CAREC’s **Vision Statement**

CAREC, a public health information, service and consulting organisation, dedicated to being the best at providing information that people need to improve health and prevent disease in the Caribbean.

CAREC’s **Mission Statement**

To improve the health status of Caribbean people by advancing the capability of member countries in epidemiology, laboratory technology and related public health disciplines through technical cooperation, service, training, research and a well-trained motivated staff.
The Caribbean Epidemiology Centre: Contributions to Public Health 1975 - 2012

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with

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and

Henry Smith

The Caribbean Epidemiology Centre (CAREC), an institute of the Pan American Health Organization/World Health Organization (PAHO/WHO), was established on 1 January 1975 succeeding the Trinidad Regional Virus Laboratory. The new CAREC’s role was to expand and improve the diagnosis, surveillance, control, and prevention of communicable diseases throughout the Commonwealth Caribbean as well as to conduct operational research. Initially, there were 18 countries and the Centre expanded later to include the former Dutch territories Aruba, Curaçao, Bonaire and the Netherlands Antilles. CAREC was funded by its Member Countries, PAHO/WHO, the British Government and grants from various funding agencies.

In July 2011 CAREC, together with four other agencies, (Caribbean Food and Nutrition Institute, the Caribbean Environmental Health Institute, Caribbean Health Research Council and the Caribbean Regional Drug Testing Laboratory) were united to form the larger Caribbean Public Health Agency (CARPHA). CAREC, therefore, ceased to exist after December 2012. CAREC’s Director at that time, Dr Beryl Irons, and former Director Dr James Hospedales thought it necessary to document its history and its contribution to Caribbean public health.

For this exercise a team consisting of Drs Irons, Hospedales, Rawlins, Mr Henry Smith, Ms Victoria Cruickshank-Taylor and myself met at CAREC to discuss the writing of its history. Topics were assigned and agreed to by various individuals, but I was asked to be the lead author and coordinator, with Ms Cruickshank-Taylor being the project leader. The outcome of the deliberations was to write a book on CAREC’s history.

The three basic units of the Centre - Surveillance, Laboratory and Training - worked closely as a team so it was inevitable there would be a certain amount of duplication, but these were kept to a minimum with each unit highlighting its own aspect of a project. In the end each chapter stands on its own merit.

CAREC’s contribution to Caribbean Public Health was enormous. The Centre brought in epidemiologists and laboratory technicians and other allied staff from CAREC’s Member Countries for training and workshops. Training activities were also conducted in the Member Countries.

In putting this book together I involved other people who had worked on specific projects at CAREC. Dr Gloria Beckles, who worked on the St James cardio-vascular project, graciously accepted my invitation to write that section of which she was an integral part with Dr George Miller.

Ms Valerie Wilson, who was in charge of the programme on “Strengthening of Medical Laboratories”, reviewed and made corrections to that section. Similarly, Ms Yvette Holder provided some changes on the Traffic Injury section which are also included. I thank them both for participating in this endeavour.

I also want to thank Dr James Hospedales with whom I had many discussions on CAREC’s history and Dr Beryl Irons for her support and moving this project forward. I acknowledge, with thanks, assistance rendered by Ms Victoria Cruickshank-Taylor for her encouragement, inserting some of the photos in the book and looking for, and supplying certain documents used in this book. I also thank Ms Sylvia Mitchell for being able to translate my handwriting and typing it. Ms Mitchell also typed some sections written by other authors. Finally, I thank my son Michael Tikasingh for computer assistance, enhancing some of the pictures for publication and taking some of the photographs.

Elisha S Tikasingh
Port of Spain
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The Caribbean Epidemiology Centre (CAREC/PAHO/WHO) was established in 1975 upon the request of the Heads of Governments of the Caribbean, facilitated by the Prime Minister of Trinidad and Tobago, Dr Eric Williams. Following a large outbreak of polio in Trinidad and Tobago, Dr Williams, in collaboration with the University of the West Indies, initiated the expansion of the Trinidad Regional Virology Laboratory (TRVL) to serve the wider Caribbean Region. Dr Williams envisaged the proposed CAREC should be self-governing and free from political interference. As such, the Pan American Health Organization/World Health Organization (PAHO/WHO) being the specialised international health agency working to improve and protect the health of the people of the Americas, was identified and approached to administer and govern the new Centre. CAREC was a unique Caribbean sub-regional health institution serving the Caribbean Community.

CAREC’s mandate was to provide public health technical cooperation, health monitoring and disease prevention, with an emphasis on epidemiology, surveillance strengthening and laboratory services to its Member States. The Centre responded to changing disease profiles in the Caribbean, expanding from coordinating surveillance of communicable diseases to include non-communicable diseases, and broadening the range and volume of laboratory testing to respond to the changing health environment.

The Caribbean Heads of Government agreed to take the helm and assume responsibility for Caribbean public health. After 37 years of service, CAREC closed its doors on 31 December 2012 to make way for the new Caribbean Public Health Agency (CARPHA), an amalgamation of five regional health agencies, including CAREC. This new agency inherited an institution with a rich history of excellence in public health and service to the people of the Caribbean. PAHO/WHO is committed to working with CARPHA to serve the Caribbean in areas of public health and indeed, to support the agency itself as a newly formed public health institution.

As the Director of PAHO/WHO I feel that the story of CAREC/PAHO/WHO is too important not to be documented, not only to provide that nostalgic memory of the Centre for those of us who lived through and benefitted from it, but also to capture the wealth of the Centre’s contribution to public health. I am most grateful to Dr Elisha Tikasingh, the lead author on this publication, for accepting and undertaking this mammoth task. I wish to express my gratitude, too, to the co-authors, Dr Samuel Rawlins and Mr Henry Smith. Finally, I thank the many former “CARECters” who have contributed to the content and/or production of this important document which would not have been possible without all of your contributions.
INTRODUCTION

The Caribbean Epidemiology Centre (CAREC) was established in January 1975 succeeding the Trinidad Regional Virus Laboratory (TRVL). The TRVL itself was established in 1952 by the Rockefeller Foundation in partnership with the Trinidad and Tobago Government. TRVL was engaged in much work on insect, tick and mite transmitted viruses, commonly called arboviruses. There was also great focus on yellow fever, and Mayaro and Oropouche viruses, which were new to science at that time, and had been isolated at TRVL. In the latter years work expanded to include respiratory and enteroviruses, such as poliomyelitis. TRVL also provided assistance to the veterinarians in isolating the virus of Newcastle disease in chickens. Non-viral diseases such as Leptospira, Toxoplasma and Trypanosoma were also investigated. Shortly thereafter, the Commonwealth Caribbean Countries and the Ministry of Overseas Development of the United Kingdom Government became associated with this effort and contributed financially to the work of TRVL.

The TRVL was originally housed in one of the World War II army barracks on the waterfront of Port of Spain. It was administered by the Rockefeller Foundation with one of its staff members, Dr Wilbur G Downs, as its Director. The Rockefeller Foundation had spent many years studying yellow fever in the field and laboratory and made many discoveries on the natural history of yellow fever.

The Rockefeller Foundation then decided to open field laboratories in selected countries around the world to see if there were other viruses lurking in the environment. They established laboratories in Poona, India; Johannesburg, South Africa; Berkeley, California, USA; Port of Spain, Trinidad and Tobago; Cali, Colombia; Belem, Brazil and subsequently in Nigeria. Trinidad was selected because it was a tropical island with good air and sea connections to the Caribbean and North and South America. Further, there was a good system of roads, a fairly dependable electricity supply and a promise of a dry-ice factory which was needed to store viruses at extremely low temperatures.

Before the establishment of TRVL, three arboviruses had been identified in Trinidad: yellow fever, dengue and Venezuelan equine encephalitis. A surveillance system had been organised to monitor fevers of unknown origin in the main hospitals and district health clinics, particularly in rural areas. Blood samples would be taken from these patients and tested for the presence of viruses. This system led to the isolation of the Mayaro and Oropouche viruses which were new to science at that time. The dengue 2 virus was also isolated for the first time in the Western Hemisphere. In 1954, the TRVL scientists also rediscovered the yellow fever virus in Trinidad after an absence of 40 years. While the monitoring of fevers of unknown origin was being conducted, studies on mosquitoes and vertebrates such as monkeys, bats, rodents and birds were carried on at the same time. By the end of 1974, these studies led to the isolation of 1542 strains of arboviruses. Thirty seven of these were distinct strains of which 19 were new to science. Most of the new strains were named after Amerindian tribes of Trinidad.

Other Caribbean Governments were now seeking assistance in outbreaks of viral diseases in their countries. Another arbovirus infecting humans in the Caribbean was dengue. There were outbreaks of dengue in 1962-1963 in Jamaica, Antigua, St Kitts and Nevis, and in Curacao. Later, in 1970, Grenada witnessed an outbreak. TRVL investigated all these outbreaks.
While TRVL was primarily engaged in a study on arboviruses, the early workers gradually started working on viruses such as the respiratory and enteroviruses. Dr Leslie Spence (Fig. 1.2) who had become Director of the TRVL in 1961, was the prime mover of this aspect of the laboratory. In 1956, for instance, he isolated the Asian influenza virus in Trinidad, the first for the Commonwealth Caribbean.

In 1960, the Colonial Microbiological Research Institute (COMIRI) which had modern facilities in Federation Park closed its doors and offered its buildings to the TRVL by the Government of Trinidad and Tobago. After the construction of a new office block and renovations, TRVL moved its operations in 1961 from Wrightson Road to the COMIRI buildings which were more conducive for growing tissue cultures in sterile environments.

In 1961, the administration of TRVL was transferred from the Rockefeller Foundation to the University of the West Indies and attached to the Department of Microbiology in the Faculty of Medicine. This transfer was in keeping with the Rockefeller Foundation’s policy to move on to other activities, leaving the local people to continue with the work. Although the administration was transferred, the Rockefeller Foundation continued to support the laboratory financially. With this transfer, the UWI agreed to appoint two members of the TRVL staff to become faculty members. Thus, Dr Leslie Spence became Senior Lecturer and Dr Elisha Tikasingh, (Fig. 1.3) Lecturer. The transfer to UWI did not hamper the work of the TRVL as it was a smooth transition.

On 11 December, TRVL received specimens from Guyana from 17 children and by 17 December, TRVL had isolated and identified Polio Type I as the culprit. With the assistance of the US Government, the epidemic was controlled. This section of the TRVL dealing with viruses other than arboviruses had come of age.

The arbovirus section of the laboratory had become internationally known for its excellent work and several scholars in arbovirology had, by this time, visited TRVL to see its field and laboratory work. However, by the end of 1968, TRVL started to have financial difficulties. About one third of its funding for its activities came from Caribbean governments and the Ministry of Overseas Development of the United Kingdom while the Rockefeller Foundation which had provided about 65 per cent of its funds decided to withdraw from further participation from this programme. It should also be noted that apart from funding the laboratory’s core programme the Rockefeller Foundation had also contributed US$189,633 to the building of an animal house and office block, and for general repairs and renovations of the Colonial Microbiological Research Institute into which the TRVL had moved in 1961. They had also provided staff members who were separately funded. In withdrawing its funding, they made it quite clear that they were not dissatisfied with the work of the laboratory nor the industry of its workers, but that they were gradually reducing their work on arboviruses. This shortage of money resulted in drastic reduction of staff and the laboratory programme.

Up to this point, TRVL had maintained surveillance not only for arboviruses but also for respiratory viruses and enteroviruses such as poliomyelitis. Various types of samples were collected and investigated from patients in hospitals and health centres of Trinidad and Tobago with jaundice, encephalitis, acute respiratory disease such as influenza, gastroenteritis and fevers of unknown origin.
An event happened in 1971 which was to change the course and character of TRVL. On 6 December 1971, three strains of polio virus Type I virus were isolated. Poliomyelitis was endemic in the country and it was not unusual to isolate a strain of the virus occasionally, but to isolate three strains of polio Type I in one day was unusual. The Ministry of Health was promptly advised of these isolations. It was the beginning of an outbreak of poliomyelitis caused by polio virus Type I. After the initial three isolates, there was another one on 10 December, another on the 11 December (Type II), three on 5 December, three on 20 December, one on 22 December and five on 28 December. The outbreak continued into January 1972. In the end, 133 isolates were made jointly by TRVL and the Ministry of Health’s Diagnostic Virus Laboratory. By 8 January 1972 an emergency unit was set up at TRVL with the Ministry of Health and the Pan American Health Organization (PAHO/WHO). The US Centers for Disease Control (CDC) assisted by sending two staff members, Dr L Schonberger and Dr M Hatch to organise an immunisation programme.

It is interesting to note that when a call was made by the Government in December 1971 to the general public to be immunised, few people availed themselves of the offer. However, when the Government decided that carnival was to be postponed that year, people turned up in thousands to be immunised at the various centres.

Following a poliomyelitis epidemic in 1970-71 Dr Eric Williams, Prime Minister of Trinidad and Tobago, invited Dr Pierre Ardoin, (Fig. 1.5) Director of TRVL, to private and confidential talks to determine the role of TRVL and how it could be expanded to serve the region. Dr Ardoin prepared a report and submitted it to Dr Williams. The Prime Minister subsequently wrote to the Vice-Chancellor, University of the West Indies on 19 April 1972 setting forth his idea for an expanded TRVL, presumably based on Dr Ardoin’s recommendations (Annex 1).

Dr Williams noted that the new laboratory could become a Centre for Communicable Diseases in the Caribbean and that it should be a self-governing body free from political considerations. Another letter, jointly written between the Trinidad and Tobago Government and the University of the West Indies, requested PAHO/WHO to organise a group of multi-disciplinary consultants to review TRVL’s past accomplishments and its needs for setting up a multi-national co-operative effort and requirements for broadening the programme of the laboratory. Later, in February 1973, the Caribbean Health Ministers’ Conference (CHMC) meeting in Dominica noted the occurrence of poliomyelitis and dengue epidemics in the Caribbean islands in the previous year and the world pandemic of cholera, and passed Resolution 19 which recommended the establishment of a Caribbean Epidemiologic Surveillance Centre at TRVL, as well as the establishment, in the Caribbean area, of a service for the detection of cholera. Further, the Resolution encouraged Caribbean governments to formulate and implement immunisation programmes and the setting up of epidemiological units in countries with a population size of over 200,000, while other countries were asked to assign a Medical Officer of Health, specifically to be responsible for epidemiological surveillance (Annex 2).

Accordingly, PAHO/WHO appointed and funded a team of experts in 1972 to:

“review the past and present accomplishments of TRVL; and to undertake a comprehensive evaluation of the resources and needs for extending and
broadening its research and service programmes as part of a multinational cooperative effort in the Caribbean region’.

It was also asked to consider and make recommendations with special reference to Resolution 19 of the CHMC. PAHO appointed the following members as the Advisory Group:

- Dr Philip Brachman, Director, Epidemiology Programme, CDC, Atlanta, USA
- Dr G Malcolm Brown, President, Medical Research Council, Ottawa, Canada
- Dr Hernando Groot, Director of Research, National Institute of Health, Bogota, Columbia
- Dr C E Gordon Smith, Dean, London School of Hygiene and Tropical Medicine, London, England
- Dr Thomas H Weller, Chairman, Department of Tropical Public Health, Harvard School of Public Health, Boston, Massachusetts, USA.

The Secretariat consisted of Dr Miles Williams, Acting Director of TRVL, and Dr Jan Sejda, Zone 1 Epidemiologist, PAHO/WHO, Caracas, Venezuela. Unfortunately, Dr Malcolm Brown was ill and unable to participate. Dr Mauricio Martins da Silva, Chief, Department of Research and Development, PAHO, Washington was the Mission Coordinator and Dr C E Gordon Smith served as its Chairman. A preliminary meeting was held on 28 June 1973 at the PAHO office in Washington, DC where the Advisory Group was briefed by the Director, Dr Abraham Horowitz. The team then dispersed individually or in teams and visited the following countries between 29 June and 5 July 1973:

- Barbados
- Curacao
- French Guiana
- Guadeloupe
- Guyana
- Jamaica
- Martinique
- Panama
- St Lucia
- Suriname
- Trinidad and Tobago
- Venezuela

During these visits, they had audiences with or contacted 83 persons. Following the visits, the team regrouped at TRVL in Port of Spain on 6-7 July to draft a report. A summary of and recommendations from this report (Resources and Needs for Expanding the Research and Service Programs of the Trinidad Regional Virus Laboratory, RD 12/9, July 1973, PAHO/WHO) are as follows:

1. We are convinced that TRVL is a unique, but greatly under-utilised resource which the Caribbean area cannot do without and which ought to be rapidly stabilised to prevent further deterioration, then expanded to improve the diagnosis, surveillance, control, and prevention of communicable diseases throughout the area.

2. We strongly endorse the Resolution of the Commonwealth Caribbean Health Ministers Conference that a Caribbean Epidemiologic Surveillance Centre be established at TRVL but point out below the developments in each country without which such a Centre would be ineffective.

3. A new administrative structure is required for TRVL. Three alternative patterns have been described (Section V). We strongly favour that of an independent institute affiliated with the University of the West Indies, but this must be decided by discussions between the governments concerned and the Council of UWI. It ought to be a first duty of the Governing Body of the new Institute to arrange for the elaboration of a full 10-year plan which should be updated annually. Whatever the structure, we believe that there is no future for TRVL unless means can be found to fund a stable core from the English-speaking countries of the Caribbean resources for 10 years ahead. This core must be viable even if all external sources of funds were cut off and the staff must be made confident of this. Salaries for senior staff must be internationally competitive and means may have to be found for supplementation. Internationally recruited staff must be given reasons for confidence that their activities (especially research) will be adequately funded for the whole period. If these conditions cannot be met, we do not believe that the objectives laid down in this Report can possibly be achieved and we would feel ourselves unable to make any recommendations for the future of the Laboratory.

