

Special Feature

AEDES AEGYPTI: A SWORD OF DAMOCLES OVER TROPICAL AMERICA

by **Hernando Groot**

The Abraham Horwitz Award, named in honor of the Director Emeritus of the Pan American Sanitary Bureau, is bestowed annually by the Pan American Health and Education Foundation (PAHEF) for outstanding contributions to health in the Americas. Dr. Hernando Groot, President of Colombia's National Academy of Medicine, was the most recent recipient of this award. The following presentation is from his address at the 30 September 1980 award ceremony.

At times like this it is customary for the recipient to speak on some scientific, technical, or philosophical subject. Clearly, it will be all the more fitting on this occasion to talk about a subject that has to do with the accomplishments of the person for whom the award is named, because this will mean we have found inspiration in his work and are guided by his example. For that reason I have chosen to offer a few comments on the risk of urban yellow fever and the current status of the war on *Aedes aegypti*, the fearsome mosquito that transmits it and dengue fever as well; for this war has been an object of the keenest interest to the Pan American Health Organization and to Dr. Horwitz, as it had been to his predecessor, Dr. Soper, and as it continues to be to PAHO's present Director, Dr. Acuña.

Today there are only jungle yellow fever cases. Yellow fever claims its victims, many of whom are never recognized as such, when unvaccinated people penetrate into the depths of tropical forests where the disease follows its hidden course. And yet the risk of urban epidemics caused by introduction of a virus from the jungle persists—with all its dramatic implications.

The disease would presumably be introduced by man when, after having been infected in the jungle, he returns to the city and infects the local *Aedes* mosquitoes. While it is

true that on several occasions people suffering from jungle yellow fever have entered unvaccinated cities that were heavily infested with *Aedes aegypti* without epidemics developing there, it is no less true that an appreciable number of outbreaks of urban yellow fever in South America between 1928 and 1942 can be accounted for only by urbanization of the jungle virus. Thus, the risk of urban epidemics following introduction of the jungle virus is still with us.

Without belittling the gravity of the risk, I think we should speculate, if only briefly, on why in certain cases the virus so introduced has not caused urban outbreaks. It has been suggested, first, that patients with jungle yellow fever come to the city only when they are seriously ill, after four days of illness, when there is no virus circulating in their blood or, if there is, then in a concentration not high enough for *Aedes aegypti* mosquitoes to be infected. Second, it has been speculated that such patients probably have little contact with the vector in hospitals, which is normally where they arrive. Third, it has been suspected, and with much reason, that a high prevalence of antibodies against dengue in the community can prevent spread of the disease.

The fact is that nothing is known with any accuracy about the immediate conditions in which jungle yellow fever becomes urbanized.

Some of those conditions relate to the virus—the varying pathogenicity of different strains that produce different levels of viremia, as well as possible modification of the virus upon entering the *aegypti*-man-*aegypti* cycle. Other conditions relate to the mosquito—its competence as a vector, the extent of its contact with man, and possible interference between the viruses of dengue and yellow fever in its tissues. And still others relate to the human population—the degree of its immunity to yellow fever and to other flaviviruses.

When these conditions are thoroughly understood—which will necessitate considerable further research—the probabilities of the virus's becoming urbanized can be more properly evaluated. Meanwhile, the risk of urban epidemics remains, unmitigated, whenever patients with jungle yellow fever arrive in unvaccinated cities with high *Aedes aegypti* densities and no steps are taken for immediate elimination of the mosquito.

This standing risk, joined to that of dengue epidemics and the not impossible prospect of hemorrhagic dengue, is a real Sword of Damocles, one that becomes more menacing with the breakdown of eradication and control campaigns and the reinvasion by *Aedes* of areas from which it had once been banished. At the present time, *Aedes* infestations are reported to exist in most countries of the Hemisphere. The only exceptions are Canada, Costa Rica, Panama, Ecuador, Peru, and the Southern Cone countries. The situation is made all the more serious by diminished motivation to combat the mosquito, and by factors having emerged that make such combat more difficult. One reason for this diminished motivation is simply the fact that no epidemic of urban yellow fever has occurred for decades. The last one in a large city took place in Rio de Janeiro in 1928 and 1929. So half a century has passed since urban yellow fever claimed any victims, terrorized any population, paralyzed any trade, and moved governments to loosen the tight purse strings of their treasury ministers to counteract the threat.

Meanwhile, mosquitoes have developed resistance to some insecticides; the cost of eradication and control program materials and operations has risen enormously; the areas to be treated are now larger because of the mosquito's invasion of new areas as well as the uncontrolled growth of urban centers; and breeding places have been multiplied by a modern "civilization" that leaves discarded tires and beer cans everywhere, this "tin-can society" so justly decried by Abel Wolman. All these factors militate strongly against any eradication or control program.

Moreover, in regard to eradication, while the technical and administrative systems for attaining it are basically understood, these systems will doubtless have to be refined or modified to deal with special circumstances—such as inaccessible vector breeding places or adaptation of the mosquito to unusual habitats. These refinements and modifications will entail additional expenses for research and operations, especially the latter—expenses that can become very great and difficult to cover.

During the last 10 years Colombia has seen three dengue epidemics, each affecting several hundred thousand people, and one jungle yellow fever outbreak. The latter, which occurred in 1979 in the foothills of the Sierra Nevada de Santa Marta, posed a very serious threat to nearby cities because of the imminent danger of its becoming urbanized. The virus came within a short distance (5-14 kilometers) of cities with *Aedes* indexes as high as 50 per cent—cities upon which patients from the countryside were converging. The ensuing alarm prompted rapid vaccination of the exposed urban populations, and measures were taken to eliminate the vector. No urban cases were reported.

