

plans alone, is not in a position to guarantee maximum use of all facilities that might be jointly used.

Consultation with Public Health Service, Federal Civil Defense, the military departments, and state and local agencies might make such a total effort possible. Some planning of this nature has already been accomplished. However, it is likely that your organization more than any other has membership that represents many of the interested agencies.

Your organization has the dedicated interest combined with the experience on how good community programs operate.

In view of this experience, would it not be appropriate that methods for furthering a plan for the coordinated action of all agencies concerned be considered by the Members and Directors of the American Mosquito Control Association? The completion of such a plan may assure that a necessary level of performance can be maintained in time of emergency. This I recognize as a Herculean task but unless every effort is made now while there's time for planning, it may never be done. I believe it can be done and that the accomplishment will be worthy of the effort in a nation-wide concept of defense.

## MORE ABOUT MALARIA ERADICATION

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I rejoice in the opportunity to talk "More about Malaria Eradication" to the members of the American Mosquito Control Association. The title is purposely vague even though the objective of the program for malaria eradication is quite specific; literally the termination of the infection of the human race by all species of *Plasmodium*.

For the skeptics, who may doubt the modern occurrence of miracles, I would say that the miracle of world malaria eradication has become inevitable as a result of technical, political and financial miracles of recent years.

Only a brief two decades ago, Dr. Mark Boyd,<sup>1</sup> a life-long student of malaria in the United States and abroad, asserted in his 1938 Presidential Address to the American Society of Tropical Medicine, 1. that malaria control would have to depend on local programs paid for by the populations to be benefited; 2. that the financing of

such programs could best be carried out through small, annual payments; 3. that malaria was not a problem to require the quick assembly of relatively large funds for its immediate suppression; 4. that malaria was to be attacked, not through a rapid campaign but through long term effort for gradual improvement. To Boyd it was obvious that permanent results could best be gotten by "building-out" malaria through permanent drainage and filling projects.

Today, 1958—20 years later—the nations of the world, banded together in the World Health Organization and the Pan American Sanitary Organization are engaged in a world-wide effort to eradicate malaria from the human race through a coordinated, simultaneous campaign to be completed within a comparatively short period of time, at a cost far beyond the local financial resources of many malarious areas.

The eradication program is based not on building malaria out, but rather on the prevention of the transmission of infection by chemical attack on such vector mosqui-

<sup>1</sup> Malaria: Retrospect and Prospect. Published in the American Journal of Tropical Medicine, Vol. 19, No. 1, Jan. 1939.

toes as enter human habitations. This attack must continue until such time as the infection dies out in the human host. Such a program carried out by a local community or attempted on a small scale, would be doomed to failure because of the reintroduction of the plasmodia from outside. Today's program calls for complete coverage of all malarious areas by national malaria services throughout the world. Financial assistance and technical co-ordination are available through WHO, PASO, UNICEF and ICA.

I submit that this present situation has been developed only on the basis of what must be considered, from the viewpoint of 1938, as technical, political, and financial miracles. It is not too much to anticipate that the additional miracles necessary to get sustained support and administrative efficiency required to finally eradicate malaria may well be forthcoming in the face of the faith and courage which are being displayed by, not only those who are responsible for the technical aspects of the eradication campaign, but also those who have to take the responsibility for the political and financial commitments.

The history of malaria control and eradication in the United States shows that, even here, anti-malaria measures have depended over the years, to a large extent on funds other than those which could be raised from the highly malarious communities themselves. Malaria control in the United States may be said to have begun with the work of Gorgas in Havana in 1901; the anti-malaria work in the Panama Canal Zone in the following years was largely responsible for setting the pattern of malaria control measures used in the United States until after the introduction of Paris green in 1921. In the beginning, within the United States itself, malaria control was limited to isolated, local efforts based on drainage, filling, screening, and oiling. Real increases of malaria control and its popularization have depended, to a great extent, on funds made available from Federal and State sources to meet specific crises in the life

of the nation. The first great period of development was in World War I when Federal, State and local funds were used to control malaria, particularly around recruitment and training centers in the southern part of the United States. The second great impact resulting in multiplying anti-malaria work was caused by the economic crisis of the 1930's when thousands of laborers on public relief were available to carry out public works. Advantage was taken of this by the Public Health Service to get considerable extension of anti-malaria activities. The third great impact on malaria, and that which led to its eradication in the United States, was the crisis of World War II, during which the establishment of numerous training camps and the development of war-time industries in the south led to the organization of extensive malaria programs, financed by Federal, State, and local funds.