4. We understand the shortage of money available throughout the Commonwealth Caribbean, but having emphasised the importance of TRVL and of a surveillance programme, we strongly recommend that the necessary resources be accumulated step by step over a period of 10 years. We do not have sufficient information (particularly financial) to elaborate such a 10-year plan in financial terms but have set out (a) those measures which must be taken without delay if our recommendations are to be implemented at all, (b) priority measures for which funds should be sought urgently so that they can be implemented as quickly as possible, and (c) longer-term measures which should be accomplished within 10 years’.
The full report was considered in detail by the CHMC at their Sixth Meeting in Nassau, Bahamas in June 1974. The CHMC then passed Resolution 14 (Annex 4) requesting PAHO to establish a Caribbean Epidemiology Centre at TRVL. It is interesting to note that the Advisory Group had suggested three possible administrative structures: (1) An independent institute affiliated to UWI, (2) An independent department of UWI, and (3) A PAHO Centre to serve the Commonwealth Caribbean (and perhaps other neighbouring governments). The CHMC chose the 3rd option.

The governance of the Centre also had to be settled. The Advisory Group had advised that there should be a Council (Fig 1.6, 1.7, 1.8) which would be responsible for broad policies and financial support, and a Scientific Advisory Committee to advise the Director on its programme and the need to have a satisfactory balance between surveillance, service, research and training. The Governing Council would have representatives from Caribbean countries and representatives of other bodies contributing significantly to the budget. The membership of this council could be made of one representative of each of the following:

- Commonwealth Caribbean Ministers of Health (but not from Trinidad and Tobago)
- Minister of Health, Trinidad and Tobago
- University of the West Indies
- PAHO
- Standing Advisory Committee from the Medical Research Council in the British Caribbean, and
- Any Government or organisation contributing more than US$20,000 to the budget (1973 prices)

The Advisory Group also noted that there should be two independent members of the Scientific Advisory Committee, while the Director of the Centre would be the ex officio secretary and Executive Officer. There was also the possibility of co-opting two other members representing interests not otherwise covered. The members of the First Council (Fig.1.6) are given in Annex 5. The first Council President was Mr A Z Preston, Pro-Vice-Chancellor of The University of the West Indies.
The Scientific Advisory Committee (Fig. 1.9) on the other hand would represent the main disciplines and interests of the Centre. For example, in the field of training, there should be someone from UWI in the field of epidemiology, microbiology or social medicine who should be nominated by the Caribbean Health Ministers Conference (CHMC), while PAHO’s Zone Epidemiologist would be an ex-officio member. The CHMC would also nominate one Chief Medical Officer and one Head of a Microbiology Laboratory.

There were also to be four independent scientists of international reputation to maintain and advise on scientific standards. A list of the First Scientific Advisory Committee in 1975 is listed in Annex 6.

The new Centre was to be administered by PAHO through their Department of Research, Development and Coordination. Later, it was transferred to the new Division of Disease Control. The interaction of PAHO, the CHMC countries, the Scientific Advisory Committee and CAREC’s Council is shown diagrammatically in Organogram 1.

To support CAREC financially, the CHMC agreed to a scale of contribution established by Resolution 14 at their Sixth Meeting. The budget approved for 1975 was as follows:

Organogram 1
The CHMC also approved a scale of contribution for “Other Countries” which was adjusted to a United Nations Scale and which was as follows:

<table>
<thead>
<tr>
<th>COUNTRIES</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anguilla</td>
<td>0.23</td>
</tr>
<tr>
<td>Antigua</td>
<td>1.23</td>
</tr>
<tr>
<td>Bahamas</td>
<td>8.22</td>
</tr>
<tr>
<td>Barbados</td>
<td>12.88</td>
</tr>
<tr>
<td>Belize</td>
<td>1.23</td>
</tr>
<tr>
<td>Bermuda</td>
<td>1.45</td>
</tr>
<tr>
<td>British Virgin Islands</td>
<td>0.26</td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>0.26</td>
</tr>
<tr>
<td>Dominica</td>
<td>1.23</td>
</tr>
<tr>
<td>Grenada</td>
<td>1.23</td>
</tr>
<tr>
<td>Guyana</td>
<td>16.99</td>
</tr>
<tr>
<td>Jamaica</td>
<td>50.70</td>
</tr>
<tr>
<td>Montserrat</td>
<td>0.41</td>
</tr>
<tr>
<td>St Kitts and Nevis</td>
<td>1.00</td>
</tr>
<tr>
<td>St Lucia</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Apart from these agreements, a contract was signed between the US Centers for Disease Control, Atlanta and the Caribbean Community Secretariat (CARICOM) to provide services related to the Sixth Meeting of the CHMC. CARICOM dispensed the funds on the advice of the Director of CAREC.

The Advisory Group had advised that funding for a core budget must be found from Caribbean sources and should be stable for at least ten years. This strong recommendation left no doubt about what the 18 participating countries should do. They all agreed that the Caribbean Epidemiology Centre incorporating the TRVL should be established and that PAHO should be the administrating body. PAHO, therefore, signed multilateral agreements (Annex 6) with the participating countries and a bi-lateral agreement with the host country, Trinidad and Tobago.

Those countries which were participating are shown in list below:

- Anguilla
- Antigua and Barbuda
- Bahamas
- Barbados
- Belize
- Bermuda
- British Virgin Islands
- Cayman Islands
- Dominica
- Grenada
- Guyana
- Jamaica
- Montserrat
- St Kitts and Nevis
- St Lucia
- St Vincent and the Grenadines
- Trinidad and Tobago
- Turks and Caicos Islands

As a result of the agreements, the administration of TRVL was assigned to PAHO/WHO on 1 October 1974. By this act, the new CAREC inherited a lease of five acres of land at 16-18 Jamaica Boulevard, Federation Park, which was originally granted by the Trinidad and Tobago Government to the University of the West Indies. All the buildings and equipment were likewise transferred. There were several buildings on the land including residential quarters with four large apartments and a smaller separate cottage building. The laboratory and office consisted of 21,400 square feet of space. A layout of the buildings is given in Annexes 7 and 8. (Figs. 1.10; 1.11; 1.12; 1.13; 1.14).

On 1 January 1975, the Caribbean Epidemiology Centre became operational. Dr Miles Williams, (Fig. 1.15) a PAHO/WHO Epidemiologist who was Acting Director of TRVL, became Acting Director of CAREC. Director-Designate, Dr Patrick J S Hamilton, who was a Senior Lecturer at the London School of Hygiene and Tropical Medicine assumed duty on 22 February 1975.

The transition of TRVL to CAREC was a fast one taking only two years and five months from conception to actual transfer. Mr K Mohammed, Minister of Health, Trinidad
and Tobago, in his inaugural address to the First Council Meeting on 18 April 1975, noting this fast transition stated, “It is also evident that all the persons and organisations concerned, were motivated by a spirit of cooperation and a desire to improve health conditions in our countries and provide necessary training and scientific facilities for the good of our peoples.” (Mr Mohammed’s address is included in Annex 10)
ADMINISTRATION

Mission Statements:
FIRST: To provide and facilitate effective management of the resources of the Centre to enable the organisation to achieve its mission.

FINAL: To provide efficient administrative support using high performance teams in the areas of finance, human resources, information technology, procurement and general services to enable the organisation to achieve its mission in a safe and healthy working environment.

Directors
Dr Patrick Hamilton (1975 – 1982)
Dr Peter H. Diggory (1982 – 1988)
Dr Franklin White (1989 – 1995)
Dr C James Hospedales (1998 - 2006)
Dr Glenda Maynard (2006 - 2008)
Dr Jose Campione-Piccardo (2008 - 2009)
Dr Beryl Irons (2009 - 2012)

Administrators/Managers
Mr Orlando Succhi (October - December 1974 and February-April 1975)
Mr Arthur Maul (August 1975 - 1984)
Mr Jean Pierre Scioville (1984 - 1985)
Ms Ava Cameo (1986 - 1995)
Ms Carol Gayle (1997 - 1999)
Mr Stephen Glover (August-October, 2000)
Dr Elton Bobb (2001)
Mr Gilberto de Barros (July 2004 - 2009)
Ms Anna Maria Frixone (2009-2012)
On 1st October 1974 the buildings, equipment and staff of the Trinidad Regional Virus Laboratory (TRVL) was transferred officially to PAHO/CAREC. Thus, TRVL moved from the administration of the University of the West Indies to a PAHO/WHO administration. Dr Miles C Williams, a PAHO/WHO epidemiologist and Acting Director of TRVL, became the Acting Director of CAREC. Ms Y Lumsden, the administrator of TRVL remained until the end of December 1974 and worked with Mr Orlando Succhi, a retired PAHO/WHO administrator re-hired as a PAHO/WHO consultant to act as administrator for the period October-December, 1974.

The transfer of TRVL to CAREC was completed by the end of December 1974 and CAREC became operational on 1st January 1975. Shortly after Dr Elisha Tikasingh (Fig. 1.4.) acted as Director until the arrival of Dr Patrick Hamilton in late February to take up duties as Director. Mr Arthur Maul (Fig. 2.10) was appointed Administrator in August 1975 and succeeding him was Jean-Pierre Scioville (Fig. 2.12) followed by Ava Camejo (Fig. 2.11).

In addition to the buildings, equipment and staff, CAREC also inherited a number of projects which were fully funded by external sources. The United Kingdom Medical Research Council (UK MRC) funded three, one of which was a study on arboviruses in bats. Dr J. C. Price led the project which ended in 1975. During the course of his study, Dr Price discovered an arbovirus new to science, the Tamana bat virus and another, new to Trinidad, the Rio Bravo virus. Another project was the study on the taxonomy of two mosquito species, *Culex porlesi* and *C. taeniopus*. These two species were singled out for study, as arboviruses were commonly isolated from them. Dr John B. Davies was the project leader. The third UK MRC project under Dr Christopher Everard was a study on rabies and the ecology of mongoose in Grenada.

A study of post-streptococcal rheumatic fever was another project which was conducted at the time of transfer of TRVL to CAREC. Mr Hugo Reid (Fig. 2.13) was the investigator of the project which was funded by the Rockefeller University of New York.

There were two other projects that were being conducted at TRVL which were concluded in 1975. One was a project on scorpion venom and pancreatitis undertaken by Dr Courtenay Bartholomew and Dr Barbara Hosein. TRVL/CAREC’s involvement was the provision of space, maintenance of the scorpion colony, and the ‘milking’ of the scorpions’ venom.

When Dr Hamilton arrived, he encouraged the continuation of these projects and incorporated them in the new structure of the Centre. In the new Organogram of the Centre, there were three basic units: Surveillance, Laboratory and Training. Dr Peter Diggory (Fig. 2.2) headed the surveillance Unit which had responsibility for data collection, statistical analysis and the preparation of reports for the dissemination of information to
the CAREC story

CAREC Member Countries (CMCs) and PAHO/WHO, while Mr Ken Latimer (Fig. 2.14) was in charge of the Training Unit responsible for the planning of courses in conjunction with the Surveillance and Laboratory Units, as well as provision of audio-visual services.

The Laboratory, which existed before the change to CAREC, had to be reorganised as a support for the Surveillance Unit. Virology - headed by Barbara Hull (Fig. 2.15) - remained, but the Entomology section had parasitology added to it as a completely new section and was headed by Dr Elisha Tikasingh. Bacteriology was expected to be developed. Dr Miles Williams was head of the Laboratory Unit.

The Administration Unit had under its direction, finance, personnel, library services, maintenance, supplies and transport. The CAREC Director reported to the PAHO/WHO Director through the newly-formed Division of Disease Control. It should be noted, that CAREC was formed under the Department of Research and Development with Dr Mauricio Martins da Silva who had a large role in the creation of CAREC. CAREC’s Director was guided by a Scientific Advisory Committee (SAC) made up of eminent scientists and other observers (Annex 6.), and a CAREC Council looked after financial matters (Annex 5). There was also a close relationship between CAREC and PAHO/WHO’s Country Representatives in the various countries.

Located in the same building as CAREC, was the Trinidad and Tobago Public Health Laboratory (TPHL) and both entities shared some common facilities and workload. However, the staff at TPHL were employees of the Trinidad and Tobago Government. In accordance with the bi-lateral agreement signed by PAHO/WHO and the Trinidad and Tobago Government, the Director of TPHL, Dr W Swanston, was made Assistant Director of CAREC. The relationship of all these entities is shown in Organogram I. (See page 14)

At its start in 1975 CAREC had a budget of US$348,171 which was woefully inadequate. The budget was based on 1973 prices and, added to that, there was rapid inflation. Staffing was inadequate as TRVL had cut its staff to an absolute minimum at the end of 1974. Some parts of the building had to be modified to meet training obligations and supplies and equipment were also needed. The lecture hall, too, was greatly improved by the installation of new lighting, the purchase of new furniture and updating of visual aids. In order to meet these commitments, CAREC’s Council at its second meeting in 1976 recommended an increase in quota contributions of 20% by member countries. There was rapid expansion under Dr Hamilton’s leadership: from a total staff of 38 in 1975, to a total of 101 in 1982 when he left. The administrative staff, too, increased from 12 in 1975 to 22 in 1982.

As Director, Dr Hamilton laid a sound foundation for the development of CAREC. His infectious enthusiasm was caught by staff members who were also excited and participated in this new adventure in raising the standard of health in the Caribbean. Governments, too, were excited as requests from them for assistance in disease outbreaks saw CAREC staff leaving on first available flights to the countries. Countries saw quality and value in this service and supported the work of the Centre.
In 1982 Dr Hamilton was succeeded by Dr Peter H Diggory who recognised that CAREC should be a resource for HIV/AIDS surveillance, research, and the development of relevant programmes for member countries. Accordingly, a special programme on STD/HIV/AIDS was formalised in 1987. CAREC then became part of the Global Network of Information Centres on AIDS, which was developed to support national programmes. Sadly, Dr Diggory died suddenly in 1988. The Annual Report for 1988 noted that the “loss of a man with such a breadth of expert knowledge, selfless devotion to public health and long experience of work in the Caribbean was felt deeply, not only in CAREC, but throughout the sub-region and in many places further afield.”

Following Dr Diggory’s demise, Dr David Bassett, microbiologist at CAREC, acted as Director for the next nine months until the arrival of Dr Franklin White in 1989.

Some Directors altered CAREC’s basic structure over the years as they interpreted the role of CAREC and its mandate. In 1989-1990 Dr Franklin White made a major revision, the purpose of which was to emphasise both laboratory and epidemiology as broadly based foundations of the Centre. Sexually transmitted diseases, HIV/AIDS, the Expanded Programme on Immunisation (EPI) and Zoonoses/Mammalogy were viewed as focused programmes. Within epidemiology, there was to be greater visibility for chronic diseases, health situation and trend assessment (HST) – all with programme evaluations.

Dr White also introduced a committee structure to CAREC which gave more individuals the opportunity to participate in the management of the Centre. As a result, nine committees were formed: Executive; Administrative Coordination; Occupational Health and Safety; Information Management, Library and Archives; Research Ethics; Human Resource Development; Laboratory Technical; and the Special Programme on Sexually Transmitted Diseases (SPSTD). This structure is shown in the Organogram II.

From its inception CAREC had a loose arrangement with the French Territories in the Caribbean inviting the technical people to meetings and workshops from time to time. However, this informal arrangement became more intensified during this period; links were established with the Pasteur Institute and the French Institute of Health and Medical Research (INSERM) and CAREC staff attended meetings in Martinique and Guadeloupe, setting the stage for future development of French Technical Cooperation activity at the Centre.
Five-Year Review of CAREC

The Multilateral Agreement signed by the CMCs and PAHO recommended that CAREC should be established for a period of 10 years with a review after five years. The review started in 1979 with a self-audit by the Centre’s staff. In addition, a questionnaire was forwarded to participating countries followed by site visits. The Director of PAHO also established a Review Team. At the Directing Council of PAHO in 1980 the Caribbean Countries gave their overwhelming desire for CAREC to continue and for PAHO to continue to support the Centre. In 1984, the Caribbean Health Ministers’ Conference again endorsed the management of the Centre by PAHO until 1990.

The fifth anniversary of CAREC was celebrated with an “Open House” mounting of an exhibition of its work at the Centre to which the public was invited. Among the visitors to the Centre were His Excellency Sir Ellis Clarke, President of the Republic of Trinidad and Tobago as well as the Director-General of the World Health Organization. Many high school students also attended and learnt of the work of the Centre. (Fig. 2.16).

The exhibition was subsequently mounted at the Caribbean Health Ministers’ Conference and at the American Society of Tropical Medicine and Hygiene’s annual meeting.

Visit of Princess Anne

In 1990, CAREC welcomed a Royal Visitor, Princess Anne (Fig. 2.17) to its campus. The Royal Princess gave high praise for its work.

Transformation period of CAREC, 1996-1997

There was another major transformation when Dr Stephen Blount (Fig. 2.5) became Director in 1995. Dr Blount noted that the “goals of transformation were to improve service to strengthen CAREC’s financial position by reducing costs and increasing income; to improve management of human and financial resources; and to improve the quality of work life” (AR, 1996). Dr Blount further noted that the decision to initiate the changes in the structure was due to trends in the economic, political and technological environment which showed a steady decline of financial support from its major contributors: the PAHO regular budget, budgeted contributions from CMCs were not being met, and there was declining support from donor agencies. Throughout this transformation process, he was informed by advice from PAHO/WHO’s leadership and the Institute of Business of the University of the West Indies.

Core competences were required for CAREC to meet its vision and mission. In this process, post descriptions had to be revised and had to include “values, attitudes, and behaviours in addition to technical skills”. All staff, except those in PAHO posts, were asked to resign and re-apply for positions with new post descriptions under a new management structure. There were many stakeholder meetings to explain and discuss the meaning of this transformation. (Fig. 2.18).

