegypti* can be said to have only begun in Argentina and Mexico and to have been very largely ignored in the United States.

The United States is practically alone in its failure to initiate *aegypti* eradication. This country is fairly well protected by eradication of *aegypti* in cities close to jungle yellow fever areas but this protection will disappear should these cities be reinfested with *aegypti* from the United States itself.

Not only is the United States threatening its own future but is failing to live up to the first application of the eradication concept on a regional basis. And this concept will surely be of tremendous interest to the United States in getting the collaboration of other countries in handling other health problems on a regional or world-wide basis in the future.

I cannot forbear quoting from the Annual Report of the Surgeon-General of the Marine Hospital Service of the U. S., as the USPHS was then known, for 1895.

The coast of Florida was patrolled by four revenue cutters carrying medical sanitary inspectors of the Marine Hospital Service to intercept fishing smacks which traveled down the coast of Florida, coming direct from Cuba, with no intent of entering legally any port of entry, but with the intent of smuggling, and also for the purpose of intercepting any returning filibustering expeditions or refugees from the island of Cuba seeking to land surreptitiously. Medical inspectors were stationed permanently in Havana, Santiago, and inspectors were also sent to every seaport of Cuba to make reports to the Bureau on the prevalence of yellow fever therein. Special inspections were made of the South Atlantic and the Gulf quarantine stations. All possible defects in administration or appliances were corrected and the whole corps of quarantine officers of this portion of the United States were made to feel the necessity of extra vigilance. Fortunately, no case of yellow fever landed upon the coast. In Cuba today there is a very active program for the eradication of

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the *Aedes aegypti* mosquito from the island and, I imagine that, if the lack of activity continues in the United States, the Director of National Health Services of Cuba might very well, a few years hence, report on similar activities on behalf of the Cuban Government patrolling the waters between the United States and Cuba to prevent the reinfestation of the island by the mosquito which has been so expensively eradicated from that island.

I now turn to page 428 of the same report from 1895, and I quote: "In closing . . . my report relating to yellow fever, it remains to be said that immunity to this dread pestilence will only be secured by intelligent sanitary work in our Southern seaports . . . ; and also by demanding of our neighbors that their ports shall be made to be as of little danger to the people of the United States as the ports of this nation are to them."

Again I suggest that the shoe is on the other foot. Our Latin American neighbors have gone so far ahead of the United States in this particular program that I, as an American citizen, and as Director of the Pan American Sanitary Bureau, am repeatedly embarrassed when my Latin-American friends say to me, "Yes, yes, we're doing this, we're doing what the Bureau is insisting, but what is your country doing?", and I have to say, "Well, just give them time, just give them time." But the years go on. It is eight years now that we have been on this continental program and nothing happens.

I would repeat what I said a moment ago, that in the past decade jungle yellow fever has been reported in from five to eight of the following countries—Argentina, Brazil, British Guiana, Bolivia, Colombia, Costa Rica, Ecuador, Honduras, Nicaragua, Panama, Peru, Trinidad and Venezuela. All of these countries are within one day's flight by plane and many of them within a few hours.

I would call attention to the fact that, in 1954, for the first time in 25 years, a maritime port in the Americas was infected with *aegypti*-transmitted yellow fever.

I would repeat again the fact that was already mentioned here, that in 1954 an infectious case of yellow fever did for the first time travel by air. It is true the flight was a national flight, but it traveled the distance of 200 miles and took an infectious case of yellow fever into the city of Caracas which had at the time a fairly high *aegypti* index, a city where yellow fever had not been recognized for four years.

It is difficult to believe that the people of the United States who have recently shown their interest in individual health in the financing of the polio vaccination programs, which is based on the reports of vaccinating 100,000 children for the prevention of thirty or forty cases in a year—I repeat I do not believe that the people of the United States, who have faced up to the costs of preventing poliomyelitis at the cost that has been indicated, desire to have it

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said that this country cannot and will not spend the money to eradicate a mosquito which, by remaining in the United States, creates a threat to the reinfestation of neighboring countries which have or are eradicating it as part of a continental program to guarantee the Americas forever against urban yellow fever. This program is, for the United States, the most important unfinished business in regard to yellow fever and only from this can the United States and the rest of the Americas get the full benefit of the genius of Carlos Finlay and all of the work which has gone into the last half century.