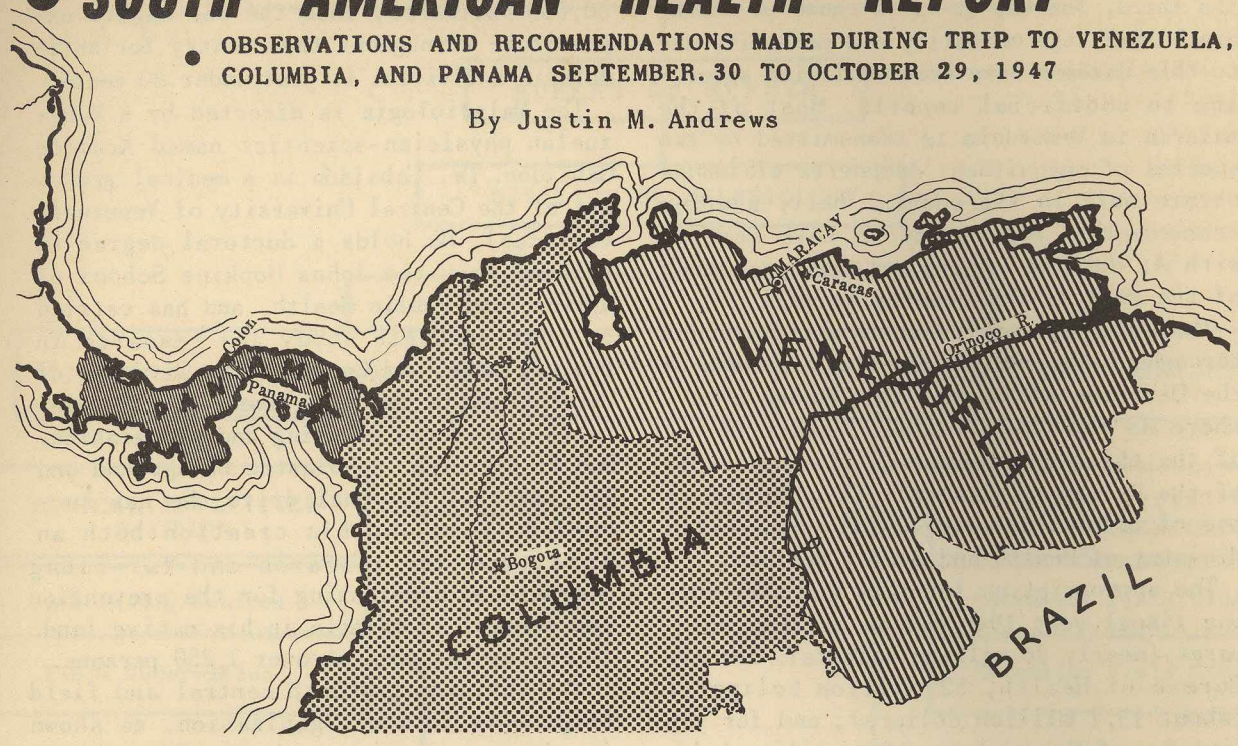


● SOUTH AMERICAN HEALTH REPORT

● OBSERVATIONS AND RECOMMENDATIONS MADE DURING TRIP TO VENEZUELA, COLUMBIA, AND PANAMA SEPTEMBER. 30 TO OCTOBER 29, 1947

By Justin M. Andrews



Dr. Andrews, Scientist Director, Deputy Officer in Charge of CDC, recently reviewed malaria activities in Venezuela, Colombia, and Panama as a representative of the Pan American Sanitary Bureau. His interesting report is presented in its entirety.

A. THE STRUCTURE, FUNCTIONS, AND ACTIVITIES OF THE VENEZUELAN DIVISION OF MALARIOLOGY

The United States of Venezuela in South America is a country of about 326,000 square miles. It lies entirely within the tropics just north of the equator and is divided into approximate halves by the Orinoco River which flows from the southwest to the northeast. Most of the population (4,000,000) lives in the portion northwest of the river. This is divided topographically into coastal, mountainous (Andean) and plains (Llanos) areas. There are twenty states, one federal district, and two federal territories in the country. Venezuela is at present subsisting largely on an oil economy. Oil is the principal, virtually the only, export. Because of the high wages paid by the petroleum industry, agricultural pursuits have declined to

the point where it is necessary to import even staple food products. In the hope of reestablishing a better balanced economy, Venezuela is inviting immigration on a huge scale. It is hoped by this means to double the existing population within the next decade. Some 15,000 immigrants, mostly displaced persons from central Europe, Italy and the Balkans, have arrived this year. Whether or not these people will be satisfied to establish a peasant class in rural Venezuela or whether they will compete successfully with native Venezuelans for the more immediately lucrative opportunities provided by the current economy remains to be seen.

Malaria occurs in all the three political subdivisions. During the years 1940 to

1944¹, inclusive, it was reported as being the third, fourth, or fifth cause of death. Since 1943, the mortality and morbidity due to this disease have been declining according to unofficial reports. Most of the malaria in Venezuela is transmitted by two species of mosquitoes. *Anopheles albimanus* occurs only in the coastal belt, sharing transmission importance in this section with *A. darlingi* which extends over most of the rest of the country as well.

Malaria control and investigations throughout the country are the functions of the Division of Malariology, known everywhere as the "Malariología". This is one of the thirteen divisions, or equivalent, of the Bureau of Health². This Bureau is one of five³ which compose the Venezuelan Ministry of Health and Social Welfare.

The appropriation for this Ministry during fiscal year 1948 was 86 million *bolivares* (nearly 26 million dollars); for the Bureau of Health, 52 million *bolivares* (about 15.7 million dollars); and for the Division of Malariology, 10.4 million *bolivares* (3.1 million dollars). Of this last, 4 million *bolivares* (1.3 million dollars) were appropriated specifically for DDT operations. With the exception of municipal and certain minor state assessments and fees, all the tax revenue in Venezuela is collected by the federal government. About 40 percent of this is made up of a production levy on crude oil. Roughly one-fifth of the total is allocated to the states on a per capita basis and the remainder is used for federal expenditures and for certain direct services, including public health activities, provided for the people by federal agencies. Accordingly, there has been little occasion for states to assist in financing public health. Nevertheless, they have just begun to participate in defraying malaria control costs; during the

current year, some of them are contributing 60,000 *bolivares*. Thus the per capita expenditure throughout the country for anti-malaria activities is just under 80 cents.