At the beginning of the transformation process in 1996, there were 101 employees including eight PAHO professionals, plus one epidemiologist from German Technical Cooperation Project (Dr Uli Wagner) and one from French Technical Cooperation (Dr Michel de Groulard).
the end of the transformation 23 staff members had accepted voluntary separation packages. There were five divisions in the new structure, each with a Manager as its Head: Epidemiology, Human Resources, Administration, Laboratory and the Special Programme on Sexually-transmitted Diseases.

The Public Health Intelligence, Research and Development Unit L.C.

The Transformation Process saw the development of a Unit in CAREC called the Public Health Intelligence, Research and Development Unit. The Mission Statement of this Unit was “To provide visionary leadership to CAREC and Member Countries into a healthier 21st century”. It was to work closely with and continue to provide technical oversight and consultancy services for each divisional programme. They were expected to “identify the strategic disease prevention and control issues facing the Caribbean, advise on opportunities and critical choices in public health practice and policy, assist in setting the strategic direction and research agenda for CAREC, and assist in the mobilisation of the resources to pursue that agenda; act as the major interface between CAREC and the external environment, including the scientific community, CMCs, and other stakeholders. The PAHO professionals at CAREC became the core of the Public Health Intelligence, Research and Development Unit. The first individuals in this grouping included the following:

Dr Jose Campione-Piccardo, Virologist,
Ms Yvette Holder, Bio-statistician,
Dr James Hospedales, Epidemiologist,
Dr Samuel Rawlins, Entomologist/Parasitologist, and
Dr Parimi Prabhakar, Microbiologist

There were subsequent changes to the Laboratory Division. The Bacteriology, Parasitology and Entomology Units were merged as the Department of Microbiology and Medical Entomology. Molecular Biology and Immunology became separate departments and there were new departments of Laboratory Administration, Support Services/ Safety and Customer Services Information. The new organisation structure is shown in Organogram III.
The organogram was modified by successive Directors between 1997 and 2012. Although some of these modifications were temporary the major ones were:

- A change in the name of the Special Programme on Sexually Transmitted Diseases (SPSTD) to the Special Programme on Sexually Transmitted Infections (SPSTI) in 1999, in keeping with the consideration of asymptomatic infections and the WHO recommendation for a change in terminology of sexually transmitted diseases to a more comprehensive one, that of sexually transmitted infections.
- In 1999 the Caribbean Tourism, Health, Safety and Resource Conservation Project was officially launched. This morphed into a Quality Tourism for the Caribbean (QTC) project, which was a unique public/private partnership between CAREC and the Caribbean Hotel Association/Caribbean Alliance. There were three units in this project: Standards, Training and Marketing.
- The introduction of a Foodborne Disease Programme in 2003 to promote a multi-disciplinary, integrated, farm to table approach to food safety.
- A European Union funded project for strengthening Medical Laboratories in the Caribbean started in 2001.
- In the late 1990s the following changes occurred:
  - Tuberculosis and Leprosy Programmes were added to Epidemiology
  - Materials Management and Human Resource units were added to Administration
  - A Surveillance and Research Unit was added to the SPSTI
  - The National Cancer Institute/Medical Research Centre was removed from the organisational structure.
  - A Non-communicable Disease (NCD), Injury and Substance Abuse Department was formed with three units, NCD Surveillance, Injury Surveillance and Substance Abuse Epidemiology

25th anniversary celebrations

CAREC celebrated its 25th anniversary in 2000 with the theme “Celebrate the Past and Imagine the Future”. A monograph with the same theme giving the highlights of the past 25 years was published as CAREC Monograph, Series 3 as part of the celebration. Many previous staff members returned to participate in a Scientific Seminar and to share their experiences – both successes and challenges – with current staff members. In addition, there was a flag-raising ceremony and monthly country displays to educate staff on the situation and needs of member country. Prime Minister Basdeo Panday (Fig. 2.19) gave the feature address and planted a tree (Fig. 2.20) to mark the occasion. Many dignitaries were in attendance, including Sir George Alleyne, Director of PAHO, the Former President of the Republic of Trinidad and Tobago Mr Noor Hassanali and his wife Mrs Zalayhar Hassanali, and Mr Kamaluddin Mohammed, Minister of Health of Trinidad and Tobago in 1975 when CAREC was established (Fig. 2.21).

The year ended with an awards ceremony where four persons who were with CAREC since its inception received 25-Year Awards bringing a fitting end to a year of celebrations. (Fig. 2.22)
Budget

The budget of CAREC grew from US$348,171 in 1975 to US$12,645,262 in 2007. Approximately half of the budget came from donor funds for special projects. The following Table 2.1 gives a yearly breakdown of the budget and graphically shown in Fig. 2.

Table 2.1. CAREC’s Budget expressed in USD 1975 - 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Budget (USD)</th>
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<tr>
<td>1975</td>
<td>348,171</td>
</tr>
<tr>
<td>1976</td>
<td>586,623</td>
</tr>
<tr>
<td>1977</td>
<td>715,823</td>
</tr>
<tr>
<td>1978</td>
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<td>675,231</td>
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<td>1,081,779</td>
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<td>1982</td>
<td>1,356,509</td>
</tr>
<tr>
<td>1983</td>
<td>1,507,760</td>
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<tr>
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<tr>
<td>1985</td>
<td>1,827,542</td>
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<td>1991</td>
<td>4,646,719</td>
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<tr>
<td>1992</td>
<td>4,012,900</td>
</tr>
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<td>1993</td>
<td>4,171,600</td>
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<td>4,212,334</td>
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<td>1997</td>
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<td>8,444,945</td>
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<tr>
<td>2005</td>
<td>10,787,781</td>
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<tr>
<td>2006</td>
<td>12,264,114</td>
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<td>12,645,262</td>
</tr>
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<td>2008</td>
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</tr>
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<td>2009</td>
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<td>2010</td>
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<tr>
<td>2011</td>
<td>NA</td>
</tr>
<tr>
<td>2012</td>
<td>NA</td>
</tr>
</tbody>
</table>

NA: Data not available.

Funds for the running of CAREC initially started with quota contributions from member countries, PAHO and the Overseas Development Agency of the United Kingdom. However, as CAREC grew nearly half of its budget came from donor agencies such as the International Development Research Centre (Canada), the Agency for International Development (USA), the National Institutes of Health (USA), the Global Programme on AIDS (WHO), as well as others. In 1994 the German and French Technical Cooperation Agencies were approached for funding and this came in 1995 for the first time. Two technical officers, one from Germany and the other from France were assigned to CAREC to assist in the technical work of the STD/HIV/AIDS programme. These and other donors are listed in Table 2.2.

Physical Structure and Infrastructure

When CAREC succeeded the TRVL the original buildings, that is, the main laboratory and administrative area, the residential flats and cottage were already at least 27 years old. The New Office Block, Animal House and Inoculation Rooms were 14 years old. One new building was added in 1991. Earlier, in 1987-1988, Dr Peter Diggory had succeeded in attracting funds from the WHO Global Programme on AIDS to fund the establishment of a Caribbean AIDS Education and Information Centre at CAREC. A portion of the grant was to fund the erection of a building which was eventually built and dedicated in 1991 and
appropriately named the “Peter Diggory Building.” (Figs 2.24 and 2.25)

Successive Directors of the TRVL and CAREC had made modifications and renovations to the existing plant to satisfy the programme of work as directed by the various Scientific Advisory Committees. In the 1960s, for example, the TRVL held meetings and lectures in the library as there was no lecture hall. As a result, two of the larger offices in the new office block had a common wall removed, creating a larger room to be used as a lecture hall. In 1975, to meet the new mandate of training, this lecture hall was renovated with new equipment and, in 1989, was further enlarged and remodelled with funds provided by the Director of PAHO and named the “Elisha Tikasingh Lecture Theatre.” (Fig. 2.26).

There was also a need for a Training Laboratory so as to bring medical laboratory technicians from CMCs for training and updating of their techniques. This training laboratory, to accommodate 20-30 students, was built by modifying a part of the “Animal House” which was originally built to house the many thousands of mice which were needed for the arbovirus programme as well as ancillary services needed for the maintenance of mouse colonies. Wild small mammals needed for experimental purposes were also kept in the “Animal House”. Later, in 1991, the Training Laboratory was enlarged, renovated with funds donated by the UK Overseas Development Administration and named the “Wilbur Downs Training Laboratory” at a ceremony where the Reverend Clive Abdullah did the blessing. (Fig. 2.27). Dr Downs, (Fig. 2.28). a Rockefeller Foundation staff member, was the first Director of the TRVL and had a special interest in the training of local personnel. As a result of these modifications the Insectary...
which was used to house live mosquito colonies for experimental purposes was lost. However, by 1982 with a grant provided by the British Development Division a small building was erected on the north-eastern corner of the campus for this purpose. Later, a caravan which was used to do field work in various parts of the country was remodelled and added to the Insectary facilities to house the Toxorhynchites colonies.

The Entomology Laboratory which was in the main building was moved to the Animal House Building close to the new Parasitology Laboratory in 1975, but had been re-configured and renovated in 1993 with funds from the British Development Division of the Caribbean. The parasitology and Entomology laboratories were dedicated in November 1993 as the “Thomas H G Aitken Laboratory.” Dr Aitken (Fig. 2.29), also a Rockefeller Foundation staff member, had been the Entomologist at the TRVL from 1954 to 1966 and laid the foundation for studies in medical entomology in Trinidad and Tobago. He was the senior author or co-author of 70 articles written while at the TRVL. Another laboratory next to the mouse colony was renovated and made into a high security laboratory and named the “Barbara Hull Laboratory”. Barbara Hull worked at the TRVL as technician, Senior Laboratory Superintendent and Virologist.

During the period of occupation of the buildings by the TRVL and CAREC various Directors had made many modifications to the electrical system to meet the ever-increasing addition of electrical equipment, both light and heavy, used in particular in the laboratories. By 1990, the power supply had become inconsistent and had a negative impact on many items of equipment. Accordingly, an independent electrical engineer was hired to investigate the state of electrical systems at CAREC. By 1993 a new switch-room/standby generator building was erected and the installation of a new switchgear/standby generator began.

In 1992, a master plan for the physical development of the Centre in accordance with the Building Fund Guidelines was proposed. Still, little was done and by 1999 the ageing physical plant took a beating when there was considerable damage to the roof in the Administration and Laboratory blocks which hampered activities in these two Divisions of the Centre for the entire year. Both the CAREC Scientific Advisory Committee and the CAREC Council concluded that a new facility was needed.

With the intensification of the HIV/AIDS programme there was also a need to expand the laboratory facilities to support the programme.

The Government of Trinidad and Tobago who owned the lands and buildings gave permission in 2003 to construct a pre-fabricated Molecular Biology Laboratory North of the main compound. Funding for this project was provided with contributions of equipment by the Walter Reed Army Institute of Research which greatly aided information for disease prevention and control. Critical information products in 1997 were the launching of the CAREC Institute of Research which greatly aided information for disease prevention and control. Critical information products in 1997 were the launching of the CAREC website and the provision of an email system for all staff members which increased accessibility to information from the Centre.

Other Equipment

Up to date communication devices were necessary when dealing with so many islands scattered around the Caribbean Sea. The Centre already had telephone and telex facilities and in 1980, a facsimile machine was
added which proved to be a simpler, less costly and more
user-friendly device than the telex machine. With the
installation of computers email services became available.
In 2000, CAREC installed a Very Small Aperture Terminal
(VSAT) Dish on its compound which made available to all
its users and stakeholders up-to-date systems for online
collaborative work, distance education, video conferences,
intranets and high speed internet services.

**Transfer of CAREC to the Caribbean Public Health
Agency**

In 2006, and perhaps before, the governance and structure
of five Regional Health Institutions (RHIs) were being
scrutinised by CARICOM Ministers responsible for health.
The group of RHIs consisted of the following organisations:
the Caribbean Epidemiology Centre (CAREC) situated in
Trinidad and Tobago, the Caribbean Food and Nutrition
Institute (CFNI) in Jamaica, the Caribbean Environmental
Health Institute (CEHI) in St Lucia, the Caribbean Health
Research Council (CHRC) in Trinidad and Tobago and the
Caribbean Regional Drug Testing Laboratory (CRDTL) in
Jamaica. At the request of the Caribbean Governments,
PAHO appointed a former Minister of Health from
Jamaica, Mr John Junor, to review the function and
governance of these institutions and to make appropriate
recommendations. Later in 2007, CAREC hosted a
meeting of all the RHI Directors, representatives from
CARICOM and PAHO/WHO, where the Junor Report was
discussed. The report of that meeting was forwarded to the
Council of Health and Social Development (COHSOD).
In turn, a report coming out of the COHSOD meeting
encouraging the establishment of a public health agency
was then forwarded to the Ministers of Health. Meanwhile,
CAREC’s Multilateral Agreement which was due to end in
2009, was given a two-year extension pending a decision
by the Heads of the Governments of CARICOM.

Through the fusion of these regional bodies the intention
was to rationalise the public health institutions in the
Caribbean. An agreement to this effect was signed by
Heads of the various CARICOM Governments in July
2011 establishing the Caribbean Public Health Agency
(CARPHA) in January 2013. Once the agreement came
into effect CAREC staff members devoted significant time,
particularly in 2012, to the transition from PAHO/WHO to
the new CARICOM entity.

The 37th CAREC Directing Council was held in July 2012,
chaired by Professor E Nigel Harris, Vice Chancellor,
University of the West Indies (UWI), Mona, Jamaica. This
was the last meeting of CAREC’s Council prior
to its transition to CARPHA. The council members in
attendance were: Dr Ernest Pate, Caribbean Program
Coordinator, Pan American Health Organization (PAHO),
The Hon. Willmoth Daniel, Minister of Health and Mr Edson
Joseph, Permanent Secretary, Antigua and Barbuda; The
Honourable Dr Fuad Khan, Minister of Health, Trinidad and
Tobago; Dr Peter Allen, Chief Executive Officer, Ministry
of Health, Belize; The Honourable Julius Timothy, Minister
of Health, Dominica; Dr Jean Dixon, Ministry of Health,
Jamaica; Dr Sirving Kell, Director of Health, Ministry of
Health, Curacao; Ms Antonia Popplewell, Permanent
Secretary, Ministry of Health, Trinidad and Tobago and Dr
Akenath Misir, Chief Medical Officer, Ministry of
Health, Trinidad and Tobago; and Dr Shamdeo Persaud,
Chief Medical Officer, Guyana. Dr Rudolph Cummings,
Programme Manager Health Sector Development,
CARICOM Secretariat and Dr Jerome Walcott, Interim
Director CARPHA were also present at the meeting.

The Chairperson conveyed thanks to PAHO, congratulated
the CAREC Director for being a stalwart to the centre
during the transition and thanked the CAREC staff for
their hard work. The Honourable Dr Fuad Khan, Minister
of Health, Trinidad and Tobago delivered the feature
address. In offering thanks to PAHO for giving Trinidad
and Tobago the opportunity over the years to partner and
develop surveillance programmes with Regional Health
Institutions, Dr Khan reaffirmed that this was not the
closing of an organisation but an opening of a new phase
in a new direction for the Caribbean.

The Caribbean Epidemiology Centre which was
established in January, 1975 came to an end in December,
2012 bringing to an end 37 years of distinguished service
in public health to Caribbean Governments.
### Table 2.2. List of donors to CAREC’s budget

<table>
<thead>
<tr>
<th>Grantor</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOSTID</td>
<td>Control of <em>Aedes aegypti</em> with <em>Toxorhynchites</em></td>
</tr>
<tr>
<td>Canada CIDA</td>
<td>Programme on AIDS or AIDS-related projects</td>
</tr>
<tr>
<td>Canada IDRC</td>
<td>Hospital-based injury surveillance</td>
</tr>
<tr>
<td>Canada IDRC &amp; TT Government</td>
<td>Arbovirus studies</td>
</tr>
<tr>
<td>Caribbean Development Bank</td>
<td>Caribbean tourism</td>
</tr>
<tr>
<td>Centers for Disease Control &amp; Prevention</td>
<td>Study of <em>Salmonella enteritidis</em></td>
</tr>
<tr>
<td>Emmaus Suisse</td>
<td>Leprosy control in the LDC’s</td>
</tr>
<tr>
<td>Emory School of Public Health/Fogarty</td>
<td>Capacity building in epidemiology</td>
</tr>
<tr>
<td>European Union</td>
<td>1. Drug abuse surveillance</td>
</tr>
<tr>
<td></td>
<td>2. HIV/AIDS</td>
</tr>
<tr>
<td></td>
<td>3. Strengthening of medical laboratories in CDCs</td>
</tr>
<tr>
<td>Family Health International</td>
<td>1. Serum pooling for HIV screening (T&amp;T)</td>
</tr>
<tr>
<td></td>
<td>2. Development of a strategy for cost recovery for blood transfusion services</td>
</tr>
<tr>
<td></td>
<td>Intervention with STD clinic patients (T&amp;T)</td>
</tr>
<tr>
<td></td>
<td>Intervention with 4 high risk behaviour groups (St Lucia and Antigua)</td>
</tr>
<tr>
<td>French Technical Cooperation</td>
<td>Reduction of HIV/AIDS and STD’s in the Caribbean</td>
</tr>
<tr>
<td>Gates Foundation (via PAHO)</td>
<td>Cervical cancer</td>
</tr>
<tr>
<td>German Agency for Technical Cooperation</td>
<td>AIDS control in the Caribbean</td>
</tr>
<tr>
<td>Japanese International Agency</td>
<td></td>
</tr>
<tr>
<td>Laboratory infrastructure strengthening</td>
<td></td>
</tr>
<tr>
<td>Mexican Health Foundation</td>
<td>Modelling HIV/AIDS in the Caribbean</td>
</tr>
<tr>
<td>National Cancer Institute (USA)</td>
<td>Human T-cell leukaemia/lymphoma virus research</td>
</tr>
<tr>
<td>National Institute of Occupational Safety</td>
<td>Health and Safety projects</td>
</tr>
<tr>
<td>Netherlands Leprosy Relief Assoc.</td>
<td>Leprosy control</td>
</tr>
<tr>
<td>Rockefeller Foundation</td>
<td>Support for travel in the Caribbean (special assignment)</td>
</tr>
</tbody>
</table>
### Grantor | Project
--- | ---
Government of Trinidad and Tobago | Cervical cancer
UNICEF | To study antibody of seroprevalence in antenatal clinics
UK Department for International Development | Prevention and control of AIDS and STDs in the Caribbean and four territories; Institutional Strengthening
UK ODA | 1. Programme on AIDS or AIDS-related projects  
2. Epidemiology training for health service personnel  
3. Health economic appraisal  
4. STD  
5. Leptospirosis
University of Maryland | Training in public health
USAID | 1. Strengthening of surveillance training  
2. Hospital infection control mainly with a training component  
3. Traffic injury prevention - training  
4. Programme on AIDS or AIDS-related projects
World Bank | Pan-Caribbean Partnership against HIV/AIDS
World AIDS Foundation | Programme on AIDS or AIDS-related projects
WHO | Chagas disease and its control in Trinidad and Guyana
WHO Global Programme on AIDS | 1. Establish AIDS education centre  
2. Programme on AIDS/ AIDS-related projects
Mission Statements:

FIRST: To maintain and strengthen the practice of epidemiology and surveillance for improved policy formulation, implementation and evaluation of programmes for the prevention and control of public health problems.

