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RESEARCH ACTIVITIES AT THE
TRINIDAD REGIONAL VIRUS LABORATORY (TRVL)

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INTRODUCTION

A review of the research of a laboratory continuously active since 1953, which has had from four to seven professional staff and has published about 175 scientific papers, requires great selectivity.

In the life of the Trinidad Regional Virus Laboratory (TRVL), three main periods emerge:

(1) 1952-1961. An expanding research program directed by the Rockefeller Foundation and confined virtually to the arthropod-borne viruses of Trinidad and the surrounding Caribbean was developed using a converted wooden building in Wrightson Road, Port of Spain. Towards the end of this period, a field station was established in Bush Bush Forest, Nariva Swamp.

(2) 1962-1968. The laboratory was moved to a modern building in Federation Park, Port of Spain, which had previously housed the Colonial Microbiological Research Institute. Extensive modification and addition to the facilities were made. The University of the West Indies took over the administration of the laboratory. Scientists expanded the ecological studies of the arthropod-borne viruses but at the end of 1966, research at Bush Bush Forest was greatly reduced.

The introduction of cell-culture techniques allowed the investigation and surveillance of enteroviruses and respiratory virus infections. Studies of acute nephritis and streptococcal infections started.

(3) 1969 to date. Rockefeller Foundation funds and staffing ceased and the staff was reduced to half. Virus surveillance increased. Arthropod-borne virus studies were reduced to a minimum. Work at the laboratory

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became divided into sections and was increasingly funded by grants. Visiting staff (resident or part-time) carried out research on mongooses and rabies; the ecology of two Culex species thought to be vectors of Eastern equine encephalitis and Venezuelan equine encephalitis; streptococcal disease; bats and arboviruses; and on scorpion venom.

Background data concerning Trinidad, the TRVL facilities, staffing, and budget, are given in the Appendix.

RESEARCH TO DATE

A. Arthropod-borne viruses

Full-scale research in this field was continuous in Trinidad but included also the survey of many islands in the Caribbean and part of mainland South America. There were a number of main avenues in the closely knit program.

- (1) Virus isolations (using infant mice) from patients with febrile illness, jaundice, and encephalitis.
- (2) Human serologic survey for arboviruses throughout the area.
- (3) Arbovirus isolations from vertebrate hosts--mainly mammals and birds of a wide variety.
- (4) Arbovirus isolations from arthropods--mainly culicine mosquitoes.
- (5) Associated ecological, behavioral, and taxonomic studies of wild animals and arthropods.
- (6) Mosquito surveys throughout much of the region.

The laboratory identified more than 30 different arboviruses belonging to at least 15 different groups, many previously undescribed, as well as agents such as rabies virus and the rodent-associated Cocal virus of the vesicular stomatitis group. Nearly all arbovirus types were isolated from mosquitoes or ticks; 11 different arbovirus came from man. Vertebrate reservoirs were determined for eight of the arboviruses. Apart from the arbovirus serologic profile and the studies which provided much basic data concerning vectors, vertebrate hosts, seasonal

patterns, and ecology in Trinidad, the following appear to be the most important findings.

(a) Yellow Fever

The virus is epizootic in primates. Haemogogus is the sylvan vector. Aedes aegypti was an important vector in the 1954 epidemic. The arbovirus research activities alerted the Trinidad health authorities in time to avert a major epidemic of yellow fever. Subsequent eradication of Aedes aegypti has been virtually achieved and there is at present little risk of urban yellow fever in the island. The vaccination of rural populations continues.

(b) Dengue

Types 1, 2, and 3 have been identified in outbreaks of dengue. The disease is endemic in many islands where Aedes aegypti survive in adequate numbers throughout the year. Hemorrhagic dengue has been reported but not confirmed.

(c) Eastern equine encephalitis

Annually isolated in Trinidad. This arbovirus produces disease in horses but human infection also occurs and one fatal case has been detected. Culex melanoconion taeniopus is an important vector but the vertebrate host has not been determined.

(d) Venezuelan equine encephalitis

Enzootic in many parts of Trinidad. Rodents are the natural reservoir. Culex (M) portesi is the main vector. Although human antibodies have been recognized, the virus has not been isolated from the naturally infected man since 1954.

(e) St. Louis encephalitis

Isolated from man in Trinidad and Jamaica. There is evidence that as elsewhere the vertebrate host is avian.

(f) Guama Group

The natural cycle is rodent/mosquito. A human infection caused by the Catu virus has been recorded.