The Malariología is directed by a Venezuelan physician-scientist named Arnaldo Gabaldón. Dr. Gabaldón is a medical graduate of the Central University of Venezuela (Caracas). He holds a doctoral degree in science from the Johns Hopkins School of Hygiene and Public Health, and has carried on post graduate study and research in Italy, France, and Germany. The Division of Malariology is the fulfillment of his carefully considered planning and preparation. Due to his rich scholastic background and his powerful personal drive, he has succeeded in making his creation both an institute for research and far-flung operational undertaking for the prevention and control of malaria in his native land. It employs at present over 1,250 persons.

The Division has both central and field components in its organization, as shown in the accompanying chart. Divisional headquarters are established in Maracay, a city located about 60 miles from Caracas. They are quartered in a building, erected for that purpose, which contains 17,000 square feet. It is about to be enlarged to accommodate additional activities.

The 14 zonal headquarters indicated in the chart cover seventeen of the states and the federal district. In two of the remaining states and in the federal territories, population densities and malaria prevalence are so low that field organizations will not be provided until malaria is reduced significantly throughout the rest of the country. Zones are established along state lines but include more than a single state in some instances. It was planned to staff each zone with a physician and a graduate engineer. Because of the scarcity of such

1 Annual reports of the Division of Epidemiology and Vital Statistics for years since 1945 not yet available.

2 The others are Tuberculosis Control; Venereal Disease Control; Health Units; Sanitary Engineering; Epidemiology and Vital Statistics; Health Education; Nutrition and Pharmacy; Maternal, Infant, and School Hygiene; Yellow Fever and Plague Control; Laboratories; Rural Medical Care; and the National Institute of Hygiene.

3 Others are Social Welfare, Administration, Legal Consultation and Cabinet Services.

VENEZUELAN MINISTRY OF HEALTH AND SOCIAL WELFARE

BUREAU OF HEALTH

DIVISION OF MALARIOLOGY

DIVISIONAL HEADQUARTERS

LIBRARY AND PUBLICATIONS

14 ZONAL HEADQUARTERS

MEDICAL ACTIVITIES SECTION

Laboratory Control

Field Supervision

ENGINEERING SECTION

DDT Operations

Project Development

Testing Laboratory

Forestry

Meteorology

Drafting

SPECIAL STUDIES SECTION

DDT Testing

Experimental Malaria Studies

Taxonomic Entomology

ADMINISTRATIVE SECTION

Supplies

Fiscal

Property

Personnel

Photographic Service

MEDICAL ACTIVITIES AND EPIDEMIOLOGY

Intensive Field Studies

Extensive Field Studies

ENGINEERING

DDT Operations

Drainage and Filling

ADMINISTRATION

Supplies

Accounts

Property

STRUCTURAL CHART OF VENEZUELAN DIVISION OF MALARIOLOGY

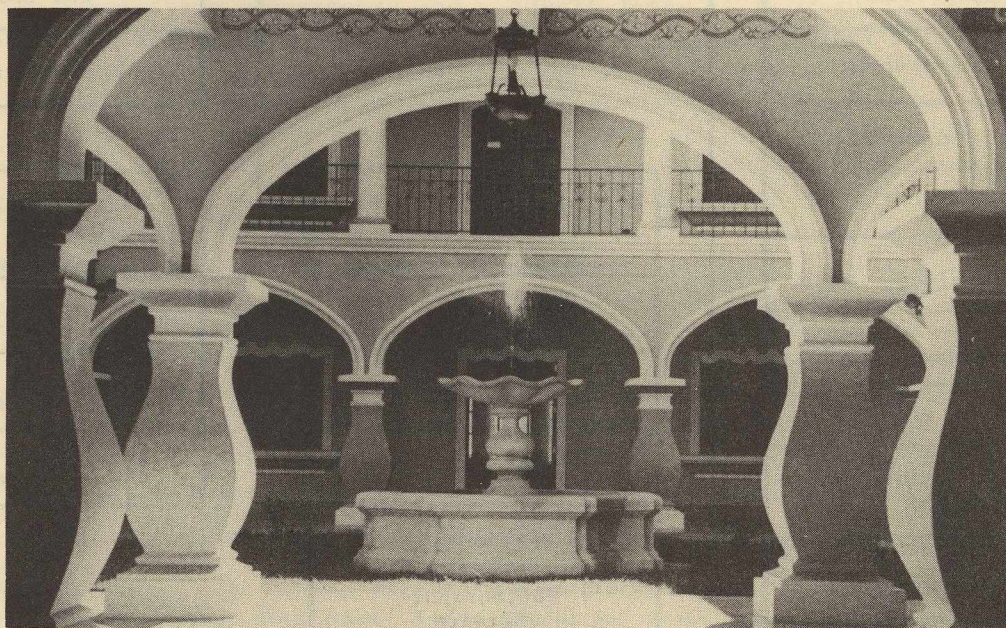
Courtesy of the David J. Sencer CDC Museum

professionally trained individuals, and because the bonification aspects of malaria control are diminishing steadily with the enlargement of the DDT program, some zone units now have medical men with or without engineers, some have engineers and no physician, and others are in the charge of non-professional individuals who have demonstrated leadership and operational ability. In the 14 established zones, there is a total of six physicians, six engineers and two non-professional directors. Six more doctors are in training and will have zone assignments in 1948.

The zonal organizations contain personnel responsible to the Medical Activities Section (physicians, parasitological and entomological inspectors and technicians, and house visitors), to the Engineering Section (engineers, topographic surveyors, foremen and laborers, DDT inspectors and sprayers, etc.) and to the Administrative Section (administrative aids, clerks, cashiers, drug distributors, etc.). Curiously enough, these are not bonded together by any sort of responsibility to a single zonal chief. They are, in actuality, extensions of Divisional Sections housed in the same building in the field but

coordinated in Maracay; soldiers in the same army but without a local commander. This is acknowledged to be an incongruous state of affairs dictated by expediency rather than principle. It is hoped that in the near future arrangements may be made so that one designated individual in each zone will be *administratively* responsible to the Divisional Chief for the entire local organization. Within such a framework, the field specialists in medical, engineering, or other activities could still retain *technical* responsibility to the chiefs of their respective Divisional Sections.