FINAL: To guide and strengthen public health surveillance and response systems of the Caribbean.

Background

CAREC became operational on 1 January 1975. The former Trinidad Regional Virus Laboratory (TRVL) was re-organised to serve as the laboratory to the new surveillance unit of CAREC. The aims and objectives of the Surveillance Unit initially were to “serve as a technical resource for communicable diseases surveillance and to support and cooperate with Governments of the Caribbean; achieve the reduction of morbidity and mortality with communicable disease in the area; act as a centre for epidemiological surveillance for all participating countries in the Caribbean; assist and advise Governments in developing effective surveillance programmes; assist Governments by providing visiting staff experts in surveillance, diagnosis and control of communicable diseases as well as the training of Governmental staff.”

However, before any activities could be undertaken, it was necessary to undertake preliminary assessments of surveillance systems and of resources of microbiological laboratories available in CAREC Member Countries (CMCs). Two teams, one of medical epidemiologists and the other of microbiologists were appointed by PAHO to visit 14 countries of the Caribbean between 29 January and 8 March 1975 to conduct the surveys. The medical epidemiologists who visited the countries either individually or collectively were as follows:

Dr Karl Western, Office of the Director, Bureau of Epidemiology, US Centers for Disease Control, Atlanta, Georgia, and
Dr H P Diggory who was then PAHO/WHO’s Country Representative for Jamaica.

Dr Diggory was subsequently transferred to CAREC on 1 April 1975 and became Head of the new surveillance unit. The medical epidemiologists noted that all the countries visited had some sort of reporting system and the presence of someone responsible for reporting. However, they noted that “no two territories were identical in organisation, staffing, support, content and emphasis of the surveillance system.” They further noted that the average Caribbean surveillance system could be characterised as:

• Confined primarily (if not exclusively) to communicable diseases
• Dependent on physician’s reporting by mail
• Limited to passive accumulation and tabulation of data
• Poorly coordinated with hospital, clinic and laboratory services
• Suitable only for the delayed detection of significant outbreaks and typical cases of internationally notifiable diseases
• Ignored by the majority of medical practitioners
• Providing little or no feedback or services to the practitioners who do participate
• Generating information of little or no use for programmatic planning, evaluation of health services or budget justification.” (Report of the Director, Ref: RD 14/5, June 1973)

The Epidemiology Team reported problems of inadequate budgets in these countries which resulted in inadequate salaries for professionals, lack of promotional opportunities and cramped conditions which resulted in migration of quality staff to North America and Europe. Once trained and in possession of a Government job these people worked in isolation without further training and no interaction with fellow workers in other Caribbean countries.

The development of a Surveillance Unit at CAREC had as its aims and functions:

• to serve as a specialised technical resource, particularly in the field of communicable diseases and their surveillance
• to achieve the reduction of mortality or morbidity associated with communicable diseases in the area
• to act as a Centre for epidemiological surveillance for all countries in the Caribbean participating in or co-operating with the Centre
• to assist and advise governments in developing effective surveillance;
• to assist and advise governments by providing visiting staff experts in the surveillance, diagnosis and control of communicable diseases.

Arising out of these observations was a number of recommendations that CAREC could fulfill. One of these recommendations was the need for further training not only for epidemiologists and statistical clerks but also for laboratory technicians.
At the time of the team’s visit, 16 countries had a physician designated as an epidemiologist. The larger countries such as Jamaica and Trinidad and Tobago already had one epidemiologist on their staff but in the smaller countries it was the Chief Medical Officer or Senior Medical Officer who acted as epidemiologist, amongst other duties.

In some countries, meetings were held with health staff of the respective countries, e.g. visits were made to the Bahamas almost yearly for the Family Islands Epidemiology Meetings (Fig. 3.1). However, a meeting of designated epidemiologists in CMCs met for the first time at CAREC in May 1975. At this meeting, basic epidemiological principles and surveillance techniques were reviewed, as were operational and logistical problems encountered in the participants’ own countries. The group noted that in some countries basic supplies such as calculators, filing cabinets, manuals, typewriters and graphic materials were absent. The CAREC Surveillance Unit was able to supply some of these items to the countries in need through a grant from CDC to CARICOM.

By 1977, it became obvious that some of the designated epidemiologists were unable to personally undertake field investigations because of multiplicity of duties. The concept of a deputy epidemiologist, such as a senior public health nurse or inspector, was suggested and accepted by the CHMC. Accordingly, a group of these people were brought to CAREC for about four weeks on an annual basis for training in surveillance techniques including statistical analyses and epidemic investigations. This group of workers, after training, strengthened the national capacity for surveillance.

### Caribbean Regional Communicable Disease Surveillance System

At the first epidemiologists’ meeting led by the Director, Patrick Hamilton, the participants showed enthusiasm and a desire to see CAREC succeed. Discussions centred on the reporting of diseases and symptoms for surveillance, transport and communication, and mobilisation of resources. At the meeting all agreed that they should continue their weekly and monthly morbidity and mortality reports to PAHO/WHO with copies of the reports to CAREC. An abbreviated list of diseases and syndromes was agreed to (Figure X).

The epidemiologists also agreed that some diseases/syndromes were to be reported immediately, others within 24 hours, and some within one week. All reports, however, would go through the designated epidemiologists. These reports from the CMCs were written reports or telephone reports depending on the nature of the disease/syndrome. By early 1977, a telex facility was installed at CAREC, which facilitated prompt reporting, particularly on disease outbreaks and CAREC was able to transmit these reports more rapidly to the other designated epidemiologists. The list of diseases and syndromes has been expanded and modified over the years. As technology advanced, the transmission of data and reports between countries and CAREC moved from being via fax to via e-mail and in some instances via on-line reporting.

During 2000-2004, funded by the UK Department for International Development (DFID), multidisciplinary CAREC teams conducted evaluations of the communicable disease surveillance systems in CMCs. These missions included the development of work plans for strengthening the countries’ surveillance systems.

### Table: Disease/Syndromes

<table>
<thead>
<tr>
<th>Disease/Syndrome</th>
<th>Reporting Time</th>
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<tbody>
<tr>
<td>Malnutrition</td>
<td>Immediately</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>24 hours</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>1 week</td>
</tr>
<tr>
<td>Influenza syndrome</td>
<td>1 week</td>
</tr>
<tr>
<td>Gastroenteritis (under 4 years)</td>
<td>1 week</td>
</tr>
<tr>
<td>Malaria</td>
<td>24 hours</td>
</tr>
<tr>
<td>Yellow Fever</td>
<td>1 week</td>
</tr>
<tr>
<td>Food poisoning</td>
<td>24 hours</td>
</tr>
<tr>
<td>Smallpox</td>
<td>1 week</td>
</tr>
<tr>
<td>Rubella</td>
<td>1 week</td>
</tr>
<tr>
<td>Cholera</td>
<td>24 hours</td>
</tr>
<tr>
<td>Rabies</td>
<td>1 week</td>
</tr>
<tr>
<td>Measles</td>
<td>1 week</td>
</tr>
<tr>
<td>Enteric fever</td>
<td>24 hours</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>1 week</td>
</tr>
<tr>
<td>Chicken Pox</td>
<td>1 week</td>
</tr>
<tr>
<td>Meningitis</td>
<td>24 hours</td>
</tr>
<tr>
<td>Tetanus</td>
<td>1 week</td>
</tr>
<tr>
<td>Dengue</td>
<td>1 week</td>
</tr>
<tr>
<td>Polio</td>
<td>24 hours</td>
</tr>
<tr>
<td>TB</td>
<td>1 week</td>
</tr>
<tr>
<td>Haemorrhagic fever</td>
<td>1 week</td>
</tr>
</tbody>
</table>

**Figure X: Disease/Syndromes**

Note: The list of diseases and syndromes has been expanded and modified over the years. As technology advanced, the transmission of data and reports between countries and CAREC moved from being via fax to via e-mail and in some instances via on-line reporting.
National operational manuals for communicable disease surveillance were developed in each of CAREC’s twenty-one member countries during 2003-2006, with a grant from Fogarty International through the University of Maryland. These manuals were developed during a series of national workshops in each country. The first two of these workshops, conducted in Belize and Antigua and Barbuda, also served as train the trainers workshops and were facilitated by CAREC staff. Workshops in the remaining countries were facilitated by two National Epidemiologists, one from the host country and a second from a neighbouring country. The outcome of each workshop was a draft national communicable disease surveillance manual for the host country. Countries subsequently conducted National Communicable Disease Surveillance Workshops in order to train staff on the manual and the national surveillance system.

In 2002, in accordance with the SAC recommendations, a multidisciplinary CAREC surveillance working group was formed and the revision of the regional communicable disease surveillance system proceeded as follows:

1. Sub-committees of the CAREC surveillance working group met and assessed which of the conditions (syndromes and diseases) previously under surveillance should remain and identified new ones to be added.
2. During 2002-2004, sensitisation sessions and consultations on the revised system were held with health personnel in member countries at various national and regional meetings, including the annual National Epidemiologists and Laboratory Directors meetings.
3. In 2003, the multidisciplinary CAREC surveillance working group was restructured and became the CAREC surveillance and response team, which was later renamed the CAREC Technical Team.
4. During 2003-2004, the revised system was piloted in 5 countries (Dominica, Grenada, St Kitts and Nevis, St Lucia, and St Vincent and the Grenadines).
5. Two of these pilots (in Dominica and St Lucia) were evaluated in May 2004 and the results were presented and discussed at the National Epidemiologists and Laboratory Directors meeting in June 2004.
6. The content, process and logistics of the system were finalised at a meeting of national epidemiologists and laboratory directors from selected member countries and CAREC technical staff in January 2005.

Training for the implementation of the revised system took place during 2005 and implementation of the revised system in countries commenced in January 2006 with the following major changes:

1. Expansion of syndromic surveillance to include: fever and haemorrhagic symptoms, fever and neurological symptoms, fever and respiratory symptoms ≥ 5 years, and undifferentiated fever.
2. The reporting of suspected cases of diseases was discontinued.
3. Weekly reporting of syndromes only, not specific diseases (with the exception of diseases requiring immediate reporting under the existing World Health Organization (WHO) regulations and regional protocols).
4. Four-weekly reporting of age- and sex-specific confirmed cases of selected diseases.
5. Systematic and standardised outbreak reporting.
6. The identification of a minimum dataset for laboratory surveillance.
7. Enhanced regional feedback from CAREC.
8. Harnessing advancements in ICT to enhance surveillance efforts.
9. Promoting an integrated inter-disciplinary approach to surveillance and response.

A paper produced in 2006 by the Epidemiology Division under the coordination of Dr Eldonna Boisson entitled "Morbidity Review of Communicable Diseases, CAREC Member Countries (CMCs) 1980-2005" detailed the status of communicable diseases during the period 1980-2005, before the major revision of the system.
In 2005, the CAREC Surveillance and Response Team in collaboration with the National Epidemiologists and Laboratory Directors from CAREC member countries and other CAREC staff members produced a document entitled “Regional Communicable Disease Surveillance Systems for CAREC Member Countries – Policy Guideline” (Fig. 3.2). It was published and disseminated to all CMCs. This regional policy guideline document was a guide for the development or strengthening of national communicable disease surveillance guidelines, and was intended to be used as an advocacy tool for the development of national and regional communicable disease surveillance systems. It also provided a description of the regional communicable disease surveillance system, complete with case definitions and reporting forms. It was revised in 2008 and again in 2010.

Other materials in support of the revised regional communicable disease surveillance system were developed and distributed (Figure Y). These included six posters - one with case definitions for the syndromes under regional surveillance - and each of the other five displayed a diagnostic flowchart for each syndrome. These flowcharts described the syndrome, epidemiological data that may accompany the syndrome, possible associated pathogens and the appropriate specimen and test for each of these. Each country received a number of posters for distribution to sites participating in the surveillance system. A web-based reporting tool was also developed for weekly on-line reporting of syndromic data.

During 2006-2009, countries conducted various activities aimed at full implementation of the revised communicable disease surveillance system, including the production and implementation of new or revised national communicable disease surveillance manuals and conducting national communicable disease surveillance training workshops on their revised systems.
International Health Regulations (IHR)

In 2003, CAREC and representatives from 13 Caribbean countries participated in the English-speaking Caribbean Consultation Meeting for the Revision of the IHR. This meeting was a key stage in the process of political agreement to the revised IHR. It was an opportunity for Member States to clarify and shape the regulations prior to the 'final draft', due to be completed in June 2004.

In compliance with the IHR that came into force in June 2007, each country was required to conduct an assessment of core capacity for the implementation of IHR by June 2009 and to develop a plan of action for achieving these capacities by June 2012. In 2008, CAREC developed and published a framework for the evaluation and audit of communicable disease surveillance systems in order to assist countries in fulfilling these IHR requirements (Fig. 3.3). This framework was used by CAREC teams to identify strengths and weaknesses in countries' communicable disease surveillance systems and epidemic preparedness and response plans, assess the quality of communicable disease surveillance data, assess core surveillance capacity in compliance with IHR, and facilitate the development of national plans of action for surveillance system strengthening in compliance with IHR. During the evaluations and audits, health facilities were visited, surveillance activities assessed, key persons were interviewed and data were reviewed and audited for completeness and accuracy. Evaluations and audits were conducted by CAREC in a total of seventeen countries and the remaining four countries conducted self-evaluations (Fig. 3.4).

By 15 June 2012, all CAREC member countries (including territories through their National IHR Focal Points in the United Kingdom and the Netherlands) had requested a two-year extension to gain core capacities by 15 June 2014. Second extensions were also requested for the period 2014-2016. These extensions were granted to all countries and territories. Analysis of the action plans showed that while countries had made progress in strengthening core capacities in compliance with IHR, there was a lack of capacity in all countries in the areas of preparedness and response to radionuclear and chemical events, as well as several limitations with respect to adequate human resources for IHR implementation.

Coordination between Epidemiology and Laboratory

An early problem was the poor utilisation of laboratory facilities, both nationally and at the CAREC laboratories. To improve the coordination between epidemiologists and laboratory directors, there was a joint meeting of the designated Caribbean National Epidemiologists and Laboratory Directors in 1977 for the first time, where the use of the laboratory facilities in surveillance activities was discussed. CAREC continued to host this joint meeting periodically, as frequently as annually, and biennially at times. Agreements, reports and recommendations from these meetings were used to guide CAREC’s technical cooperation to countries, with the main aim being to strengthen surveillance systems in countries and provide information for public health action. In later years, during these meetings awards for outstanding improvement and excellent surveillance were presented to countries. The 11th, and last, Joint Meeting of Caribbean National Epidemiologists and Laboratory Directors was held in 2011 and Non-Communicable Disease Focal Points from countries also participated (Fig. 3.5).
Outbreak investigations

During disease outbreaks, Governments frequently requested CAREC’s assistance. CAREC normally responded by getting staff and whatever equipment and supplies that were needed on the first available flight to the affected country. Guidance via the telephone was also provided at times. Standard outbreak and case investigation forms were needed and these were initially developed for diphtheria, dengue, imported malaria, typhoid and poliomyelitis investigations. The forms were printed at CAREC and distributed to the countries as necessary.

By the mid 1990s, following capacity building efforts, there had been a shift to encouraging country teams to investigate outbreaks with CAREC providing guidance and guidelines remotely. However, when required, CAREC staff would be deployed immediately to countries to assist the local authorities with their investigations. Most of the outbreaks investigated were food- or water-borne, or vector-borne. By 1999, standard outbreak investigation forms were produced for many more communicable diseases, and were contained in the Caribbean Communicable Disease Surveillance Manual for Public Health Action that was produced that year by CAREC. Countries received both electronic and hard copies of these manuals and were free to print the outbreak investigations forms as required.

In 2007 a workshop for a Caribbean Network of Emergency Response Team Leaders was held in Trinidad and Tobago, with the aim to create a network of team leaders in the Caribbean able and available for rapid deployment to a Public Health Event of Concern, including outbreaks and disasters. As a result the network of potential responders to outbreaks in the region was widened to include not just CAREC staff, but also staff of Ministries of Health of Caribbean countries. (See Figs. 3.6 and 3.7)

A second training of the RHERT was conducted in 2011 in Trinidad and Tobago to strengthen the network of technical officers in the Caribbean, able and available for in-country response and rapid deployment to a Public Health Emergency (Fig. 3.8).