The pattern which developed in the United States between 1900 and 1950, was for a national crisis to loose the national purse strings and permit the expansion of malaria control activities.

An important part of the pattern was that successful control programs, once undertaken with emergency funds, were never or almost never, allowed to lapse. Either the augmented wellbeing and the recognition of its importance caused the people, following malaria control, to demand its continuation; or obviously improved economic conditions permitted continuation of what was previously beyond financing from local resources.

With the expansion of anti-malaria measures in the United States during World War II, by 1943, anti-malaria campaigns were active in many of the 120 malarious counties, none of which were heavily infected. Complete national coverage was planned and in 1945 Congress appropriated funds to extend operations to all areas where malaria transmission was occurring; for the first time, the United States had a nation-wide malaria campaign. In 1947, the Congress recognized

the nature of this effort and appropriated funds for "The National Malaria Eradication Program."

The nation-wide campaign plan of 1943 was predicated on the use of paris green as a larvicide. Although larviciding with paris green could have led to success, eradication was greatly facilitated by the introduction of DDT as a residual insecticide to be sprayed on the inner walls of human habitations. From 1945 on, the use of DDT made the human habitation the determining unit of cost rather than the surface of anopheline breeding areas.

By 1947, it was obvious that indigenous malaria had been halted in the United States and by 1950 close observers were convinced that malaria eradication had been achieved. This eradication, it should be emphasized, could occur when it did, only because of the outpouring of federal funds as part of the war effort, during and immediately after World War II and through the coordination of State and local programs by the U. S. Public Health Service.

Other malarious countries began to use DDT and to develop the concept of eradication during and immediately after World War II; in Europe, demonstrations in Italy in 1944, and in Greece in 1945 gave rise to nation-wide campaigns, and in the Americas, campaigns covering most of the populations of Venezuela, and British Guiana were inaugurated in 1945.

In 1950, at a symposium on "Nation-wide Malaria Eradication Programs," under the auspices of the National Malaria Society at Savannah, programs in Brazil, British Guiana, the United States and Venezuela were presented for discussion.

In 1950, a reconnaissance<sup>2</sup> of the malaria control programs in the Americas was made under the auspices of the Pan American Sanitary Bureau. The report of this reconnaissance was submitted to the XIII Pan American Sanitary Confer-

ence meeting in Ciudad Trujillo the same year. The Conference instructed the Pan American Sanitary Bureau ". . . to provide for greatest intensification and co-ordination of anti-malaria work in the hemisphere, stimulating existing programs, facilitating interchange of information and furnishing technical and, whenever possible, economic assistance to the various countries with a view to achieving the eradication of malaria from the Western Hemisphere."

The succeeding years proved that the time was not ripe for an all-out effort at eradication. Too much publicity had been given to the marked malaria reduction which had occurred as the result of the introduction of DDT and some resistance to even the continued expenditure of the sums then being devoted to malaria control had been developed by a number of Ministers of Finance. In the meantime, the attempt made by the Pan American Sanitary Bureau to combine programs for the eradication of the *Aedes aegypti* mosquito and malaria failed to prove administratively advantageous. By the end of 1953, the recurrence of malaria in certain countries where control measures had been neglected, and the demonstration of the existence of resistance to chlorinated insecticides on the part of certain anopheline mosquitoes, caused a change of atmosphere.

A second reconnaissance<sup>3</sup> of the malaria situation in the Americas, carried out in 1954, indicated that no noteworthy progress had occurred during the previous four years. The situation was reported to the XIV Pan American Sanitary Conference at Santiago, Chile, in October 1954 and an emergency resolution, actively supported by the United States Delegation, was passed, calling upon the Pan American Sanitary Bureau to take more effective

<sup>2</sup> Alvarado, Carlos A., 1950, "IV Informe de la lucha anti-malárica en el Continente Americano," submitted to the XIII Pan American Sanitary Conference, Ciudad Trujillo, 1-10 October 1950.