(g) Tacaribe

This virus was isolated from bats. It is a member of the group of South American hemorrhagic fever viruses. Its natural history is unknown.

B. Rabies

Field studies soon yielded rabies virus from frugivorous bats. The virus is enzootic in vampire bats in Trinidad, which occasionally transmit the virus to domestic cattle.

In Grenada, rabies is enzootic in the mongoose Herpestes auropunctatus, which transmit the disease to dogs, cattle, and other domestic animals. Four human deaths occurred. Research focussed on the ecology of the mongoose. One to four percent captured mongooses are infected with rabies and up to 19 percent contain neutralizing antibodies to the virus. Control of rabies in Grenada includes the vaccination of domestic animals and an expanding program of mongoose poisoning. The surveillance of rabies virus activity and of mongoose populations continues.

C. Leptospirosis

Throughout much of the period leptospiral isolation and serologic studies have been made on febrile patients, particularly those with jaundice. Between one and two percent of them have either yielded leptospire or shown serologic conversion. Six serotypes of leptospira, some apparently hitherto unknown, have been recovered. Leptospira have also been found in rodents and mongooses. There is no reason to believe the natural history of the disease is exceptional in the Caribbean. It does, however, appear to be a significant health problem and mortality and morbidity data are inadequate.

D. Streptococcal disease

Acute glomerulonephritis reached epidemic proportions in Trinidad in 1964-1965. Since then TRVL has provided facilities for visiting workers

to study the disease and the streptococcal infections that are common and widespread. Activities encompassed:

- (1) Isolation of streptococci from patients with skin sepsis, nephritis, and rheumatic fever for typing overseas
- (2) Studies to detect changes in streptococcal types
- (3) Isolation studies from flies of the genus Hippelates
- (4) Trials of skin creams and drugs in the treatment of streptococcal disease
- (5) Recent studies to determine if there is a genetic predisposition to the disease rheumatic fever and
- (6) Assays of cellular reactivity to cellular and extra-cellular streptococcal antigens

E. Enteroviruses and respiratory syncytial virus

Routine isolation in cell cultures yielded a range of viruses found throughout the world. Influenza A₂, Asian, Hongkong, and England, have been found during epidemic periods. Influenza B and respiratory syncytial outbreaks have occurred. Adenoviruses were frequently found. Poliomyelitis epidemics were studied. Some outbreaks of gastroenteritis appear to be associated with an increase in echovirus activity. Broadly the pattern in the Caribbean does not appear to be significantly different from that of other parts of the world.

F. Parasitology

Little work has been done. Study of human feces showed that intestinal parasites are common. Human serology demonstrated that toxoplasma infection is widespread and associated with eye disease. Collections of avian malaria, reptilian hemogregarines and a variety of nematodes from reptiles, amphibians, bats, and other small mammals have been made. Leishmania is enzootic in rodents and the vector is a phlebotomus sandfly.

FUTURE RESEARCH

Although the future and possible expansion of TRVL is being reviewed by an expert committee, it seems reasonable to make suggestions for future research.

1. Surveillance

There is an immediate need for improvement in the reporting and the laboratory network for the investigation of disease in this region. Although largely in the service area, the development will require applied investigation to determine an efficient system for the Caribbean.

2. Arthropod-borne viruses

a. Yellow fever remains a continental problem. In Trinidad it is a threat and its control, a continuing burden. The vaccination program makes it difficult to determine the incidence of human infection. Research is needed on monkey ecology. The possibility of vaccinating monkeys should be considered as a potentially cheaper and more effective method of control. An immunologic test is needed to distinguish between natural and vaccine infections. The decision to stop Aedes aegypti eradication in the United States may lead to infestation of areas in the Caribbean where control or eradication has been successful.

b. A dengue surveillance needs to be established widely in the Caribbean--a region where the hemorrhagic form of the disease is forecast. Immunologic tests and isolation techniques require improvement.

c. Eastern equine encephalitis. The definition of the vertebrate reservoir in Trinidad seems a worthwhile and achievable objective.

Agricultural developments in Trinidad and elsewhere should be monitored to detect significant changes in disease patterns. On the mainland, in Guyana, studies should be developed in relation to arbovirus distribution and outbreaks.

3. Rabies

Mongoose are wild in many of the Caribbean islands and are reservoirs of rabies in three of them. Introduction of rabies to other islands is to be feared. Ecologic and immunologic studies on mongooses, particularly in Grenada, should be expanded and adequately funded. In Grenada, where there is widescale poisoning of mongooses, there is a danger that there will be inadequate resources to study the changes.