The functions of the four sections in Divisional Headquarters, together with their zonal counterparts, are summarized briefly below. Because of the extreme paucity of malaria and insect-control specialists in the country, it has been necessary to develop the organization so that available technical knowledge and skills are utilized and compounded to the utmost. Thus non-professional but promising candidates are trained by the Malariología for specific tasks and are given manuals which detail each operation they are expected to perform. Their accomplishments



A view of the patio of the "Malariología" in Maracay. The "Malariología" is directed by Dr. Arnaldo Cabaldón and is a fulfillment of his planning and preparation.

are checked constantly thereafter by their Divisional preceptors. This is admittedly a time-consuming and expensive means of achieving a malaria control organization but until more professional and technical personnel interested in health careers are available in Venezuela, there seems to be no alternative.

MEDICAL ACTIVITIES. These functions consist of the measurement and treatment of malaria, including field entomology. About 15 percent of the budget is allocated to these purposes.

There are two types of programs in the field, extensive and intensive. The former is designed to provide general routine information about the current prevalence of malaria and its transmitters all over the country. This supplies the means for the early recognition of developing epidemics and for selecting sites where permanent malaria control measures may be employed profitably.

For the extensive study program, the zone doctors make spleen surveys in the schools throughout their zones early each year. Blood smears are made from children with enlarged spleens and from every fourth child with a normal spleen. The smears are stained and examined in the subdivisions of zones, *demarciones*, from which they were collected. During the last three years, an annual average of over 32,000 students has been examined.

Each demarkation has an *inspector de demarcacion* responsible to the physician and in charge of malaria control medical activities in his area. These demarkation inspectors and their technical aids stain and examine slides, locate and map breeding places from which they identify anopheline larvae to species, and identify captured anopheline adults. During the last three years, the annual number of breeding-place visits averaged over 21,000, adult-station visits over 90,000 per year.

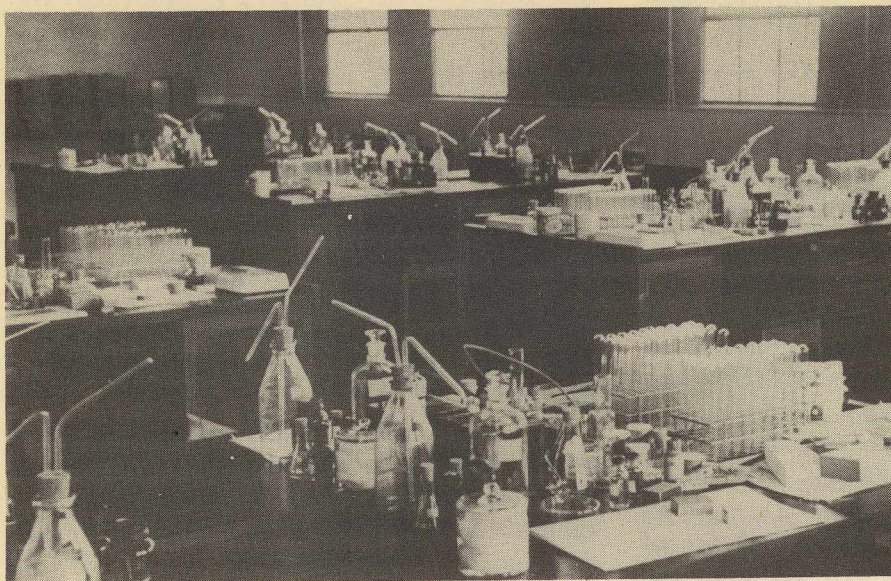
Each demarkation is separated into sectors and in each sector there is a male *visitador rural*, responsible to the demarkation inspector. He visits homes where he makes blood smears (thick and thin films)

from persons suspected of having malaria. The thick films are stained and examined by the technicians, usually within 48 hours; thin films are stained only if the thick smears are positive. From 1944 to 1946, inclusive, the average annual number of case-finding home visits was 842,000 which resulted in finding an average of 92,000 persons sick with malaria each year. The rural visitor takes treatment to the homes of persons found positive. He also searches for and captures adult anophelines in houses.

Sections are divided into *circumscripciones*. These are the smallest geographic units of malaria control influence and in each is located one or more drug distribution posts. From these posts, anyone who feels that he has malaria may obtain treatment free. These posts are selected by the zone physicians and utilize the part-time services of telegraph operators, post-office employees, etc., as treatment distributors. They are visited periodically by the demarkation inspectors but are considered adjuncts of the Administrative Section as the principal divisional functions involved are the procurement and distribution of the antimalarial supplies. Quinine was the standard treatment until 1944 when it was replaced with quina-crine hydrochloride. Some chloroquine is now in use, and may be substituted in the future when the present supply of quina-crine hydrochloride is used. During the last three years, about 524,000 antimalarial treatments were distributed each year, though in 1943 the number was 817,115.

Reports made by rural visitors are combined by demarkation inspectors who add accounts of their own laboratory and field activities and forward these to the zone physician. He consolidates all of these data by states, adding his own observations, and makes monthly state summaries which are sent to the Chief of the Medical Activities Section.

All of the blood films, mosquito larvae and adults collected and examined or identified are sent to Divisional headquarters in



A view of a
laboratory
classroom
in the
"Malariología",
Maracay,
Venezuela.

Maracay, where samples of each lot (including all positive slides) are checked.