We have lived a truly anxious decade, not only with the ever-present risk that jungle yellow fever would be urbanized, but also in expectation of an outbreak of hemorrhagic dengue. With regard to yellow fever, by far the greatest danger occurred in 1979, when the virus came perilously near large cities, in-

vaded new areas, and even turned up in places ecologically distinct from the classic yellow fever foci—places such as coffee plantations and narrow strips of riverbank forest surrounded by dry areas. Because of this anxiety, as well as the ineffectiveness of current control methods, we who live amid the reservoirs of jungle yellow fever in tropical America want no more dengue cases and would like to see the urban yellow fever threat dispelled once and for all. That is because we ourselves feel personally threatened, for the fire is in our own backyards.

Of course, we also understand the reasons of the temperate-zone countries of the Americas for not favoring *Aedes aegypti* eradication. Being nowhere near the jungle yellow fever reservoirs, they perceive the urbanization risk as slight, as a danger that could only threaten them (if it ever did) from some urban epidemic in the Caribbean, and as a problem that could be countered in timely fashion with preventive measures. Nor does the possibility of dengue appear to present any great source of alarm. For one thing, it is generally presumed that the usually low *Aedes* densities in temperate areas will hinder dengue transmission. In addition, the disease is ordinarily benign; and, if it were to appear, there would always be time to eliminate the mosquito before any serious clinical manifestations emerged.

Given the present state of our knowledge and the failings of *Aedes* control alone, eradication of *Aedes aegypti* constitutes the surest way to prevent dengue and to keep urban yellow fever from breaking out in the tropical Western Hemisphere countries that harbor jungle yellow fever. Nevertheless, it is being asked just how realistic it would be to attempt this measure. Why eradicate the mosquito if some countries have not done so, are not going to, and will therefore always be a source of reinfestation for those that do?

Considering the enormous cost of eradication today, can any case be made for it? Put differently, if eradication cannot be accomplished at a "reasonable" cost, would we be

right to attempt it? Or should we seek alternative methods—such as intensive and continual vaccination against yellow fever, some control of the mosquito, and immediate application of insecticides to stem outbreaks of dengue and urban yellow fever?

These and similar questions, frequently asked in tropical America, have no easy answer. I have none to offer now, and studies and research are doubtless needed to answer them properly. However, I cannot help asking some questions of my own, and I offer the following opinion that I have done my best to keep objective: It may be possible to reduce the risk of reinfestation by stepping up operations against the mosquito in the part of an infested country that is adjacent to a "clean" country, but it is a firmly established fact that reinfestation can be eliminated if the latter country has a surveillance system capable of detecting reinfestation early and attacking it immediately. This sequence of events happened in Colombia in 1966, in Belem, Brazil, in 1967, and more recently in Panama and Ecuador. The reason for the later defeat in Colombia was that although the reinvasion was detected in August 1969, it was not until two years later that a few limited operations were launched to control it.

Insecticide and operating costs are certainly higher today than they were 20 years ago; but, truly, can they be so high as to be unaffordable? What is a "reasonable" cost when human lives are at stake? I recall that a major cause of eradication campaign breakdown has sometimes been doubt that the program could succeed, that there was any justification for it—in other words a lack of resolve to overcome obstacles and appropriate scarce funds. I cannot resist the temptation to quote here the words spoken recently by Farid in connection with the eradication of malaria:

The goal of global malaria eradication—in the revised form—must be maintained no matter how difficult its ultimate realization, to keep governments constantly mindful of the intermediate epidemiological goals they must attain in their prog-

ress towards this end. By its very nature, such a target will be symbolic of the fact that public health authorities are acquiring a consciousness of their responsibilities.

In closing, I would ask two last questions: Can we be sure that the usual control measures alone will permanently keep mosquito densities low enough to prevent transmission of the virus? And, if such measures will be that effective, how much would they cost? Because if the answer to the first question is yes, and to the second is that they would cost less than eradication, then our problem would be solved.

A year ago, in telling the American Society of Tropical Medicine the distressing and absorbing story of Colombia's three dengue epidemics and the threat of urban yellow fever in that country—in the Second Fred L. Soper

Lecture—I thought of giving my presentation the title "A Drama in Four Acts." I did not do so, and this was fortunate—because there are more acts to come. A fifth is already starting with another dengue epidemic. A sixth will probably begin when the yellow fever virus becomes active again in the neighborhood of *Aedes*-infested urban centers, this time toward the eastern part of the country. And there are sure to be other acts after that. As a consequence, appropriate preventive measures will have to be stepped up, among them a vigorous effort against the mosquito, so that the next act will not see the advent of urban yellow fever and possibly hemorrhagic dengue—the fall of the Sword of Damocles. For not even the classic fable about the courtier of Syracuse had such a fearsome ending—it being said that although distracted by other activities, he managed to see the danger in time to avoid it.

COMMISSION ON FOOD STANDARDS

The WHO/FAO Codex Alimentarius Commission, which recommends food standards designed to protect consumer health, held its fourteenth session in Geneva from 29 June to 10 July 1981. For the previous 10 years the commission had been meeting in Rome.

In his opening address to the meeting, WHO Director-General Halfdan Mahler expressed satisfaction that the commission was concentrating on foods of particular nutritional significance to people in developing countries, adding that "this new direction of the work of the commission should be vigorously pursued." Dr. Mahler also conveyed WHO's appreciation to the Food and Agriculture Organization for efficient administration of the commission's joint FAO/WHO secretariat and drew attention to the importance of the commission's work. [Source: WHO Press Release No. 20, 30 June 1981.]