4. Leptospirosis

There is a need for expanded investigation of this problem in man, domestic and wild animals.

5. Streptococcal disease

Two groups with support from the United States are studying streptococcal infections, nephritis, and rheumatic fever in Trinidad. The work appears to be underfunded and justify expansion. Virtually nothing is known about infections in other islands or the mainland.

6. Viral hepatitis

This disease is common in the Caribbean. Basic screening facilities for the Australia antigen are not available in much of the area. The possibility of insect transmission could be investigated.

7. Parasitology

Facilities exist to allow further investigation of human and animal parasites.

8. Entomology

The increasing reluctance to use insecticides widely for the eradication of biting arthropods means that there should be continuing

studies of common species to determine possible biological or environmental control measures. On the mainland, the knowledge about Simulium is very limited. Control of these flies is of importance for the development of the country.

These are only a few lines of research in the infectious disease field. The TRVL has underutilized good laboratory facilities. It can provide a satisfactory base for investigation in the surrounding area. The Caribbean region offers island and mainland communities of varying sizes. Where Aedes aegypti is controlled, all homes are individually numbered - perhaps a useful starting point for some epidemiological studies.

APPENDIX

I Directors

1952 - 1961	Dr. W. G. Downs
1962 - 1968	Dr. L. Spence
1969 - 1972	Dr. P. Ardoin

II Funding and Staff

From 1952 to 1961 the annual expenditure gradually increased to about US\$146,000.00 with an increasing proportion coming from the Caribbean and the British Governments. During 1962 expenditure was:

Rockefeller Foundation	US\$62,222.00
CD&W	36,965.00
West Indian Governments	<u>55,448.00</u>
	<u>US\$154,635.00</u>

In addition, during 1961/62 nearly US\$200,000.00 was provided by the Rockefeller Foundation for modification and addition to the new quarters. From 1962-1968 expenditure ranged between US\$145,000.00 and \$225,000.00. Staff varied between 4 to 7 professional, 11 to 18 technical, and 36 to 48 other workers. None of the above expenditures included the salaries and other associated expenses for up to 4 Rockefeller Foundation staff members or one Medical Research Council (UK) senior laboratory technician. Nor does it include the purchasing and freight facilities provided by the Rockefeller Foundation.

Since 1969 the laboratory has operated on a triennial budget. During the triennium 1969-70 to 1971-72 the total budget was just under £200,000 and this supported a core establishment of 2 professional, 7 technical, and 15 other staff. Contributions came in roughly the following proportions:

<u>Government</u>	<u>% Contribution</u>
Barbados	2.9
Trinidad & Tobago	40.4
Jamaica	17.3
Guyana	4.4
United Kingdom (Overseas Development Agency)	<u>45.0</u>
	<u>100.0</u>

The budget for the new triennium 1972-73 to 1975-76 totals just over £250,000 and the staff of the establishment has been increased by one professional, one technical, and two other workers. In addition, the laboratory receives grants for special projects from the National Institutes of Health (finishing this year), Medical Research Council (UK), the World Health Organization, and the Wellcome Trust. Resident visiting staff are two from the Medical Research Council (UK), who are separately funded, and one scientist from the Pan American Health Organization.

III Facilities

The Trinidad Regional Virus Laboratory is sited in a residential area, in its own compound of about 10 acres that also contain a block of four large apartments and a cottage for the staff. The mainly one-floor laboratory complex is brick built. Physically part of it is the new Trinidad Public Health Laboratory (TPHL).

Space is utilized very approximately as follows:

	Square Feet
Laboratories	5,000
Animals & Insectary	5,000
Offices	3,800
Stores	1,200
Library & Seminar Room	1,200
Unused or undeveloped	2,400
TPHL	<u>2,800</u>
	<u>21,400</u>

Services include electrical mains, water, and drainage. Liquid nitrogen, gas, and solid CO₂ are available. An international airport with daily communication to the Caribbean, Continental America, and Europe is 45 minutes distant.

IV Trinidad

Trinidad is an island (30 x 40 miles) that lies a few miles off the northeast tip of Venezuela between 10° and 11° north latitude. Ecologically, it is in most respects an extension of the mainland with a mountain range rising to 3,000 feet, tropical forest, savannah, and swamp. The population is about 1,000,000 inhabitants.