In 2006, a CAREC Policy and Protocol for anticipating and responding to disease outbreaks and threats was developed and implemented. This document was revised in 2008 and stated that “CAREC’s response to unusual disease situations and outbreaks includes investigation and control procedures that are flexible and relevant to the situation. Depending on the size, nature and sensitivity of the problem, an interdisciplinary team is assembled at CAREC. This team could include epidemiologists, laboratory technologists, virologists, entomologists, biostatisticians, information technologists, communication specialists and other relevant staff from specific programmes. If needed, advice and guidelines are provided and on request an epidemiologist and often an interdisciplinary team are dispatched on the next available plane to assist in-country. Outbreak investigation then follows the standard 10-step protocol, with parallel steps for communication and logistics management”.

CAREC maintained membership in the WHO Global Outbreak Alert and Response Network (GOARN) and participated in a PAHO Regional GOARN Meeting in June 2011. The objective of the meeting was to provide an opportunity for the exchange of information and ideas among GOARN members and PAHO/WHO, and help
strengthen the coordination and consolidation of regional partners. Regionalisation of GOARN took place in the PAHO region in 2012 and the Caribbean continued to be able to benefit from regional and global responses as needed, as well as training, through the GOARN mechanisms.

Training and Capacity Building

Basic Epidemiology Manual
As part of the training activities a “Manual of Epidemiology” which provided basic training in epidemiology was printed and distributed to CAREC Member Countries in 1981. The Manual was suitable for many grades of staff in the new thrust of Primary Health Care. Its production created interest outside of the Caribbean such that, after the initial printing, there was a demand for the manual and another 1000 copies were printed and distributed.

Applications in Health Information Management (Level 2)
In the period 1998-2001, PAHO delivered a project on Human Resources Training and Development in Health Information Systems for the English-speaking Caribbean Countries, sponsored by the WK Kellogg Foundation. There were three levels to this course and CAREC was responsible for delivering one week of the two-week level 2 course, covering data management and analysis, survey methods and epidemiology. During 1997-1998 CAREC developed the level II training curriculum and materials, including a manual.

This two-week programme targeted middle and upper level managers who needed to use information for programme planning and decision-making. The two weeks of face-to-face training was followed by a six-week application period in the work setting for the learners to utilise newly-acquired knowledge and skills. At the end of the six-week period, candidates formally presented their project to the immediate supervisor and senior level Ministry of Health officials. The projects were generated by the participants, addressed key problems in the health information systems of the countries and had the capacity for integration within the Health Services.

This Project exceeded the original targets set by the stakeholders, with 151 persons from 10 countries being trained in the Level 2 Applications in Health Information Management workshops during 1998-2001.

Educational video - ‘How to investigate an outbreak – The initial steps’
In 2001, in collaboration with the US CDC, CAREC produced its first educational video, entitled “How to investigate an outbreak – The initial steps”. This was the first in a series of videos on the topic ‘Outbreak Investigation’ and focused on the first three steps in the process. In 2002, CAREC filmed the final two videos in the series with funds provided by Fogarty International. This video series takes the viewer through the ten steps of an outbreak investigation using a food borne outbreak as an example. The target audience for this series is members of an outbreak investigation team, namely, Epidemiologists, Medical Officers of Health, Public Health or Surveillance Nurses, Public Health Inspectors, Environmental Health Officers, Statisticians, Laboratory Technicians, Data Entry Clerks and Communications Specialists. The video series was reproduced and distributed to member countries early in 2003 (Fig. 3.9). As technology advanced a CD version was produced and disseminated and subsequently it was uploaded to YouTube.
Applied Epidemiology and Surveillance Training Courses

In 2000, a project agreement, funded by the National Institutes of Health Fogarty International Center, was signed between CAREC and the University of Maryland. The aim of the project was to enhance efforts to prevent and control HIV/AIDS/STI and other important public health conditions in the 21 CAREC member countries by building capacity in Applied Epidemiology, Research and Surveillance. During 2001-2003, the following six courses were conducted as part of this project:

- Three-week workshop in Applied Epidemiology: with twenty-one (21) participants from 18 CAREC member countries
- One-week workshop in Surveillance: there were fifty-five (55) participants, 22 Ministry of Health staff from CAREC member countries and 33 students from the Masters of Public Health programme at the Jamaican campus of UWI.
- Three-day workshop in Communications: nine participants from member countries and two CAREC staff participated in this workshop. The facilitator was Dr Elliott Churchill, senior Communications Officer in the Epidemiology Program Office of the U.S. Centers for Disease Control and Prevention and co-author of the book entitled Principles and Practice of Public Health Surveillance.
- Three-day workshop in Communicating with the Media: with ten participants, six from member countries and four CAREC staff, including the Director and two managers. The facilitators were two experienced broadcast journalists from the United Kingdom, Ms Deborah Hall, a journalist and broadcaster with BBC1 and BBC World, and Ms Linda Fairbrother, a presenter and reporter for Anglia TV (Fig 3.10).
- Three-day workshop in Prevention Effectiveness: there were 15 participants from member countries and eight participants from CAREC. The workshop was delivered by two facilitators from the Rollins School of Public Health of Emory University, Atlanta, USA, Dr Anne Haddix, Associate Professor in the Department of International Health and one of the authors of the book entitled Prevention Effectiveness, and an MPH student.
- Two-week workshop in Public Health Management: this Workshop was facilitated by a local organisational development company called Odyssey Consultinc, the US Centers for Disease Control and Prevention and members of CAREC staff. Nineteen persons participated in the workshop, fourteen from CAREC member countries and five CAREC staff.

All but one of the workshops were conducted at CAREC, with the surveillance workshop being held in Jamaica at the University of the West Indies. The workshops used a combination of didactic lectures, exercises (including computer-based), case studies and group field exercises. They also served as pilot courses to be included in a Caribbean Field Epidemiology Training Programme that CAREC was initiating efforts to establish. These workshops were therefore targeted at persons with leadership potential in public health.

Epi Info manual

Epi Info is a computer software package designed primarily for management and analysis of epidemiologic data. In 1999 CAREC developed an Epi Info training manual on the basis...
of requests received from various stakeholders in CAREC member countries for training to enhance their capacity to manage and analyse data for public health action and decision-making. It covered the areas of word processing, data entry and analysis and was designed for persons who wanted to learn Epi Info at an elementary level. This manual was intended to be used as a self-instructional tool or as a reference document.

**Orientation of New National Epidemiologists**

CAREC routinely hosted newly-appointed National Epidemiologists for a one-week surveillance orientation. During this period the epidemiologists were briefed on various programme areas, made familiar with regional surveillance databases, and visited the Trinidad and Tobago National Surveillance Unit to gain an understanding of how surveillance is conducted in another country and, therefore be able to exchange expertise. They also visited the PAHO/WHO Representative.

In addition to the trainings outlined above, CAREC routinely conducted national and regional training based on need, or as requested by countries, in the following areas:

- Data analysis and presentation
- Outbreak investigation and control
- Biostatistics
- Epidemiology – at different levels and disease-specific
- Surveillance and public health
- Methods of Epidemiological Research in Communicable Diseases
- Epi Info
- Access

**Surveillance of Some Specific Diseases**

**Influenza and Other Respiratory Illnesses**

In 2007, a programme for enhanced surveillance of respiratory illness and pandemic influenza preparedness was initiated in seven member countries: Barbados, Dominica, Jamaica, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago. In 2011, Belize also initiated implementation of enhanced surveillance. This programme involved the strengthening of surveillance for Acute Respiratory Infections (ARI) as well as implementing Severe Acute Respiratory Infections (SARI) surveillance at selected sentinel hospitals. A total of 17 sentinel sites were chosen in the seven countries based on a surveillance protocol developed by PAHO/CDC for the surveillance of influenza.

As part of the enhanced surveillance for ARI and SARI, personnel from the seven countries were trained in the use of the protocol in each country. In each country, an individual certified in International Air Transport Association (IATA) regulations for the transportation of "dangerous goods" was identified, as part of the requirement for referring specimens to CAREC. Since the Department of Microbiology at UWI in Jamaica and CAREC were the only laboratories designated by WHO National Influenza Centres and contributed to the Global Influenza Surveillance Network, it was necessary to train laboratory technicians in the seven participating countries in the diagnosis of influenza and other respiratory viruses using immunofluorescence assays (IFA). CAREC provided fluorescent microscopes, reagents and other necessary supplies to the countries. Thereafter, workshops were held both in the countries and at CAREC on a continuous basis to update the influenza network on the status of ARI/SARI surveillance, both at the national and sub-regional levels.
Following the introduction of pandemic influenza A (H1N1), there was improved and continuous surveillance in member countries. In early 2009, Mexico and the United States reported unusual cases of respiratory illnesses. Immediately thereafter, the “CAREC Situation Room” was activated on a 24/7 basis. A multidisciplinary team was appointed to manage this activity.

In order to deal with influenza issues and queries from countries in a timely manner, two dedicated telephone lines were used and a specific email address was established for this purpose. Regional guidelines, updates and other relevant information were regularly posted on the CAREC website.

In May 2009, CAREC received reagents and the specific test for the new strain of H1N1 virus was implemented. In order to facilitate the rapid shipment of influenza specimens from member countries, pre-paid courier accounts were established. There was daily reporting of test results to facilitate rapid response. This outbreak highlighted a number of shortcomings at all levels: regional, national and sub-national. Human resources were limited, as were laboratory supplies. Steps were subsequently taken to address these shortcomings.

**Polioymyelitis**

It was a polio outbreak in Trinidad in 1971-72 that was the catalyst for the establishment of CAREC. But there have also been isolated outbreaks of poliomyelitis in other countries. In 1982, for example, an outbreak due to Polio Type I occurred in the Parish of St James, Jamaica, with 58 confirmed cases. A mass immunisation programme with oral vaccine successfully brought this outbreak to an end. Subsequently, an intensive campaign for the surveillance of acute flaccid paralysis in CMCs was established and no further poliomyelitis cases were identified. In 1982, the Caribbean Region was free of poliomyelitis. (See Expanded Programme on Immunisation).

**Cholera**

Cholera is caused by the bacterium *Vibrio cholera*. It is normally found in contaminated food and water and humans become infected by ingesting either one. The worldwide occurrence of cholera in 1974 was one of the reasons for establishing CAREC. Indeed, even before CAREC became established on 1 January 1975, a laboratory course on the diagnosis of cholera was held at the TRVL in October 1974. However, it was not until 1992 that cholera appeared in Latin America and then spread to three CAREC member Countries: Belize, Suriname and Guyana. CAREC maintained an alert throughout the year which kept the Surveillance and Laboratory Divisions busy.

The Belizean outbreak occurred in the south near the Guatemalan border. Transmission ceased temporarily only to resume in July in Toledo and Cayo districts. CAREC surveyed all English and Dutch speaking countries in a timely manner, two dedicated telephone lines were used and a specific email address was established for this purpose. Regional guidelines, updates and other relevant information were regularly posted on the CAREC website.

**Clinical management of cholera**

A sub-regional Workshop on “Clinical management of cholera” was held at CAREC in May 1992 where staff from Johns Hopkins University, PAHO and CAREC, and 15 countries participated. Finally, a Knowledge, Attitudes, Practices and Beliefs (KAPB) survey on cholera was conducted among food-handlers in April, in Port of Spain, Trinidad. Participants showed a high level of awareness of cholera and preventive measures. However, 44% were not aware that cholera may be asymptomatic and 48% thought it was not easily cured.

Following the introduction of cholera into Haiti in 2010, CAREC surveyed all English and Dutch speaking countries of the Caribbean to gather data and information on the status of national preparedness for a possible outbreak of cholera. The main findings showed that all the countries had an emergency response plan that could be adapted for Cholera, namely the National Influenza Pandemic Plan. A workshop was conducted at the end of 2010 in an effort to bring CAREC member countries up to date with an updated protocol for the identification and isolation of *V. cholerae*. The workshop consisted of an intense mix of lectures and laboratory practical sessions with 23 participating laboratory professionals from 17 CAREC member countries. This workshop was made possible through a collaborative effort of PAHO, UKAID and CAREC. Concurrently, another workshop was conducted to assist countries to review their national plans and to develop activities to strengthen their national capacity to respond to a health emergency such as cholera or other waterborne diseases.
Leptospirosis
A leptospirosis programme was started early in the life of the TRVL, and was held in abeyance for a short while, but eventually restarted in the 1970s by Dr C Everard. However, after Dr Everard left CAREC the programme was stopped due to a lack of funding. In 1992, diagnostic work again commenced at CAREC with assistance of the Leptospirosis Laboratory in Barbados, and funding from the European Economic Commission and the Royal Tropical Institute. The Barbados Laboratory had originally been established by Dr Everard.

Nosocomial infections
Nosocomial infections are acquired during the hospitalisation of an individual. Such infections are the cause of much preventable morbidity and mortality which have a high economic cost because it increases the length of stay of an individual in a hospital. Treatment of cases is also increased. A project on nosocomial infections and control was started in 1985 under Dr Christopher Bartlett, Senior Epidemiologist at the Public Health Laboratory Service of the United Kingdom. The project was funded by USAID. After Dr Bartlett’s departure, the project was transferred to the control of Nurse-Epidemiologist, Sherlyn Monteil.

The objective of the project was to conduct studies on the prevalence and analyses of nosocomial infections in Jamaica, Trinidad and Tobago, and St Lucia. The results of these studies were presented in a series of workshops to administrators, medical and nursing personnel as well as to personnel in three hospitals in Trinidad and Tobago, Barbados and St Lucia. Through these and other studies, it was found that prevalence rates for nosocomial infections varied between 5% and 14% in Antigua and Barbuda, Jamaica and Trinidad and Tobago. The biggest contributor to costs was ‘hospital cost’, which was 96%. The main extra costs per nosocomial infection in these hospitals were shown to vary between US$1525 to US$3150.

One component of this project was the training of nurses, including intensive care nurses, physicians and coordinators. Courses and workshops were held both at CAREC and in certain countries and centred on:

• a basic course in surveillance and control of nosocomial infections
• an advanced course
• a management course and
• sensitivity and awareness for the problem.

During the two-year period 1986-1987, fifty-six persons were trained while another one hundred and fifty-five persons were trained in the period 1991-1992.

By 1994, HIV and hepatitis were under surveillance by the nurses trained in nosocomial infections. Further, a Technical Working Group developed “Guidelines for the Prevention and Transmission of HIV and Hepatitis B virus in Health Care Settings.”

A fatal outbreak of nosocomially acquired neonatal septicaemia occurred in Guyana in May 2000 at the Georgetown Public Hospital. CAREC staff investigated this outbreak and noted that the outbreak actually started in September 1999 with a peak transmission in February 2000. The causative agent was *Klebsiella pneumoniae* and was associated with the relocation of the neonatal unit to the “caesarean mothers” ward. It was noted that serious lapses occurred in the practice of basic hygiene. This outbreak reinforced the urgent need for governments and their Health Authorities to give serious consideration to hospital infection control committees, which should have the full support from the Medical Chiefs of Staff and Hospital Administrators.

Occupational Health
Another initiative of CAREC and the Surveillance Unit was to give greater support to activities in Occupational Safety and Health (OSH). This project was under the guidance of Dr Richard Keenlyside who joined CAREC in 1987. The project was supported by a grant from the USAID and the CDC in the United States. The objectives of the project were to prevent occupational disease and to ensure the health of workers. Several countries in the Eastern Caribbean expressed interest in this programme and six were chosen for initial work: St Lucia, Dominica, St Kitts and Nevis, St Vincent and the Grenadines, Antigua and Barbuda, and Grenada.

After fact-finding visits to some of these countries a basic course in OSH was developed and conducted in some countries; and seminars and consultative “walk-through” evaluations were also provided. The project ended towards the end of 1988 when Dr Keenlyside left, but funds remaining from the grant were renegotiated with the donors to be used as seed money for other projects.

Hansen’s Disease (Leprosy)
Hansen’s disease is a chronic bacterial disease. The causative agent *Mycobacterium leprae* causes damage to the peripheral nerves, skin and mucous membranes – particularly of the nose and eyes. In 1980, CAREC became...
the coordinating centre for the Leprosy programme in the Caribbean. Dr Lawrence Charles Snr was in charge of this programme, which had as its objectives the introduction of standardised records, diagnostic criteria, treatment regimens and follow-up programmes.

By 1990, PAHO Headquarters transferred its responsibility for technical coordination for Hansen’s disease to CAREC for its Member Countries. With the help of short-term consultants and temporary advisors, country review programmes were undertaken for Jamaica, Dominica, St Vincent and the Grenadines, Grenada, Suriname and Turks and Caicos in 1991-1992. It was noted that Guyana, Trinidad and Tobago (from previous studies), Suriname and St Lucia were the most seriously affected countries based on the WHO’s figure of more than one case per 10,000. Both PAHO and WHO had set a goal of elimination of leprosy (less than one case per 10,000) by the year 2000.

The main objectives were to assist national Leprosy Control Programmes in CMCs with their mobilisation of resources, budgeting, and educational materials, training, supplies, surveillance, quality control, as well as occasional clinical backup. From 1992, the programme was funded by a donor agency Aide Aux Lepreux Emmaus Suisse (ALES). This source of funding, however, came to an end in December 1993. Following the departure of ALES, the Netherlands Antilles Leprosy Relief Association (NSL) funded the programme. The NSL is a non-governmental organisation supporting leprosy control in endemic countries. Strategies employed for the elimination of leprosy included:

- improved diagnostic capacity and epidemiological surveillance
- multi-drug therapy
- training of technical and administrative personnel
- elements for programming, surveillance, evaluation and certification of results obtained
- operational research

Ms Marlene Francis was the Programme Manager and with intense efforts and resources, the elimination target of less than one case per 10,000 was achieved by all CAREC Member Countries by 2012.