The intensive studies represent an ordered attempt to discover pertinent epidemiologic facts about malaria in different parts of the country. Nine cities known as *estaciones*, representing diverse terrain from the Caribbean coast line to the forests in the south, and from the Orinoco delta region in the east to the Andes in the west, have been selected and are subjected to something more than routine malariological scrutiny. Spleen and blood surveys in schools are made annually by the zone physicians. Slides are stained in the station laboratories. Each station has an *inspector de estación*, with assistants including technicians and *visitadoras urbanas*, girls who make case-finding visits each week to homes in various *distritos* of the station. Blood smears are collected from suspects, mosquito breeding-places are examined at regular intervals, and the numbers of larvae taken per 100 visits are recorded, as are the numbers and species of anopheline adults collected in houses at periodic visits. These data are summarized into monthly reports and are transmitted to the Chief of the Medical Activities Section through the zone physician, who adds epidemiologic comments of his own, if indicated. Their contents are analyzed by the Chief of the Medical Activities Section in

considerable detail, correlating them with meteorologic and other environmental influences. Thus a growing volume of basic information is being accumulated interpreting the special epidemiology of Venezuelan malaria in coastal, mountain valley, inland lake, and llanos situations, with respect to different species of transmitters, and under various climatic conditions.

ENGINEERING. This is the most expensive group of activities, requiring some 34 and 39 percent of budgeted funds for the drainage-and-filling program and for the DDT residual spray program, respectively.

Certain functions of the Divisional Engineering Section, such as meteorology and drafting, are obvious. The Testing Laboratory is used mainly to determine and measure characteristics of sand for concrete and of finished concrete structures. The Forestry unit is concerned with: 1) reforestation, mainly with eucalyptus trees, of low, incompletely drained areas; 2) stabilization of open ditch banks with sod and other vegetation; and 3) protection of open ditches from cows, pigs, etc., by thick, thorny hedges planted along each side of the channels.

The two other subsections are the operational anti-anopheline programs. Drainage-and-filling projects are initiated in the Division as the result of conferences based

on the clinical, parasitological, and entomological findings of the Medical Activities Section. As far as possible, these projects are restricted to construction and installation of permanent malaria control facilities with low maintenance costs. Each work unit is designed by the zone engineer. Actual field surveys are made by *topografos* within the zone organization. Final plans are sent to the Division for checking and approval. Foremen, laborers, heavy and light equipment, and the necessary materials are assembled and the work proceeds under the supervision of the zone engineer who planned it. Most of the concrete structures are made on or close to the job sites. During the last three years, annual averages of 186,650 concrete structures have been fabricated and 34,890 meters of ditches or canals have been paved.

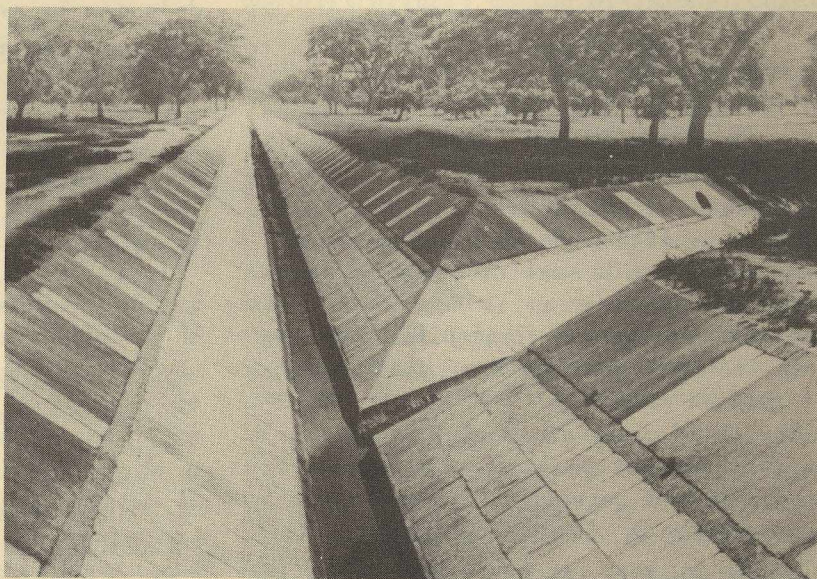
Present plans are to reduce this activity in the future, limiting it to projects in urban communities where its benefits would be widely distributed and where collateral justification such as sewerage and storm-water drainage exists in addition to malaria control. Some such combination projects have already been completed in cooperation with the ministry of Public Works.

The DDT program consists of the application of wettable DDT in water suspension at the rate of 1 gram/meter (100 mgm/sq.ft.) three times a year to the interior walls and ceilings or roofs of suburban and rural homes in malarious parts of the country. DDT teams, *cuadrillas*, consist of eight men, hand-spraying equipment and a heavy truck with tanks or drums in which to mix the suspension. The trucks, like all the other Malariología vehicles, are painted a conspicuous yellow-orange color, and all the field employees in the DDT service are

uniformed in light grey-green two-piece coveralls with DDT shoulder patches indicating rank. The program was started in December 1945. During the following year, 29,013 house sprayings were made, using 17,040 pounds of DDT for the protection of 92,493 persons. This is an application rate of 0.59 pound per house and costs 7.11 *bolivares* (\$2.36) per house spraying.

Another element in the DDT program is the preparation and sale by the government of five percent DDT in kerosene. This is mixed and packaged by the Malariología. It is advertised extensively and is distributed and sold all over the country at virtual cost by the Bank for Agriculture and Animal Husbandry for use as a domestic spray.

SPECIAL STUDIES. These represent a cooperative project between the Malariología and the International Health Division of



A concrete ditch lining near Maracay, Venezuela. The area of treatment has been expanded from Maracay, first chosen as a proving ground.

the Rockefeller Foundation. About two percent of the total budget is devoted to their support.

The work planned and under way falls into three categories. The first is concerned with the chemical and biological testing of DDT to measure the relative purity and potency of various lots of that material against *A. albimanus* and *A. darlingi*, and

the durability of its insecticidal activity on different types of surfaces such as adobe, plaster, wattle-and-daub, and the fine and coarse plants used for thatching houses. Some of these observations are being made on blocks of test substances which can be subjected to various environmental influences and assayed biologically whenever desired. Comparable determinations on a larger scale will be made on the walls and other surfaces within inhabited and uninhabited houses.

New insectary facilities are being constructed to supply the biological material for the testing experiments and to study the bionomics and behavior of the vectorial species.