<sup>3</sup> Alvarado, Carlos A., 1954, "Status of the Antimalaria Campaign in the Americas V Report," presented to the XIV Pan American Sanitary Conference, Santiago, Chile, October 1954, as Annex I of Document CSP14/36 (PASB Sc. Pub. No. 27, December 1956).

measures to implement the resolution of the XIII Conference calling for the eradication of malaria in the Western Hemisphere. An emergency fund of \$100,000 for administrative purposes was approved for 1955 and authorization given for a special voluntary malaria eradication fund, with the participation of organizations, public and private, national and international, in order to achieve eradication. Plainly the first international body to envision continental eradication of malaria now realized that lack of funds had been a significant deterrent to success.

Just as the expansion of anti-malaria work in the U.S.A. depended, during half a century, on the availability of funds other than those of the local malarious communities themselves, the success of the world malaria eradication program inevitably depends on the financial support of economically able countries.

None of those attending the XIV Conference could possibly have foreseen the rapidity of developments which have followed the action of this Conference. Only a few of the highlights of the intervening period can be mentioned here. (a) In January of 1955 the President of Mexico authorized the Minister of Health to arrange, if possible, for the financing of a Malaria Eradication Program for this country, considered at that time to be one of the principal reservoirs of malaria transmission in the Americas. (b) The International Cooperation Administration joined in stimulating the conversion of control to eradication programs and has actively supported the concept of malaria eradication whenever its interest has been felt. (c) In March 1955, the United Nations International Children's Fund, on the basis of an initial request from Mexico, tentatively approved malaria eradication as a field for UNICEF commitments and at the same time decided to curtail future participation in partial control programs. UNICEF commitments for malaria eradication have amounted to many millions of dollars and have been of signal importance because of their early availability as well as of the relatively large amounts committed. (d)

In May of 1955 the WHO/UNICEF Joint Committee on Program Planning approved malaria eradication as a field for combined activities. (e) In May 1955, the Eighth World Health Assembly meeting in Mexico City, after hearing the first official commitment of the Government of Mexico to eradicate malaria, approved a resolution for the development of a coordinated program for the eradication of malaria throughout the world, and established a special malaria eradication fund. (f) During 1955 and succeeding years there has been a widespread acceptance on the part of governments throughout the Americas, and, to an important extent, in other parts of the world, followed by the consequent planning for the conversion of control efforts to nation-wide eradication programs. (g) In 1957, a Special Committee of the Representatives of the Presidents of the American Republics approved the Malaria Eradication Program in the Americas for special consideration. (h) Early in 1957, contributions to the special Pan American Malaria Eradication fund were received from the United States in the amount of one and one-half million dollars, from Venezuela three hundred thousand dollars and from the Dominican Republic one hundred thousand dollars. (i) One of the most significant developments since action of the XIV Conference in 1954, is the action taken by the Congress of the United States with regard to malaria eradication in the Mutual Security Act of 1957. Recommended reading for those interested in broad international statemanship is to be found in the hearings on this Act before the Committee on Foreign Relations of the U. S. Senate, pp. 576 to 590. To quote, "In 1955 the World Health Assembly unanimously adopted a Resolution giving top priority to the support of eradication. More than sixty free nations have malaria within their borders. Although nearly all of these nations have embarked on eradication programs, they are for the most part not economically able to wage an effective war against this ancient enemy.

"Since the World Health Assembly ac-

tion in 1955 pressure and enthusiasm in the underdeveloped countries has continued to mount. This pressure has been reflected in the increased anti-malaria activities of the international organizations, notably the World Health Organization, UNICEF and the Pan American Sanitary Organization.

"However, it is clear that in order for this great goal to be achieved, the United States must spark an all-out effort utilizing all available resources national and international. The proposed program provides for such an effort and if adequately supported and energetically prosecuted by all elements should result in the eradication of this dread disease in many areas within five years time."

Under this Act five million dollars has been made available to the special malaria account of the World Health Organization, two million dollars has been contributed to the special malaria fund of the Pan American Sanitary Bureau, and sixteen million three hundred thousand dollars is to be used by the International Cooperation Administration for the support of national malaria eradication programs in various countries of the world.