**Tuberculosis Control**

Tuberculosis is caused by an airborne bacterium, mainly *Mycobacterium tuberculosis*. By the mid-1990s it was noted that there was a worldwide re-emergence of tuberculosis disease, the emergence of multi-drug resistance and an increased risk resulting from the AIDS epidemic. In response to requests from CMCs for guidance in addressing this problem, the Surveillance Unit under the guidance of its Head, Dr C J Hospedales, prepared a report entitled "Tuberculosis Control in the Caribbean: A Strategy for the Mid-1990s". This report documented the very limited infrastructure available in CAREC Member Countries with which to control the disease. Other problems documented included the lack of a standardised case definition, limited diagnostic capability in most of the countries, the use of inappropriate drugs and, when appropriate drugs were used these were not routinely available.

A study done in 2000 showed that the incidence rate for tuberculosis in 1992 was 10.4 per 100,000 population in the Caribbean. By 1999, however, the rate was 14.7 per 100,000. Incidence rates were highest in the mainland countries of Guyana, Suriname and Belize and three island territories – Bahamas, St Lucia, and St Vincent and the Grenadines. In countries with the highest number of cases, males were more commonly affected than females, particularly in the 15 to 44 age group. For other island territories the combined incidence rates were no more than 4 per 100,000.

CAREC’s activities were to encourage member countries to utilise effective management and control strategies. These strategies were to increase clinical awareness in order to facilitate the early identification, treatment and cure of cases of tuberculosis.

Clinicians and managers assigned to the programme were given training and some of them went to the Tuberculosis Model Programme in New Jersey, USA, to improve their clinical expertise in tuberculosis control. This training was supported by PAHO through preceptorships as well as funding from the CARICOM/GTZ TB training programme.

A successful tuberculosis prevention and control programme, according to WHO’s strategy, required the implementation of three basic elements: early case detection, urine and sputum smear microscopy among symptomatic patients presenting at health care facilities; the availability of regular supplies of anti-tuberculosis drugs, and the adoption of the Directly Observed Therapy Short Course (DOTS); and the establishment of a standardised reporting system.

Due to the growing awareness of the adverse impact of the Human Immunodeficiency Virus (HIV) in the tuberculosis situation, the six priority countries (Trinidad and Tobago, Guyana, Suriname, Belize, St Lucia and the Bahamas)
made efforts to strengthen the national tuberculosis management and control programmes. CAREC’s inputs were to provide procedural manuals, training materials, the sources of funds for training, the holding of workshops at CAREC and in member countries.

The main hindrance to these programmes were the lack of funding, shortage of staff in the countries, the multiplicity of workloads for managers and the lack of availability of drugs for treatment. When drugs were available, there was a problem with TB/HIV patients who were not always complying with treatment regimens with the potential for the development of drug-resistance.

In 2006, an international partnership was established to address HIV and TB co-infection across a large part of the Caribbean. Higher reported rates of TB in 2006 compared to 1996 in some countries had signalled the need to re-focus on TB and interaction between TB and HIV. The main challenge was the separate functioning of national TB and HIV programmes. USAID provided funding to support the strengthening and coordination of these programmes. CAREC and the Caribbean HIV/AIDS Regional Training Network (CHART) served as project co-leads in partnership with the International Training & Regional Training Network (CHART) as project co-leads in partnership with the International Training & Education Center for Health and the Curry International TB Center. Representatives from TB and HIV/AIDS programmes from nine target countries took part in stakeholder meetings and trainings. Visits were made to selected countries to support implementation of rapid HIV testing and implementation of DOTS. A trans-Caribbean technical working group met to update Caribbean TB guidelines, incorporating TB/HIV co-infection. Curricula and job aids were prepared and pilot tested. A TB nurses’ network and a TB clinical consultation service were established. Experience in TB and HIV care and treatment in high burden countries and expertise from international partners were shared. Clinical and laboratory staff worked to develop TB-HIV collaborative plans for national implementation. Caribbean TB guidelines were updated, incorporating the International Standards for TB Care and WHO guidelines. These were disseminated throughout the region and were adapted for national use.

By 2010, data on tuberculosis (TB) were being collected by the World Health Organization (WHO) on an annual basis through direct online reporting by countries. CAREC supported member countries to collect, validate and submit these data. The annual TB incidence in CMCs varied from zero to approximately 100 new cases / 100,000 inhabitants. Guyana, Belize, and Suriname had the highest incidence rates. Overall, about 27% of the new cases were found among people living with HIV. In total, the number of Multi Drug Resistant cases reported for 2010 by all CMCs was limited to 8 cases, though the number of times Drug Sensitivity Testing was performed varied from zero to approximately 100.

Some of the main conclusions reached at the workshop included the need to establish standardised definitions, methodology and the use of validated data collection instruments which would allow comparison of data between countries and on a sub-regional basis. There was also a need to strengthen routine information data sources on supply and demand factors in substance abuse.

CARICOM and CAREC hosted another workshop in June 1990 with the financial support of the Bureau of International Narcotic Matters of the USA. The objective of the workshop was to ascertain the level of research already completed amongst participating states and to establish consensus on a data collection questionnaire. In addition, its objective was to look at sources of routinely collected data which could assist in surveillance of substance abuse.

In 2000, the CARIFORUM Secretariat and the European Commission signed a two-year contract to provide funding for the substance abuse programme, which was then called the Drug Abuse Epidemiological and Surveillance System Project (DAESSP). In light of their expertise and experience in drug control and prevention, the UNDCP
and OAS/CICAD were contracted as key partners in the implementation of this project. The main objective of this project was to provide a sound database and early warning surveillance system for use by national and regional policy makers in demand reduction. The main activities were to provide training, research, management and coordination. The project was able to establish the Caribbean Drug Information Network (CARIDIN) while establishing drug information networks in 10 CARIFORUM countries and two British Caribbean Overseas Territories. In addition, the project was able to develop a 5-year strategic plan for drug demand reduction in the Caribbean, but funding was not forthcoming. Nevertheless, basic research skills of 15 drug councils were enhanced through training workshops.

Post-disaster surveillance
Like many parts of the world, the Caribbean countries are also subject to many natural disasters, be they volcanic eruptions, hurricanes, flooding or earthquakes. In keeping with the recommendation of CAREC’s Scientific Advisory Committee, CAREC’s role was limited to the surveillance in pre-disaster planning and post-disaster situations.

Early in CAREC’s history, in April, 1979, the Soufriere volcano in St Vincent erupted, necessitating the evacuation of the entire population from the north of the country to evacuation centres to the south. Then in June, Jamaica experienced serious flooding in parts of high-risk areas for typhoid and leptospirosis. At the end of August, a severe hurricane hit Dominica causing widespread devastation. CAREC’s assistance was sought in all these disasters and the Centre responded to assist with surveillance systems and general public health measures. CAREC’s experiences were shared with others at a seminar held in Barbados organised by the Disaster Preparedness Section of PAHO’s Division of Disease Prevention and Control. CAREC actively participated in another disaster preparedness workshop sponsored by PAHO and held in Jamaica. PAHO subsequently developed the Office of the Pan Caribbean Disaster Preparedness and Prevention in which CAREC’s Chief of Surveillance, Dr Peter Diggory, became the team epidemiologist. CAREC subsequently continued to be responsible for providing the epidemiologist for the team, sometimes providing more than one person depending on need.

In 1980, Hurricane Allen hit St Lucia causing direct damage to buildings, and the same hurricane caused severe flooding in Jamaica. CAREC staff again participated in post-disaster surveillance and were able to assist in strengthening local capacity. Hurricane Hugo was disastrous to Montserrat in 1989. (Figs. 3.12 and 3.13).

In 1995, the Langs-Soufriere volcano in Montserrat erupted causing the evacuation of 7000 people from the south to the north of the island. CAREC’s Chief of Surveillance, Dr James Hospedales was part of a PAHO Caribbean Disaster Response Team which provided assistance to Montserrat. Some 2000 persons were housed in 28 shelters, mostly in churches and schools. Such displacement of people provided conditions which could cause an increase of communicable diseases, and social and mental health problems including alcohol abuse. A form was designed to record reports of infectious diseases, injuries, alcohol abuse and inhalation of volcanic ash/dust. Control measures for enteric, respiratory and blood borne diseases and skin infestations were reviewed
daily. The Glendon Hospital, which was in the south, was relocated to the north of the island. The team of experts, along with the Permanent Secretary of the Ministry of Health, developed a list of health sector needs which was forwarded to PAHO Barbados for transmittal to donor agencies.

In September 1998, Hurricane Georges hit St Kitts and Nevis and a post-disaster assessment indicated that 73% (273/376) of the morbidity was due to injuries. In November 1998 Hurricane Mitch hit Belize and three CAREC staff members visited to make a post-disaster assessment. The team noted that members of the health team at the district levels had worked tirelessly and with dedication, above and beyond the call of duty, to ensure that 75,000 persons were evacuated, housed and fed for a period of time that had not been anticipated, without any fatalities or major casualties occurring. The team noted, however, that there was an absence of epidemiological surveillance both at the level of the shelters and immediately after the post-recovery period.

There was an urgent need for the following:

a. the design of a simple disaster surveillance system with appropriate training of relevant staff in the conduct of post-disaster surveillance
b. clarification of the roles and responsibilities of designated surveillance personnel
c. education of the public in matters related to environmental health, vector control, etc.
d. more attention to be paid to disaster planning for different hazards and scenarios, and
e. more detailed planning in the important area of shelter management.

In 2004, the hurricane season was particularly harsh as hurricanes Frances, Ivan and Jeanne hit the islands, with the Bahamas, Cayman Islands, Grenada, Haiti and Jamaica being the most affected. Deaths ranged from two in the Cayman Islands to 28 in Grenada (Figs 3.14 and 3.15). However, Haiti suffered the most, with more than 2000 deaths. Post-disaster assessments showed that there was extensive infrastructural damage. In Grenada, 90% of the houses were damaged. There was disruption in the supply of electricity, water, communication and road access, destruction of crops and flora and fauna. There were injuries due to nail punctures and lacerations. However, there was no report of outbreaks of diseases except in Jamaica where there was an increase in the number of cases of gastroenteritis in 11 of 13 parishes.

Following the disastrous Hurricane “Katrina” in New Orleans, CAREC was asked to join a team of observers and advisors from the PAHO/WHO system to work with US national and federal agencies. Two persons, one from CAREC and the other from WHO, were assigned to the CDC, Atlanta, to observe the CDC operations regarding their surveillance on the public health aspect and of the response.

Examples of CAREC’s participation in disaster response are shown in Table 3.1.
Traffic injury prevention

Major traffic injuries and fatalities are of exceptionally high levels in the Caribbean. National authorities have recognised that these injuries and fatalities, both in human and economic terms, were major health problems. At a workshop held in Barbados in 1984 on the "Prevention and care of motor vehicle injuries in the Caribbean" in which a CAREC staff member, Dr Diggory participated, CAREC was designated the coordinating Centre for epidemiological training and research activities in the Caribbean. CAREC acquired both print and audio-visual materials for its reference library. Arising out of this initiative, several countries appointed National Traffic Safety Committees. Ms Yvette Holder (Fig. 3.16), who had joined CAREC as a Statistician-trainee, eventually became the project leader for this activity.

In a later paper (1995) Ms Holder had estimated that there were approximately 60,000 collisions every year in the Caribbean, with 20,000 traffic injuries and 1,000 fatalities.

The burden was high with about 37,000 years of potential life lost. Three countries re-activated their Transport Boards and extended their membership to include health monitoring and insurance sectors. Dominica received a grant from an agency which assisted in road construction to review the roads and remove hazards. At the same time, Suriname developed a new reporting system. With the help of CAREC, new forms were designed and printed which facilitated data collection and electronic data processing. The system was subsequently computerised in 1989 with the assistance of Chris Boguley of the Road Transport and Research Association of the United Kingdom, while in Montserrat two staff members were assigned to monitor traffic injuries. By this time, most countries had embarked on programmes to reduce collisions and traffic injuries.

In 1987, research studies were completed in St Lucia, Dominica and Suriname. The results of the studies showed that an average of 40+ years of potential life were lost, and that an average serious traffic injury required a hospital stay of 27 days, with a resulting cost of over EC$4,000.

Other positives from this project include the following: five countries reformed Traffic Boards to function as Traffic Safety Councils; three countries used radar guns in an effort to control speeding; one country amended its traffic legislation to allow the use of breathalysers to detect drivers under the influence of alcohol; seven countries established traffic collision surveillance and two of them instituted a traffic injury surveillance system. Both Trinidad and Tobago and St Lucia embarked on intervention programmes with significant reduction in mortalities: Trinidad and Tobago from 23.6 to 10.4 and St Lucia from 27.4 to 13.7 per 100,000 population.
Ms Holder also supported defensive driving courses that were conducted in Trinidad and Tobago for fleet owners, and in Grenada and St Lucia for taxis driving tourists. Breathalyser pilot tests were done in Barbados, Trinidad and Tobago and Jamaica. There was also participation in the development of a road safety curriculum, and text that was integrated into the primary school education system. Along with the Traffic Management Branch of Trinidad and Tobago, CAREC hosted an annual traffic injury prevention activity called the “Traffic City” where all road users, children and adults, pedestrians, cyclists and motorists, would navigate the City using their usual mode of transport in a simulation exercise designed to teach them good road use habits. CAREC also fostered the development of national Traffic Safety Committees in Jamaica, Barbados, Bahamas, St Kitts and Nevis, St Lucia, Dominica and the British Virgin Islands. Throughout the study Ms Holder encouraged the surveillance of traffic injury programmes in Trinidad and Tobago, Dominica, Barbados, Jamaica, St Lucia, Bahamas and Suriname.

Accident and Emergency Injury Surveillance System (AEDISS) in Trinidad and Tobago
In early 2002, the introduction of an AEDISS at the San Fernando General Hospital in Trinidad and Tobago resulted in the compilation of a rich dataset which is now available at the institution. The aim of the system was to raise the profile of injuries as an important cause of morbidity and mortality in Trinidad and Tobago and to help policy-makers develop timely and relevant intervention strategies to decrease the burden of illness due to injuries. Many challenges were encountered in the initial stages overcome. Among these were issues related to staff recruitment for data validation and entry, as well as the involvement of staff in analysing data and producing reports. In this regard, non-governmental agencies – The Rotary (Southern Chapter, Trinidad) and the McLaughlin Centre for Population Health Risk Assessment, Ottawa, Canada became partners in this endeavour. The former agency supported the recruitment of a data entry clerk while the latter agency subsequently supported a proposal that provided additional funds to advance the process of project assessment, a scholarship to visit that agency for further training in skills related to data analysis, report writing and developing templates for regular analysis and reporting.

The highlight of the project was the analysis and presentation of data by the visiting experts at the end of the year. The presentations provided insights into patterns of injury morbidity and to a lesser extent mortality. During the period 2002-2004, demographic characteristics of injured patients captured in the AEDISS showed that overall, the greater proportion was male. The age group 15–44 years was most affected for both genders combined. Most injuries occurred at home (42.2%) and falls accounted for the largest proportion of injuries (31.3%), followed by blunt force (24.6%), stabs or cuts (11.4%) and traffic injuries (11.1%). While most of the injuries were unintentional (78.6%), the proportion of intentional interpersonal injuries was high (16.7%). The analyses also gave insight into the utility of the health service.

One key, limiting factor was that only a proportion of the South West Regional Health Authority’s population was represented in the data set. However, assessment of the AEDISS showed a number of strengths which indirectly alluded to sustained efforts and, to a greater extent, underscored the quality of the system.

Mass gathering surveillance system
Whenever and wherever there is a mass gathering of people a risk of illnesses and outbreaks of diseases is created. Further, there is also the possibility for terrorist activities.

Between 11 March and 28 April 2007, the International Cricket Council World Cup tournament was hosted in the Caribbean. Antigua and Barbuda, Barbados; Grenada, Guyana, Jamaica, St Lucia, St Kitts and Nevis, Trinidad and Tobago, and St Vincent and the Grenadines were the countries involved. A total of 16 cricket teams from various parts of the world competed over a period of 47 days in 51 matches. In addition to team members, many of their supporters came along with them.

To meet this challenge, enhanced surveillance systems had to be put in place in the nine host countries. The system had to be designed to quickly detect any outbreaks of diseases or any possible acts of biologic terrorism so that appropriate public health intervention and response could be rapidly put in place. However, to implement this system it was necessary to boost the limited resource available in the Caribbean. Twenty short-term epidemiological technical assistants were secured from Canada, the United Kingdom and European countries to assist the nine host countries, as well as at CAREC. It was also necessary to procure supplies that were needed to investigate outbreaks and support laboratory diagnosis of food-borne diseases. CAREC, in collaboration with the PAHO Office of the Caribbean Program Coordinator, conducted training in the nine host countries in food and water safety and rodent control, as well as the production of educational messages on food safety and sanitation for food establishments. CAREC also provided test kits,
reagents and supplies for the nine host countries, as well as twelve other CAREC member countries. CAREC was also a member of the ICC Medical, Health and Anti-doping Directorate for the event.

The Mass Gathering Surveillance System involved a daily review of syndromic and laboratory data and feedback to reporting personnel. A web-based reporting tool was implemented in order to facilitate real-time transmission of surveillance data from host countries to CAREC on a daily basis. The software (EARS-X) developed by the US CDC and Prevention was utilised for analysis. Only three disease events occurred and all three were in Trinidad. There were two small (five persons each) localised outbreaks of gastroenteritis due to the organisms *E. coli* and *Salmonella enteritidis*. There was also a report in Trinidad of a gas canister being discharged at a hotel where four of the cricket teams were staying. Eighteen persons were observed at health facilities for minor symptoms, with one hospitalised overnight for observation. There was also an unofficial report of diarrhoea among 16 staff members of a hotel.

The countries of the Caribbean were well prepared for the ICC CWC WI 2007 and equipped to respond to any disease situation that might have occurred during the tournament. As a by-product of the preparation, host countries received extra training and personnel enhanced their capacity for national communicable disease surveillance.