The second type of study consists of field observations of the effect of single annual sprayings in selected *darlingi* and *albimanus* villages which will be contrasted with that of two or more applications per year in other comparable communities to see whether the same or different patterns of DDT application should be used against these two species of anophelines. It is also planned to study and appraise the influence of DDT house spraying on the general health and welfare of the inhabitants of certain small Venezuelan towns.

As time permits, it is hoped to survey the blood protozoa of local birds, reptiles, bats, and other possible hosts for *Plasmodium* or related genera.

The third class of special studies is a continuation of the taxonomic entomology which has been carried on for some years in Venezuela by Dr. Pable Cova-Garcia.

ADMINISTRATIVE. About 10 percent of the budget is required for these activities. In the field, the functions of ordering supplies, handling payrolls, and accounting for property are discharged by administrative aides and clerks. Comparable activities, including personnel actions, are performed by the Administrative Section which also contains the photographic unit.

The Division appears to have considerable freedom in the recruiting, placement, classification, and movement of personnel. On the other hand, it suffers great delays

and inefficiencies, resulting from the present necessity of procuring supplies through a highly centralized governmental purchasing agency. These difficulties are, of course, greatly augmented by the fact that most of the equipment and materials have to be imported.

Except for petty items, direct purchasing by the Malariología is not permitted. All that the Divisional Administrative Section can do is transmit to the Ministry of Health specifications for items desired and indicate agents from whom they may be procured. The administrative unit within the Ministry obtains bids, makes purchasing arrangements, and prepares the purchase orders. These must then be preaudited and approved in the Comptroller General's Office, at which level it is not uncommon to have negotiations reopened with local agents or with sales agencies abroad, thus delaying by months the arrival of items which may be critical for continued operations. Authorization for the Malariología to make direct purchases, at least of standard materials and equipment, subject to post-audit, would undoubtedly improve the efficiency and probably reduce the cost of malaria control activities.

It is the fiscal practice in the Venezuelan Government to make funds available on a monthly basis in equal sums throughout the year. While this routine is undoubtedly satisfactory for many departments and agencies, it is very difficult for units in which activities are as highly seasonal as malaria control to meet their obligations promptly and adequately, or to take advantage of occasional but profitable opportunities to buy at bargain rates. If funds could be transferred to the Malariología in accordance with seasonal needs, additional economies might be effected.

In summary, it may be said that Dr. Gabaldón has established an effective organization which is giving essential malaria-control service to the citizens of Venezuela. It is flexible enough to adapt easily to a DDT program which is planned to become country-wide in its application. Between the DDT and the free antimalarial

treatments, it is probable that malaria will be reduced to a very low prevalence and in time may be extinguished completely in certain places. Indeed, it is not unlikely that, in certain biological islands such as some of the mountain valleys, the vectors of malaria may be eradicated. There appears to be no reason why the primary malaria control objective of the Malariología cannot be expanded in time to include

the control of all domestic insects and rodents and the diseases of man which they transmit. This would presumably achieve such collateral health benefits as reduction of enteric infections, especially in the very young, Chagas' disease, murine typhus, filariasis, sandfly fever, leishmaniasis, and possibly other maladies the transmission of which by insects or arthropods is not now recognized.

RECOMMENDATIONS

The following suggestions are made with the view of improving the efficiency and effectiveness of Venezuelan malaria control operations in general, and of DDT service in particular:

1. Responsible Divisional personnel, especially Section Chiefs, should make frequent visits into the field to observe: 1) the collection of exploratory, inspectorial, and evaluative data, and 2) operational procedures.

Members of the field staff can not have the perspective of divisional headquarters personnel. They may unknowingly drift into or permit substandard practices to develop, the inferiority of which is immediately apparent to persons familiar with the programs in all zones. Corrections and constructive suggestions should be made to the ranking zone representative who should transmit them to his own subordinates.

The field is a fertile territory for the development of new methods and ideas. Such improvements should be considered carefully by Section Chiefs,

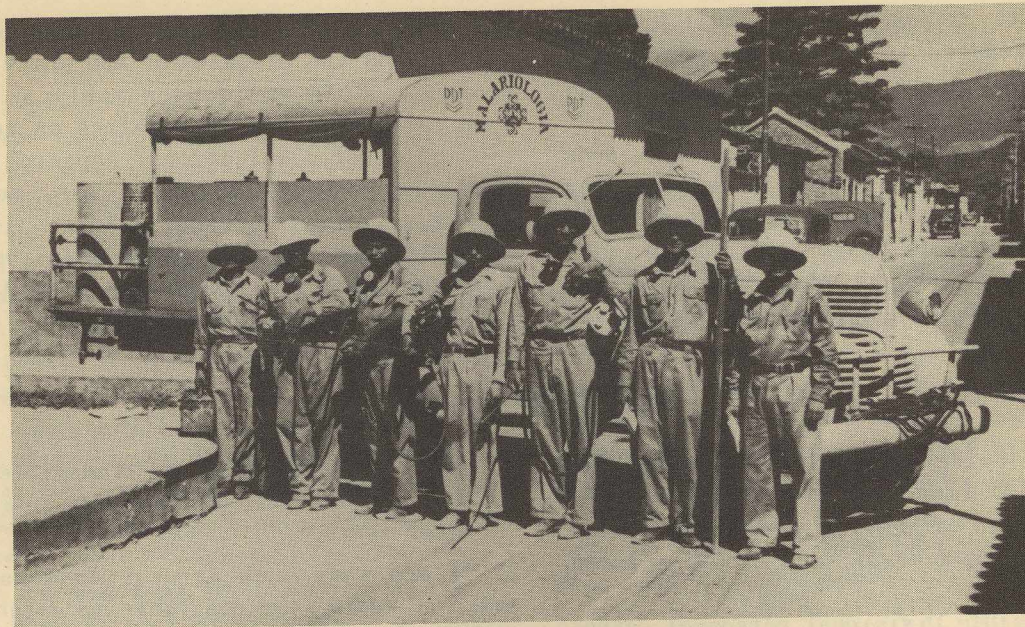
and, if meritorious, be transmitted to and demonstrated before personnel in other zones.