It must be emphasized, that a clear distinction is made in the use of these funds between Malaria Control Projects and Malaria Eradication Programs.

A malaria control project may have a limited objective of reducing the incidence of malaria in a given area at a given time; it may be a pilot or demonstration project, may be limited to the most malarious, to the most heavily populated or to the most economically important malarious areas. The control project has limited objectives and involves limited commitments.

The definition of the malaria eradication program may be given in the terms established by WHO for eligibility of programs for assistance from the Special Malaria Fund:

"Before a country is eligible for assistance in malaria eradication, it must be determined that such a programme is, for that country, technically, administratively

and practically feasible. A programme for malaria eradication must be country-wide, with the specific goal of eradication, although it may be carried out in stages in different parts of the country.

"Countries to which help is given must be prepared to take all necessary action—legislative, financial and administrative—and be able to recruit staff, provide locally-produced supplies and equipment, and to grant all facilities necessary to the success of the programme. Malaria eradication is different from other projects carried out with WHO assistance in size, duration and objective. Governments should undertake such programmes only when they can and will take the actions necessary to ultimate success—otherwise, the effort will be wasted, and failure to achieve eradication will have not only internal repercussions but may jeopardize the eradication programmes of neighboring countries."

No attempt can be made here to report on progress in individual countries. Suffice it to say that Governments are calling on WHO, PASO, UNICEF, and ICA for malaria eradication programs faster than personnel can be trained to develop and administer those programs.

Accumulated demands have recently exceeded the available capacity of insecticide production and caused a sudden rise in the price of DDT of some 20 percent.

Eradication has progressed far enough in the Americas, in Europe, in the Eastern Mediterranean, in S.E. Asia and in the W. Pacific to convince the specialists that no insoluble problems are anticipated, if adequate financing can be had. There is little information regarding malaria in the Communist areas but such reports as exist are optimistic. Africa has problems but these may well be largely economic and administrative rather than technical. The vastness of the malarious area of Africa, the lack of roads, the low economic status of the people and the intensity of their infection are frightening to local authorities and awesome to distant ones. Each of these impediments has been surmounted here or there and from time to

time even in the heart of Africa. All of them can be overcome by the ingenuity of malariologists, provided only that funds in sufficient quantity be forthcoming in due course.

In April 1901 Sir William McGregor<sup>4</sup> wrote to Ronald Ross, "I shall be glad to send you a few notes on malaria in the field, what we are doing and what lions roar at us in the path. So far the greatest obstacle is the Colonial Office. It is bad enough to have to deal with malaria alone; but malaria entrenched behind Sir \_\_\_\_\_ is impregnable." If I were to paraphrase Sir William's words for the American Mosquito Control Association today, I might do it thus, "I have been very glad to give you a few notes on the world malaria eradication program, what the international organizations are doing, and what lions are aiding and abetting us in the task. So far the greatest acceptance of the concept of eradication has been noted on the part of practically all of the malarious countries of the world and the fullest recognition of their responsibilities and opportunities must be recorded for the non-technical elements of certain governments, especially the government of the United States and certain others which have come

<sup>4</sup> Memoirs: Ronald Ross—John Murray, London, 1923, p. 458.

forward with voluntary contributions to the support of the world programme. Certain doubts which must have clouded the vision of the early supporters of the campaign for the world eradication of malaria have been cleared, and it can be said that this campaign, adequately financed by the economically able countries of the world, is bound to succeed."

In his state of the union message to the Congress on January 9, 1958, President Eisenhower said, "Another kind of work of peace is cooperation on projects of human welfare. For example we now have it within our power to eradicate from the face of the earth that age old scourge of mankind: malaria. We are embarking with other nations in an all-out five-year campaign to blot out this curse forever."

The United States has been free of malaria for a decade and now makes available for malaria ridden countries a very small part of what this disease used to cost the USA economy. Should other countries, similarly, as they become free of malaria, contribute a portion of the funds the disease previously cost them, the snowballing effect of these contributions will be notable in speeding the final solution of the malaria problem.

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