Trinidad and Tobago hosted two events in 2009 where large numbers of people attended: the Summit of the Americas and the Commonwealth Heads of Government Meeting. Both meetings were held in the capital, Port of Spain. Not only did Heads of Governments attend the two meetings, but there were also business people and non-governmental organisations (NGO) representatives. CAREC had to develop an enhanced surveillance system to coordinate risk assessments for the early detection of health threats for these events.

A PAHO/WHO team visited CAREC to assess its capacity for surveillance for mass gatherings and to identify gaps and needs. One decision taken was that CAREC would participate in PAHO Headquarters “Morning Meeting” where information was shared and potential health hazards discussed.

During all the mass gathering events, CAREC’s team met daily to review and validate data and reports received from the Ministry of Health and other sources, produced a daily report which was posted on its website, as well as updated the Event Management System at the World Health Organization (WHO) and routinely teleconferenced with PAHO, Washington. No untoward event was noted.

The Public Health Laboratory Information System (PHLIS)
The Public Health Laboratory Information System (PHLIS) had as its objective the establishment of a communication network between laboratories and epidemiologists in their own countries and between countries and CAREC. The PHLIS was a PC-based software application developed by the CDC. In 1998, CAREC and some of its member countries received technical, financial and infrastructural support from the Walter Reid Army Institute of Research (WRAIR) for the establishment of this system in the
Caribbean. The programme was a collaboration between the Epidemiology and Laboratory Divisions, headed by Dr Eldonna Boisson (epidemiologist) and Ms Carine Ali (microbiologist) at CAREC. The concept of PHLIS was introduced to the following countries in 1999: Barbados, St Vincent and the Grenadines, Antigua and Barbuda, Montserrat, Dominica, St Lucia, Jamaica, Aruba, Turks and Caicos Islands, Suriname and Belize. By 1999, the system had become operational in three countries and by 2001 there were 32 sites in 11 participating countries: Antigua and Barbuda, Barbados, Dominica, Grenada, Jamaica, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Suriname, Trinidad and Tobago, and the Turks and Caicos Islands (Figs. 3.18 and 3.19). Three modules were developed and implemented: Enteric, Dengue and HIV/AIDS. CAREC conducted regional analyses and feedback to member countries and maintained a PHLIS helpdesk to provide technical assistance to countries in the network.

Physician-Based Sentinel Surveillance System (PBSS)

Physician-Based Sentinel Surveillance System (PBSS) was a project developed in 2001 between the Caribbean College of Family Physicians, CAREC and three CAREC member countries: St Lucia, Jamaica and Trinidad and Tobago. It was funded by the World Bank and the Walter Reed Army Institute of Research (WRAIR). The major aim of this project was to develop an internet-based surveillance system between 24 family physicians in the three countries. Data were collected on three disease syndromes: febrile rash illness, diarrhoeal illness and sexually transmitted disease syndromes. A website was developed for communication which was subsequently upgraded by an intern from the Canadian Society of International Health. However, participants found that reporting and receiving data on a quarterly basis did not help them in the clinical management of their patients, particularly as their clientele suffered from chronic diseases and, this project unfortunately folded in 2002.

Mortality Surveillance

CAREC’s 16th Scientific Advisory Committee in 1990 recommended that CAREC should be given a clear mandate to establish and strengthen its role in health situation analysis and disease trend assessment at the sub-regional and country level. Prior to this development, PAHO Headquarters was responsible for the collation of information for health situations and trend analysis in Latin America and the Caribbean. The need for such a unit at CAREC arose due to the lack of a comprehensive database for the Caribbean sub-region held locally. Further, there was a lack of timely input into training and support of national staff in member countries in the accurate collection of data and feedback information. There was also a need to assist staff to analyse data, interpret and use the information to inform decision makers in health service planning. While national staff members had been collecting statistics routinely, there was little evaluation of the accuracy, completeness and validity of the data collected. Dr M Libel and Mrs E Roberts of PAHO, Washington visited CAREC in October 1990 to assess the epidemiological capability of the Centre to undertake this work as a result of which some resources were transferred to assist CAREC.

Mortality Database (MORTBASE)

The first version of a mortality database for the capture, validation and collation of mortality data, MORTBASE, was established at CAREC in 1991. An upgraded version
of this database, MORTBASE 10, an MS Access-based application that worked with mortality data in ICD 10 format, was distributed to member countries in 2000. A manual to accompany the software was also produced and disseminated. These were periodically revised and training in the software was conducted based on user feedback.

**Mortality Surveillance Evaluations and Audits**

In an effort to assess the quality of mortality surveillance systems, evaluations of these systems and mortality data audits were routinely conducted in countries. The evaluations of the systems entailed observing how mortality systems function and making recommendations on weak aspects and areas for improvement or change. The audits entailed randomly selecting a percentage of medical certificates of death and examining them for correct completion and assignment of underlying cause codes. Recommendations would be made for systems straightening and improving data quality.

**Mortality Data Coding**

Skills of mortality coders, statistical officers and data entry clerks were enhanced through the delivery of mortality coding workshops. The overall objective of these clinics and workshops was to promote the use and application of the International Classification of Diseases (ICD) 10 Automatic Classification of Medical Entry (ACME) decision tables for classifying underlying causes of death and strengthen the ability of mortality coders to determine the underlying cause of death.

**Mortality Medical Data System (MMDS)**

Recognising that there were no trained nosologists within Ministries of Health in CMCs, and that the majority of current coders were not medically trained, CAREC also introduced an automated system for coding the cause of death – the Mortality Medical Data System (MMDS) – developed and used by the National Center for Health Statistics (NCHS), a division of the CDC. The system was piloted in 2006 in two countries, Dominica and St Lucia, and installation and training were subsequently done in other countries. This automated system did not fully replace the manual system and coders still required training to handle certificates that the automated system was unable to process.

**Correct Completion of the Medical Certificate of Death**

In order to improve the quality of completion of the medical certification of death by physicians, training sessions on this topic were held with physicians in countries. In 2007, a DVD on the Completion of the Medical Certificate of Death was produced and disseminated to all countries. The DVD was developed to provide physicians with a quick reference guide on issues related to completion of medical certificates of death, as well as examples on how to complete them. It utilised WHO guidelines for certification of death.
Non-Communicable Disease Surveillance

Behavioural Risk Factor Surveys

A report by the World Health Organization in 2011 (Global status report on non-communicable diseases, 2010. WHO, Geneva, Switzerland) noted that non-communicable diseases globally were the leading causes of death. Data collected by CAREC over the previous 10 years from its Member Countries also noted that non-communicable diseases, many of which were related to risk factors such as tobacco smoking, lack of physical activity, harmful use of alcohol and the lack of healthy diets, were the leading causes of death.

These behavioural risk factors (BRF) had never been measured in the Caribbean. In 2005, a Caribbean sub-regional non-communicable disease surveillance meeting was held at CAREC to strengthen plans for initiation and continued data collection on BRFs. Participants at this meeting came from the Ministries of Health of Trinidad and Tobago, Barbados and Dominica; the Office of the Caribbean Program Coordinator (PAHO); PAHO Washington, DC; the Tropical Medicine Research Institute; the Chronic Disease Research Centre of the University of the West Indies; and the Caribbean Health Research Council. Specific objectives of the meeting were to: “share lessons learnt from BRF surveys already done in St Lucia and Trinidad and Tobago, discuss how the information gathered from the BRF surveys could be put to good use, identify countries interested in conducting BRF surveys and develop a timeline for doing the surveys, and develop a plan for testing the agreed minimum data set for non-communicable diseases” (AR 2005).

The need to do BRF surveys stemmed from the fact that they could assist in the development of relevant policies and appropriate interventions in CMCs. The surveys, however, needed to have uniform methodology so that comparisons of the countries of the Caribbean sub-region could be made. It was decided that in doing the BRF surveys the WHO STEPS methodology should be used and in-country workshops were conducted to train persons on the methodology (Figs. 3.24 and 3.25). The surveys were population-based from which a random sample was selected. The WHO STEPS methodology involved a stepwise collection of data. STEP 1 was the determination of behavioural risk factors by a trained interviewer from individuals in the selected sample. In later years, the interviewers used Personal Digital Assistants in recording the information. In STEP 2 physical measurements were taken which included weight, height, waist circumference and blood pressure. STEP 3 was biochemical in nature where blood samples were taken for measurements of glucose levels and cholesterol determination.

Countries participating in this project were: Bahamas (2005), Aruba (2006), Barbados (2007), Dominica (2008), St Kitts and Nevis (2008), British Virgin Islands (2009), Grenada (2011), and Trinidad and Tobago (2011). Following the selection of the sample size the response rate for these countries varied from 97% in Aruba to 48% in Dominica.

Preliminary results for tobacco smoking showed that the greatest percentage of smokers was found in the Bahamas (43%) followed by Trinidad and Tobago with 23.1%. The country with the lowest percentage of smokers was found in the British Virgin Islands (BVI) with 6.4%. The CAREC Annual Report for 2011 noted that this small percentage...
in BVI might have been due to a policy to promote the end of smoking. The Bahamas also had the highest prevalence of women smokers when compared to the other countries. Men started smoking between 17 and 20 years of age while the range in women was 20 to 21 years.

The data for alcohol consumption were based on those who had drunk alcohol in the previous 30 days. Roughly more than 40% of individuals in all countries surveyed drank alcohol, with the highest prevalence rate (51.3%) in Dominica. With reference to those who were engaged in the harmful use of alcohol, men in Aruba had the highest prevalence rate (48.6%). Likewise, 34.4% of women in Aruba also had the highest prevalence rate for the harmful use of alcohol.

Healthy diets were measured by the proportion of people eating equal or greater than five servings of fruits and vegetables per day. All countries performed poorly, having rates less than 3%.

In 2008, the WHO noted that globally the average levels of low activity were 31%. The Caribbean data for the countries surveyed indicated that Barbados had the highest proportion of low levels of physical activity at 51.3%, followed by Trinidad and Tobago with 45.8%.

Metabolic and physiological factors such as obesity and overweight, and blood pressure were also measured. The WHO established overweight in an individual as having a BMI of equal or greater than 25 kg/m² in persons of 20 years of age and older. Using this definition all countries in the Caribbean studied had rates higher than the global prevalence, the sole exception being males in Dominica. High levels of obesity were found in Aruba, Barbados, Bahamas, British Virgin Islands, St Kitts and Trinidad and Tobago.

In measuring blood pressure, a systolic pressure of equal or more than 140 mmHg and/or diastolic blood pressure of equal or greater than 90 mmHg or persons currently on medication was considered raised. According to this definition the Bahamas had the highest percentage of elevated blood pressure (43.7% of the population). The lowest rate was found in the population of Dominica with 32.1%.

A raised level of risk for developing chronic diseases is present in individuals having three or more of the risks mentioned above. When calculations were made for each of the countries studied it was found that high proportions of the population had raised risk for chronic diseases in the age group 25-44 years. For women the highest proportion was found in St Kitts with 49.7%, and lowest in Grenada with 28.8%. For men the highest proportion was found in Aruba with 62.1% and the lowest in Dominica with 15.1%.

Using the foregoing data CAREC member countries could take action to reduce risk factors and therefore reduce chronic diseases in their populations.

Reporting on the Non-communicable Diseases (NCD) Minimum Data Set
By 2011, 15 countries had begun reporting to CAREC on the NCD Minimum Data Set, which includes indicators on mortality from selected NCDs, prevalence and incidence of selected diseases, risk factors of chronic diseases, health system performance, as well as social and context indicators. However, only three countries: Dominica, British Virgin Islands and St Lucia submitted a second report. Only two additional countries submitted reports in 2012.
TRAINING

During February to March 1975 two teams, consisting of medical epidemiologists and microbiologists, visited Caribbean countries to assess surveillance systems existing in each country and resources available in the microbiological laboratories. During their visit a common theme reported was the need for further training. This need came from several categories of staff: doctors, epidemiologists, nurses, public health inspectors, statistical clerks, hospital record clerks and medical laboratory technicians. Such training was necessary in order to raise the level of expertise in epidemiology and special microbiological techniques. A Training Unit was created in CAREC, as a separate entity, to meet this need.

The objectives of this unit were to:

- Provide training in epidemiological surveillance and laboratory diagnosis and their field applications for personnel at various levels in health and other related fields, and
- Collaborate closely with universities in CAREC Member Countries (CMCs), particularly in the faculties of Medicine and Agriculture, the Caribbean Health Research Council, and the Secretariat of the Commonwealth Health Ministers’ Conference

The Training Unit provided logistical support to the surveillance and laboratory departments of the Centre and training activities were conducted at CAREC as well as in member countries. It was the function of the Training Unit to make routine travel arrangements, per diem payments, transport, meeting rooms, laboratory spaces, audio-visual equipment and other necessary supplies. The Technical Officer also assisted in the development of course materials.

CAREC was fortunate to have a Public Health Advisor, Ken Latimer (Fig. 2.13) from the Centers for Disease Control (CDC), Atlanta, USA, assisting in training activities from its onset. Mr Latimer was the first Training Officer. After his departure in July 1977, he was replaced by another CDC employee, Ross Cox, who remained until June 1980. In August 1980, Dr Abdool Hosein (Fig. 4.0) was hired as the Technical Officer for training.

To support these training activities, funding was necessary, and very early in the programme CAREC accessed a CDC grant to the Health Desk of CARICOM. This grant came to an end in 1980, and two other agencies provided funds for the continuance of the training activities. USAID provided a grant of 1.2 million US dollars to CAREC for the strengthening of surveillance and training over a period of three years. The British Development Division (BDD) in Barbados also provided funds for workshops. In addition to the BDD and USAID funds, the French Government supported staff in the French territories in the Caribbean to attend meetings, seminars and workshops at CAREC. In 1981, the USAID training grant was evaluated by a USAID team. Their findings showed that the training courses, workshops, attachments, clerkships had been well subscribed.

CAREC had inherited medical technicians from the TRVL, some of whom were given on the job training shortly after graduating from high schools and who were trained initially to perform a particular task. For example, a staff member trained only in serology could not perform in another area of activity. Starting in 1975, a series of training courses were organised in-house so that staff could be cross-trained. The provision, at a later date of a complete set of 80 two by two-slide/tape laboratory update programmes by CDC assisted greatly in this programme. Staff could now update themselves via self-study using the slide/tape series.
Three professional groups were identified as being fundamental to the success or failure of surveillance of communicable diseases in the Caribbean, the designated epidemiologists, the laboratory directors and statistical surveillance officers. During the period 1976-1985, eight thousand, six hundred and forty three (8,643) persons were trained using funds from the various training grants. Table 4.1 shows the professional groups which most frequently attended training sessions: nurses, doctors, public health inspectors and laboratory technicians.

Table 4.1

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<th>YEAR</th>
<th>Doctors</th>
<th>Nurses</th>
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PHIs = Public Health Inspectors
LT = Laboratory technicians
SO = Statistical Officers
MS = Medical Students
Others include: Medical records clerks, nursing students, administrative assistants, nutritionists, veterinary public health assistants, food handlers, rodent control officers, Agricultural Extension Officers

Training sessions were held not only at CAREC but also in CMCs. The number of persons who availed themselves of training in their own countries is shown in Table 4.2.

Table 4.2 Numbers of people trained, by country*

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<td>933</td>
<td>697</td>
<td>1483</td>
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<td>8643</td>
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* Excluding training by the Special Programme on Sexually Transmitted Diseases.
A wide variety of print and non-print materials were used in training activities, including pamphlets, study guides, overhead transparencies and 2 x 2 slides. These materials combined with various teaching methodologies including lectures/discussions, “hands-on” practical and field exercises facilitated both a meaningful learning experience and the attainment of training objectives. Further, many of the training materials were produced at CAREC by the Training Unit in conjunction with the relevant departments.

With the closure of the Training Unit in 1985, due to lack of funding, training activities continued, but under the Departments of Administration, Surveillance and Laboratories. The effectiveness of the training programmes is reflected in the fact that there were fewer requests from member countries to investigate outbreaks of diseases, as there was improved capacity in country. CAREC continued to provide support more via telephone consultations than country missions. Collection of statistical data from countries became more accurate and standardised, facilitating collation and comparison among countries. Laboratory diagnosis too, became more efficient, relying on CAREC more for reference and confirmation. CAREC continued to assist Universities and Colleges in the Region. In 1994, The College of Arts, Sciences and Technology in Jamaica awarded CAREC a plaque and citation for its valuable teaching programme.

**Medical Clerkships**

In October 1977, at the request of The UWI and the Port of Spain General Hospital, CAREC agreed to host a two-week Clinical Clerkship in Clinical Microbiology for their second-year clinical students. The Clerkship was held annually for several years under the general direction of Dr David Bassett and was taught by several of CAREC staff. After each year, evaluations were made by the students of their training at CAREC. The general consensus was the training was very valuable to them and the students always had high praise for the programme conducted by the Centre. Indeed, one of the students, Dr James Hospedales, returned to CAREC as an epidemiologist after graduation and further qualifications, and later became Director of the Centre.

**CAREC Scientific Seminars**

Early in the history of CAREC two staff members, Mr Hugo Reid and Dr Elisha Tikasingh with the blessings of the Director, Dr Hamilton started a “Journal Club” where a staff member would read a recent article from a Journal and present it to the general staff of the Centre for subsequent discussion. Soon, the Club took advantage of visiting scientists to the Centre to give lectures on their work. Invitations were then given to CAREC staff members and other researchers from Trinidad and Tobago to present the results of their work. These were luncheon sessions with CAREC providing coffee/tea. Invitations to the Seminars were extended to doctors both in private practice and at the hospitals, to medical students and other interested parties, some of whom came from as far as San Fernando. These seminars were popular and continued through a large part of the life of CAREC.
HIGHLIGHTS OF THE CAREC LABORATORIES

Mission Statement

FIRST: To strengthen the national laboratory capabilities by providing microbiology reference and referral services, training and appropriate research for surveillance and control of communicable diseases.