2. If and when such arrangements can be made, it would seem desirable to establish one designated individual as chief or director for each zone, to be responsible *administratively* to the Divisional Chief for the entire zonal organization. Within such a framework, the field representatives of medical, engineering, or other activities would still obtain technical direction from the Chiefs of their respective Divisional Sections.

3. In the opinion of the author, the DDT program may be improved as indicated below. Wide-scale operational changes should not, of course, be undertaken until adequate field testing under local conditions has established their desirability.

- a) Change from DDT suspension to DDT emulsion; unless the cost differential (including savings on labor and equipment maintenance) is prohibitive.¹
- b) Increase the application rate from

¹This recommendation was based upon (a) the uncertain efficiency and excessive maintenance and replacement costs for handspray equipment as used in Venezuela for applying wettable DDT, plus (b) the presumption, based on insufficient study, that there was no significant difference in the insecticidal effectiveness and durability of emulsified and suspended DDT. Since then, more technological evidence bearing on this point has been published from other countries indicating that the residual efficiency of wettable DDT definitely surpasses that of emulsions or solutions of DDT on earthen walls. In view of this more recent information, experiments should be made in Venezuela to assess the comparative insecticidal properties of these two forms of DDT under local conditions. Such investigations are now in progress. If it is determined that water-wettable DDT is best adapted for the needs of the country, the next developments should be to obtain spray equipment more suitable for its application.-J.M.A.



A Venezuelan DDT spraying crew and truck.

one to two grams per square meter. If the spraying is to be done only for malaria-control purposes, it should be possible to reduce the number of sprays per year from three to two, the first of which should come at the end of the dry season, and the second approximately four months later. If the program is expanded for the destruction of *all* household insects, a third spraying at the same application rate should be added four months after the second.

- c) It is believed that smaller crews of two or three sprayers could operate more efficiently than the present crews of six sprayers where houses are greatly dispersed. It is suggested, therefore, that studies be made in each of the zones to determine the amount of terrain which could be served most efficiently 1) by the larger crews carried in heavier trucks, and 2) by smaller crews carried in lighter trucks. It would then be possible to place an order for small but substantial vehicles, and organize itineraries for each type of truck.
- d) All trucks should be equipped with

functional air compressors and tanks so that spray cans may be charged with compressed air from the tanks, rather than by hand pumping.

- e) Tanks for holding and mixing DDT emulsion should be installed permanently in the trucks. Drums of 55-gallon capacity constitute a good makeshift, but are now expensive and hard to obtain. It seems likely that substantial metal tanks with less waste space than drums could be fabricated locally and installed in the trucks.
- f) Motor-driven water pumps should be installed on all trucks, plumbed to the DDT tanks, and equipped with sufficient inlet hose so that water may be pumped from a natural source directly into the tanks without the use of hand labor. These could also be rigged for mixing DDT with water if desired.
- g) Extra spray nozzles should be carried by each sprayer. He should not be allowed to clean nozzles with metal probes. Wooden ones (toothpicks) will do the job as well, and will not deform or enlarge the nozzle aperture.

Pending the arrival of more nozzles, the operation of many now on hand could be improved by filling the present aperture with brazing metal and reboring and shaping a new one.

- h) Spray cans should be equipped with inlet extensions so that they cannot be filled with DDT mixtures beyond two-thirds capacity.

4. It is believed that the present anti-anopheline DDT program should be extended to a complete domestic insecticidal program. As malaria prevalence decreases, interest in and budgetary support for continued malaria operations will decline. If the objectives of DDT service were redefined to include the control of all domestic insects, this would diminish the number of household pests and insure collateral health benefits in reduction of enteric infections, Chagas' disease, filariasis, sandfly fever, leishmaniasis, and possibly other maladies the transmission of which by arthropods is not now recognized. If and when such a program

is realized, it would seem logical to consolidate the Division of Yellow Fever and Plague Control with the Division of Malariology.

5. Prints of aerial photographs taken for any government agency should be made available at cost to the Division of Malariology for mapping purposes.

6. It would be desirable to have fiscal allowances transferred to the Malariología according to its seasonal needs, rather than on a parity monthly basis. The expenses of operational programs which are as seasonal as malaria control require more funds during certain months than others.

7. It is highly desirable that the Malariología be authorized to make direct purchases of standard items used recurrently in the operational programs, subject to post-audit. The uncertainties and delays inherent in the activities of any distant and unrelated purchasing agency, together with the pre-auditing practice, are inconsistent with the most efficient conduct of large operational programs.

B. OBSERVATIONS IN COLOMBIA



The Institute de Estudios Especiales "Carlos Finlay" is located in Bogota and was founded in 1935 by the International

Health Division of the Rockefeller Foundation to provide facilities for the study of yellow fever problems in northern South America. Past directors and investigators have included the following members of the International Health Division: Drs. George Bevier, John Bugher, Charles R. Anderson, Hugh Smith, Henry Kumm, John R. Paul, Rolla D. Hill and Austin Kerr. The present director is Dr. John E. Elmendorf and he is assisted by Dr. Augusto Gast-Galvis,

Pathologist, and Dr. Manuel Roca-Garcia, Vaccine Specialist.

The laboratory produces yellow fever vaccine for use in the vaccination campaign against yellow fever in Colombia. From 1937 to May 1, 1947, 1,120,000 persons have been vaccinated in this country. Vaccine produced in this laboratory is also distributed free to the neighboring countries with actual or potential yellow fever problems (Equador, Peru, Venezuela, Panama, Cuba, Dominican Republic, Haiti, British Guiana, and Curacao).

As a diagnostic element in the yellow fever control program, a viscerotomy service has been established throughout the country. This includes some 200 posts

equipped to obtain specimens of liver from cadavers of persons dying with unrecognized types of fevers. These specimens of liver are fixed, sectioned and examined histopathologically at the Institute with the object of determining whether or not yellow fever or some other disease diagnosable from liver sections was the cause of death. Thus, it has been possible to confirm rapidly the presence of yellow fever outbreaks — sylvatic or urban — before epidemics get under way. Furthermore, by means of this viscerotomy service there have been discovered in Colombia cases of visceral leishmaniasis and histoplasmosis which previously have not been known to occur in that country. Since the Institute was established, no cases of urban yellow fever have been reported except for a few cases at Buena Vista on the Magdalena River (reported about 1947). Some 20,000 liver specimens have been examined from Colombia and other South American countries.

The laboratory is also making investigations on the medical entomology of yellow fever and studies upon immunity contributing to knowledge of the spread of yellow fever, and is attempting to discover the duration of vaccine protection.

A continuation of present activities is planned for the future. In addition, it is hoped to undertake studies of rickettsial diseases, principally typhus and spotted-fever, and other diseases caused by viruses. It is planned to produce vaccine against typhus and spotted-fever. Special studies will be made in pathology in relation to public health.

The Instituto de Estudios Especiales "Carlos Finlay" is being consolidated with the Samper Martinez National Institute of Hygiene; both buildings are located in the same block. The Carlos Finlay Institute will constitute the Sections on Pathology and Medical Entomology of the larger National Institute of Hygiene.

Yellow Fever is a disease which seems removed, unreal, and not especially important to many American public health scientists. Nevertheless, as of October 17, 1947, 56 fatal cases of yellow fever had

been diagnosed in Colombia that year. That is not the complete total of deaths due to this disease as viscerotomy coverage is incomplete and imperfect.

For the past 15 years, all yellow fever cases in Colombia have occurred in isolated forest areas, principally sparsely populated regions. Occasionally a yellow fever patient is able to reach town before he dies or recovers and, since *Aedes aegypti* occurs in many towns in certain regions, the threat of urban epidemics is ever-present. One of the arguments for getting rid of *Aedes aegypti* in South America is that there are large parts of the continent where the species has never arrived. One of these areas is the entire eastern slope of the Andes and the llanos in Colombia. *Aedes aegypti* has never been found in Villavicencio or Acacias (a town from which many cases of yellow fever are currently reported) but, with constantly improving means of transportation, the species will arrive in these areas sooner or later unless eradication is completed. It is probably because many of the areas are without *Aedes aegypti* that urban outbreaks have not been more frequent in those areas where jungle yellow fever has occurred. Vaccination is the only known means of preventing this disease at present so it must be continued on a large scale until some better method is found.

There is an important international aspect to the yellow fever problem. Yellow fever is one of the diseases that travels well in ships and probably even better in airplanes. The disease accompanied sailing ships that carried water in barrels and tanks which were left open so that *Aedes aegypti* could breed freely throughout the voyage. Although ships today are less vulnerable, the airplane carries the infected case through to any destination in less than the maximum incubation period of yellow fever. Every effort is made in South American countries where yellow fever is a potential problem to prevent the extension of this deadly disease from jungle situations to cities and especially to seaports and airports. Large-scale eradication

programs are in effect in all South American countries where the disease occurs. An agreement has been negotiated by Colombia with Brazil and Peru to the effect that all three countries will enlarge their campaigns against this disease. Due to the research of the International Health Division personnel and their associates in Brazil and

present activities are concerned with describing species in terms of functional rather than morphological differences, using anopheline mosquitoes. There are 23 species of *Anopheles* in the area. Dr. Bates is of the opinion that anatomic differentiations are the reflections of environmental adaptations. Studies are



This Venezuelan worker is stencilling the date of DDT application on the wall of a house.

Colombia, it is now known that yellow fever is reservoired principally in aboreal primates, principally marmosets, and possibly marsupials from which it is transmitted in nature by various species of *Haemagogus* mosquitoes. It occasionally reaches man when wood-cutters or cacao gatherers or others working in wooded situations are bitten by these mosquitoes.

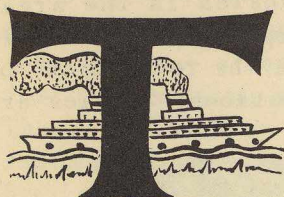
The Villavicencio Field Laboratory of the International Health Division of the Rockefeller foundation is directed by Dr. Marston Bates and was established in 1934 to conduct special studies in conjunction with the Carlos Finlay Institute on the reservoirs and transmitters of jungle (sylvan) yellow fever in northern South America. This work has now been discontinued. The

now in progress describing the physiologic rhythms of anopheline species, e.g., rate of growth and moulting, time of day of moulting or pupation, etc.

The Laboratory is a series of one-story buildings with insectaries above and under ground, animal cages and laboratory-offices. Dr. Julian Zulueta of Madrid, Spain, is working on mosquitoes with one or two helpers under the supervision of Dr. Bates.

Dr. Bates is just finishing a book to be entitled, "The Natural History of Mosquitoes", but his wife, Nancy Bell Bates, has beaten him to the market with her report of life in the llanos, entitled "East of the Andes and West of Nowhere".

C. OBSERVATIONS IN PANAMA



The Gorgas Memorial Laboratory is the research component of the Gorgas Memorial Institute, the administrative headquarters of which are located in Washington, D. C. The Laboratory is situated in the city of Panama, R.P., and operates at present a single field station known as the Juan Mina Station. This last provides field facilities for certain mosquito and malaria studies in the Chagres River area.

The full-time scientific staff of the Gorgas Memorial Laboratory consists of Dr. Herbert C. Clark, Director; Major Marshall Hertig, Sn.C., AUS, Investigator; Dr. Graham Fairchild, Investigator; and Dr. Harold Trapido, Biologist (absent on a Rockefeller Foundation-sponsored trip to Colombia and Venezuela when Laboratory was visited). In addition, Srs. Pedro Galindo and Marcelo Gallardo, members of the *Compañía Antimalarica* of the Panamanian Government, have part-time appointments with the Laboratory.

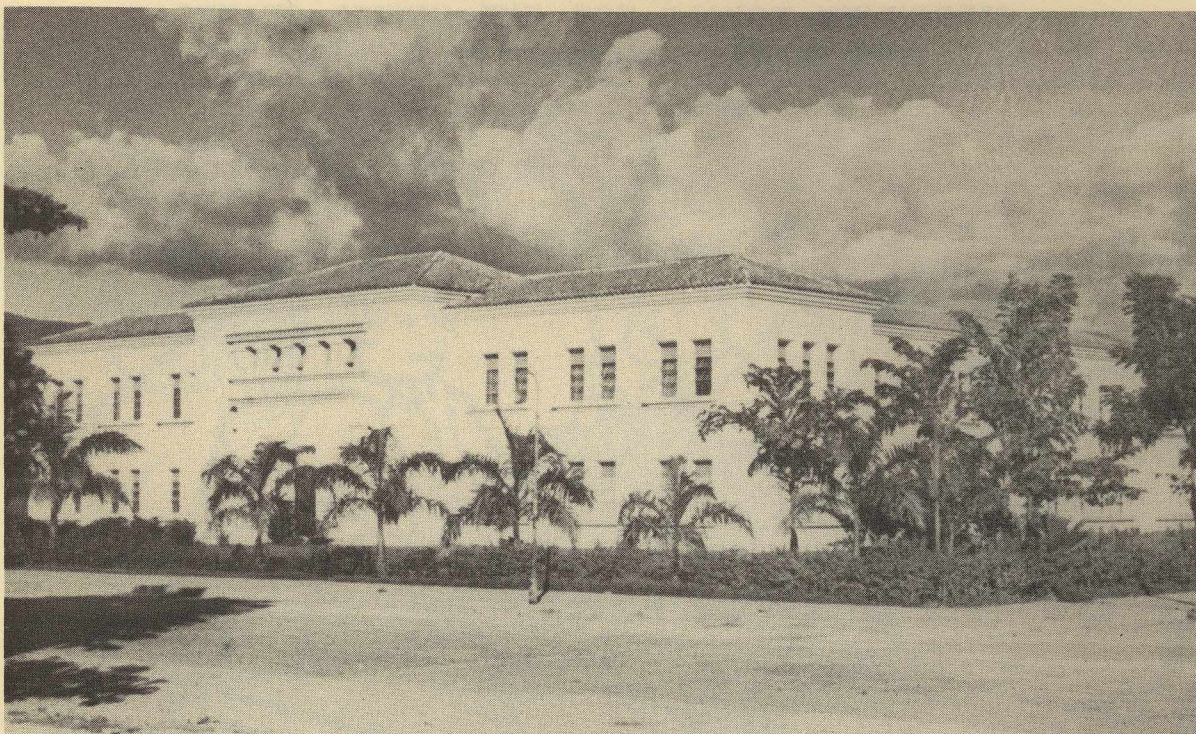
The activities of the Laboratory for many years have been concerned with research on diseases effecting man and animals in the American tropics. Dr. Clark is interested primarily in practicable types of malaria control which will enhance the physical effectiveness of tropical labor. For some 17 years, he and Colonel W. H. W. Komp of the USPHS have been evaluating standard antimalarial drugs (quinine, atabrine and plasmochin) for this purpose. These observations have been made on the inhabitants of isolated villages situated on the banks of the Chagres River. In general, the practice has been to make monthly blood surveys and to provide parasite positives with courses of treatment of one or another or a combination of these drugs. Present conclusions are that, used according to the conditions of this study,

these drugs reduce malaria morbidity to a marked degree but hold no promise of malaria eradication and probably do not interfere significantly in the transmission of the disease. During the FY 1945, Dr. Trapido commenced spraying certain of these villages with residual DDT. He succeeded in reducing the domestic mosquito population (*Anopheles albimanus*) in a single season to the point where transmission — as measured by monthly blood positives — was lower than it had ever been in the past by treatment, though it had not been eradicated. Present plans are to stop or reduce drug treatment in all these villages and to substitute residual DDT house spraying.

With the advent of chloroquine and paludrine, Dr. Clark has commenced some new 12-month experiments with drug control on the inhabitants of isolated villages on the shores of Gatun Lake. These involve the distribution of suppressive doses to every resident each week and blood surveys each two or three months. In some instances, the villages are also sprayed with DDT. These observations have been in progress since the first of this calendar year but are much more promising not only from the standpoint of reducing morbidity but of diminishing parasitemia and preventing transmission as well. Of the two drugs, chloroquine seems to be the more efficient.

Major Hertig and Dr. Fairchild work almost exclusively on sandflies of the genus *Phlebotomus*. Their taxonomic activities have produced many revised and improved descriptions of old species and accounts of new ones. Operationally, they have shown that relatively minute quantities of residual DDT placed on sandfly breeding places and within the walls of houses reduce the sandfly population virtually to the point of extinction.

In addition to his malaria interest, Dr. Trapido, who has a broad biological background, has been making investigations



This fine, white-stone laboratory and office building is the "Malariología" in Maracay, Venezuela.

concerning the life history and taxonomy of tropical amphibia and reptiles.

Drs. Clark and Trapido act as consultants to the Campana Antimalarica in the development of a program of malaria control for the country. As presently formulated, it consists of weekly administration of chloroquine to school children combined with DDT house-spraying.

The author visited the town of Nata while spraying was in progress. A 2½% mixture of wettable DDT in water is used and efforts are made to wet thoroughly ceilings and walls with this spray so that approximately 200 mm. of DDT are deposited per sq. ft. While the DDT program is still in its formulative stages, it is being developed with simplicity and economy. Pickup trucks are used to transport hand sprayers to villages. DDT mixtures are made by hand in 55-gallon drums which are taken out of the truck and set up on a platform in the center of each village. The same mechanical

disabilities with hand sprayers noted in Venezuela were seen also in Panama. Nozzles became occluded, valves stuck and hand pumps jammed as a result of the use of wettable DDT. This resulted in reduced labor productivity.

This form of DDT has been selected because of the experiments and experience of Dr. Trapido, plus the practical consideration that wettable DDT, delivered in Panama, costs less than any other type. He found that oil-borne DDT was not as effective as the wettable product and that DDT-xylene-triton emulsions were much more irritating to the eyes and mucous membranes of the sprayers. The advantages and disadvantages of the three types of DDT were discussed with Mr. Gallardo and Dr. Clark and the suggestion made that the use of emulsified DDT be reconsidered, taking into account excessive labor and equipment maintenance cost, factors mentioned relative to the Venezuelan observations.