FINAL: To lead, energise and support Caribbean laboratory staff and stakeholders to provide the highest quality information for clinical care, disease surveillance, health policy formulation and personal safety through a commitment to technological and technical relevance, appropriate research and performance-driven training – recognising the importance of medical laboratory services to Caribbean economies.

When the Caribbean Epidemiology Centre (CAREC) was established under the technical and administrative supervision of the Pan American Health Organization (PAHO) on 1 January 1975, it incorporated the Trinidad Regional Virus Laboratory (TRVL). This establishment of CAREC required the rapid completion of a change from a virus research and service programme from 1953-1974 to a centre for disease surveillance with the laboratory as a supporting facility for diagnostic services, training and research. Even before the Centre was fully operational it had conducted its first laboratory course, which was on cholera, in October 1974 due to the threatening pandemic of the disease. The course was taught at CAREC by Dr T Hawkins from the US Centers for Disease Control (CDC) along with CAREC technicians Cameile Ali and Malcolm Race. Course participants came from what was to become CAREC Member Countries (CMCs) (Fig. 5.1).

Initially, there were three Scientific Laboratory staff at CAREC: Dr M C Williams, Scientist; Dr E S Tikasingh, Parasitologist/Entomologist; Ms Barbara P Hull, Virologist; along with a laboratory superintendent, 12 technicians and one nurse. There were three research staff: Dr C Everard, mammalogist, Dr J B Davies, entomologist, (both from the UK’s Medical Research Council), and Dr J Price (zoologist), three technical staff and three field assistants. In addition, the Rockefeller University research staff consisted of one Immunologist, Mr H F M Reid, one nurse, and one laboratory assistant. From the start the laboratory senior staff outnumbered the other senior surveillance staff by a ratio of 8:5.

Thus, the new CAREC Laboratory Division had staff in:

- Scientific Services, which included Immunology/Serology, Biochemistry, Specimen Reception, Media Preparation and Animal Colonies.
- Virology, including Arbovirus and tissue culture.
- Parasitology, a new area of interest which started and was added to the Entomology Section.
- Bacteriology, which was started as soon as a bacteriologist could be hired. The Section would include enteric, sexually transmitted, food- and water-borne diseases.

Fig. 5.1. Participants of the first ever laboratory course to be held at CAREC: October, 1974. Standing (l to r): H Been, E Mitchell, M Charlton, Dr M Williams, C Ali, A Fadelle, Dr T Hawkins, S. Harryram, J Michelle, M Sooknanan, M Campbell, A Clarke, A Ayres, D Watkins, J Hodge, R Ebanks, A Isaac. Dr P Hamilton, F Ho Sang, C Daniel, M Smith, P Garcia, A Charles; Stooping (l to r): Dr E Tikasingh, C Gollop, M Raze, N O’Neil, B Anthony, R Gonzalez.
Because of the close relationship with the Trinidad Public Health Laboratory (TPHL), the TPHL Director, Dr W H Swanston was appointed Assistant Director of CAREC. The laboratory’s input into the Centre was quite significant from the beginning. The primary objective of the Laboratory Division was to provide support to the surveillance and training programmes of the Centre. The Laboratory Division also continued some of its former (TRVL) activities as a collaborating centre of the WHO. CAREC’s cooperation with the TPHL was developed in areas of appropriate technology, safety, planning and in-service training programmes. Proficiency testing was initiated and CAREC supported training of technical staff in CMCs.

The First Two Years of the Functioning of the CAREC Laboratories 1975-1976

For the first two years of its existence, CAREC’s, work centred on the core areas of virology, medical entomology and the development of a parasitology laboratory, immunology and general research which fitted in with the core competences of the scientific staff.

Virology

Because of the existing competence in virology dating back to the TRVL days, laboratory work in virology dominated the output of the new CAREC, especially in the fields of arbovirus investigation of jaundices and diseases of the central nervous system, as well as other cases referred to CAREC from CMCs. In the area of service virology, including surveillance, diagnostic virology which included enteric and respiratory viruses, and special projects, out of 2082 tests performed, 458 (22%) were found to be positive for a viral infection. Initially, the laboratory received and responded to requests mainly from Trinidad and Tobago, but there were also requests for virus isolation and serology from Barbados, Curacao and Guyana. Also, samples for rabies testing and other animal studies were received from Belize, Grenada, St Lucia and Trinidad and Tobago.

The need to develop routine shipping procedures and suitable containers for transport of specimens was recognised. Additionally, in these early days of CAREC, in investigation for viral infections, the opportunity was taken to demonstrate the occurrence of bacterial and parasitological infection, even if a specific request for such investigation was not made by the referring CMC. Yellow fever surveillance became one of the areas of emphasis in CAREC; there were investigations into the potential risk for Yellow fever spread to monkeys in forested areas (by Haemagogus mosquitoes) and into urban areas (by *Aedes aegypti*). Also, a survey of poliomyelitis antibody levels was done for Barbados, Dominica and Trinidad and Tobago in the first year of CAREC.

Parasitology & Entomology

Training in areas of human parasitology was established for the local technologists by the CAREC scientist, Dr Elisha Tikasingh and also by the scientist from the London School of Hygiene and Tropical Medicine, Dr R Muller in helminthology. This training was followed by identification work on samples collected in Dominica. A range of parasites (helminths and protozoans), as well as bacteria and viruses were identified from gastrointestinal tract (GIT) samples from children in closed communities in Trinidad.

With a grant from the Commonwealth Caribbean Medical Research Council, Dr Tikasingh was able to complete studies on zoonotic leishmaniasis demonstrating that the parasite involved was *Leishmania mexicana amazonensis* and the vector sandfly was *Lutzomyia flaviscutellata*. One of the vertebrate hosts was a murine opossum, *Marmosa mils chapmani*. The Entomology Unit, which had established colonies of selected arthropods under the TRVL continued to be maintained. These colonies included *Culex portesi*, from which a number of arboviruses were isolated including Venezuelan equine encephalitis and *Culex fatigans* (quinquefasciatus) – a potential vector of lymphatic filariasis (*Wuchereria bancrofti*).

Bacteriology

Because of the absence of a professional bacteriologist on staff in the first year of the Centre’s existence, relatively little work in this field was attempted or executed.

Research

The role of the laboratory became central to the surveillance centre, especially with the presence and help of the UK MRC staff who were stationed at CAREC. Apart from the direct research associated with service activities, specific projects were carved out on issues such as rabies, leptospirosis, streptococcal diseases, Kabowra flies (*Simulium* spp), a nuisance species which prevented the development of the interior of Guyana, scorpion venom, bat viruses, orbiviruses and the biology of reduvid bugs.
The Formative Years – 1977 - 1982

General
By January 1977, the CAREC laboratory was beginning to grow in size and diversity; the appointment of a bacteriologist, Dr David J Bassett led to the establishment of a Unit of Bacteriology. The laboratory staff had grown to four professional scientific staff, three departmental chief technicians, a senior laboratory superintendent and 20 technicians. In addition, there were continuing projects associated with the laboratory such as ones supported through the Medical Research Council (UK) and led by Dr C OR Everard, and Dr Michael Nathan. There was also the Rockefeller University Immunologist, Mr Hugo Reid. They were supported by several technicians and nurses as appropriate.

Laboratory Safety and Maintenance
During 1981, negotiations with the High Commission for Canada in Trinidad and Tobago resulted in the Government of Canada paying for two experts in laboratory safety and maintenance to draw up a programme for safety at CAREC. There was also the offer of aid to support training in maintenance by a Canadian expert for two months.

Laboratory Development
Regular laboratory division meetings, including lectures on specific topics, were held to channel relevant information to staff and to encourage discussions on matters of general interest. Developments during this period included the establishment of proficiency testing in bacteriology for all CMC laboratories, the first annual meeting of the CMC Laboratory Directors and an in-service training programme initiated for all junior technologists.

The Bacteriology Unit 1977 – 1982
By 1977, the Bacteriology Unit had settled under the leadership of Dr David Bassett to perform its core functions of reference and referral services for the CMC laboratories. For example, in 1977 811 specimens were referred to CAREC for bacteriology testing. The majority of these samples were from Trinidad and Tobago while the others were from six other countries. Service work in bacteriology was increased in 1978: 1548 specimens received from 13 CMCs were processed. The majority of the samples (1405) originated from Trinidad and Tobago. This pattern of sample submission from CMCs to CAREC for culture and sensitivity as part of surveillance would continue over the years.

Training of medical technologists at CAREC and in CMC laboratories was to become another of CAREC’s main functions. In 1977, a clinical bacteriology course was conducted at CAREC in collaboration with US CDC. Twenty-four technicians attended, representing 19 laboratories in 15 CMCs. By 1978, there was progress in training in the field of bacteriology with attempts to rapidly improve the standards of bacteriology in countries. Thus on-the-spot training visits by CAREC trainer Ms Lynette Berkeley (through the support of a USAID grant) were done in CMCs such as St Lucia, St Kitts and Nevis, and Antigua and Barbuda. Further in-country training in bacteriology was provided for laboratory technologists in Guyana, Suriname, Bermuda, the Bahamas, Dominica, St Lucia, St Vincent and the Grenadines, and Grand Cayman in 1978-1979, when a range of subjects from water quality to STD microbiology was taught. This on-the-spot training in CMCs continued until 1981 when training in Anguilla, St Kitts and Nevis, Montserrat, the British Virgin Islands, St Vincent and the Grenadines, St...
Lucia, and the Turks and Caicos Islands were executed. In 1979, a course in anaerobic bacteriology was conducted at CAREC for participants of 14 CMCs. Also at CAREC laboratories, a course of the bacteriology of the urinary tract, genital tract and gastro-intestinal tract infections was held for CMC technologists (Fig. 5.2).

Proficiency Tests: The success in training in bacteriology was evaluated by six proficiency tests for 1978 which demonstrated varying levels of competence in the CMC laboratories. Proficiency testing in bacteriology continued in 35-38 laboratories of the CMCs in 1980. Over the previous years, there was an evident improvement in the proportion of responses that could be considered satisfactory. In 1981, the Bacteriology Proficiency Testing programme continued, but the number of responding laboratories in the CMCs was disappointing despite efforts taken to encourage every laboratory carrying out bacteriological work to participate regularly. The good news was the encouraging level of proficiency in the CMC laboratories that did participate.

Parasitology and Entomology 1977-1982

Parasitology

As an outreach to CMCs, in 1977 CAREC laboratories started surveys to determine the prevalence of gastro-intestinal tract (GIT) parasitisms in selected communities.

GIT. Parasitisms

Pilot surveys were conducted as part of the surveillance programme for enteric parasites in children of CMCs. Pilot surveys were done among school children ages 5 and 9, initially in St Andrew/St David, Trinidad.

The objectives were to:

- estimate the prevalence of enteric parasites, particularly, hookworm in children
- provide information on parasite control programmes, and
- train local staff in conducting surveys and assessing their own control programmes

In St Andrew and St David, major parasites found in 1977 were Trichuris (3%), hookworms (10%) and Ascaris (9%). In another community – St Ann’s – as much as 83% Trichuris infection was discovered. Further afield, as many as 89% of 5 and 9 years-olds, were positive for this parasite. Thus, this early pilot survey for GIT parasites unearthed a problem which could be prevalent in other CMCs. In 1978, GIT parasites were demonstrated in children in community-based studies in Trinidad and Montserrat.

In the period 1979-1982, further GIT parasite baseline studies were done and CMC public health authorities were advised that there was poor quality of hygiene in the communities and advice was given on the best methods to counteract these parasitisms.

Malaria Surveillance

Despite the declared elimination of malaria from the CMC islands by PAHO in 1961, in 1978 CAREC was able to demonstrate by microscopic and serological, indirect fluorescent antibody test (IFAT) methods, the occurrence of 55 cases of P. malariae malaria on the island of Grenada (Westerhall). The possession of these diagnostic tools for such a dangerous disease as malaria at CAREC was to become a tremendous asset for the CMCs. CAREC parasitology unit was able to assist Dominica – which had been certified free of malaria in the early 1960 – with the identification of 9 cases of malaria from 333 blood samples by IFAT. The IFAT proved itself to be a useful tool to be used in areas of risk of low endemicity or of risk of re-invasion of malaria – as exists with most CMCs.

Further Malaria Studies

By 1982, the CAREC laboratory had assisted national authorities to demonstrate the malaria parasite P. falciparum by microscopic and serological methods in the Bahamas where malaria was not normally endemic, but had been imported, CAREC provided additional assistance in strengthening national surveillance for malaria, and control through the training of the public health inspectors in mosquito collection, identification, and training and preservation and control measures. CAREC and the MOH joined in a house-to-house fever survey which helped to detect an additional nine cases of which four were native.

Training courses in “The Laboratory Diagnosis of Malaria for Laboratory Technicians” were conducted by Dr Tikasingh and technicians in the Bahamas, Belize, and CAREC itself for technicians from 14 CMCs.

Proficiency Tests in Parasitisms

In 1978, training and confirmation of diagnostic skills in CMCs were demonstrated through three proficiency tests which showed varying levels of parasitology competencies. Similarly, in 1979 and succeeding years the CAREC laboratory continued its proficiency test for 19 – 35 laboratories in CMCs as a means of sharing skills and reminding technical staff in laboratories of the identification of blood-borne and GIT parasites. Responses
received from CMC laboratories indicated varying levels of competence in the identification of parasites. Generally, the results showed that Caribbean technicians were weak in the identification of parasitic protozoans, though there were strengths in the recognition in GIT helminths.

**Medical Entomology**

In 1977, CAREC laboratory launched a programme for the surveillance of eastern equine encephalitis / Venezuelan equine encephalitis (EEE/EEE) and other arboviruses in Trinidad and Tobago (T&T). There were positive findings in T&T of VEE, EEE and of St Louis encephalitis (SLE). With regard to the potential vectors of VEE/SLE/EEE, various mosquito species especially that of *Culex* collections were made at three locations in Trinidad. Subsequently in Guyana, EEE was identified in equines with encephalitis in the NW District.

**Insectary Establishment**

In the new insectary established at CAREC, live specimens of *C. quinquefasciatus*, as well as two species of a reduviid bug were successfully established.

**Museum**

CAREC inherited a museum with a large collection of arthropods of medical and veterinary importance from the TRVL. The museum also included 317 bird skins which represented 77 species as well as mammals, amphibians, reptiles and other species of animals of interest. These were being maintained as reference and teaching materials to assist researchers in the arbovirus programme.

In 1978, the CARECs laboratory was asked by the Government of Trinidad and Tobago – and agreed - to help the Insect Vector Control Division (IVCD) in the surveillance for *Aedes aegypti* on the islands and to assist in the monitoring of the mosquito control programme. CAREC’s ovitrapping programme at strategic locations in the country, e.g. both airports, was significant in defining the prevalence of the mosquitoes and the efficacy of the control programme for Trinidad and Tobago.

The surveillance of vectors of other arboviruses such as EEE was executed in 1978. Sentinel animals such as mice and chickens were used and the processing of mosquitoes were processed for possible virus isolations. The identification of arthropods – potential vectors of diseases in CMCs - was one of the services the CAREC laboratory started for CMCs in 1978. Thus, a range of ticks, mosquitoes, sandflies and scorpions were identified for CMCs, which assisted in disease control and prevention.

**Yellow Fever Studies**

In 1978 it was reported to CAREC that monkeys were dying in the south-eastern part of Trinidad. Investigations were initiated in collaboration with the Ministry of Health Insect Vector Control Division, Veterinary Public Health and the Forestry Division. *Haemagogus* sp. mosquitoes and dead howler monkeys were collected, which revealed the presence of yellow fever virus.

In 1979, CAREC’s entomology laboratory was also involved in:

- the continued surveillance of *Aedes aegypti* at Piarco and Crown Point airports (Trinidad and Tobago);
- training entomological aides for CMCs as requested;
- assisting with *Simulium* (Kabowra fly) studies in Guyana;
- providing CMCs with identification of insect and other arthropod vectors for surveillance as requested.

**Lymphatic Filariasis Project**

This project which was sponsored by the Government of Trinidad and Tobago and the MRC (UK), was aimed at studying the dynamics of transmission of *Wuchereria bancrofti* – mainly in the Blanchisseuse area of North Trinidad – by vectors (mainly *Culex fatigans* (quinquefasciatus)). The other filarial organism, *Mansonella ozzardi* and its transmission by *Culicoides phlebotomus* was also studied with respect to potential control measures.

**Further Vector Surveillance Studies**

In 1981, surveillance for *Aedes aegypti* (the dengue vector) at Piarco airport (Trinidad) resulted in detection of the vector on only two occasions - breeding in ovitraps. At Crown Point, Tobago, no ovitrapping was seen over the same period. However, *Haemagogus equinus* mosquito eggs were deposited in 8 of the 11 months of sampling. Yellow fever vector studies in *Haemagogus* mosquitoes (Adults) collected in four locations in Trinidad and Tobago, (from 1419 mosquitoes) were performed; Yellow fever virus was isolated from the mosquitoes.
In 1982 in the presence of the on-going Caribbean dengue epidemic, CAREC continued its Aedes aegypti surveillance in two strategic locations in the environs of Piarco and Crown Point airports (in Trinidad and Tobago respectively), as well as at two other Tobago sites – Scarborough and Mount Irvine.

In Trinidad, eight Aedes aegypti ovitraps were positive, which signalled a continued rise in mosquito oviposition since 1979. The majority of the positives were found in the car park area which could suggest the transportation of adult Aedes aegypti by vehicle into the airport compound. None of the ovitraps in Tobago airport was positive for Aedes aegypti, but the IVCD detected breeding in a tyre near Scarborough during the year. No other area in Tobago was found positive for Aedes aegypti by the IVCD. As in previous year, the ovitraps set at ground level in Trinidad and Tobago for Aedes aegypti were attractive to Haemagogus females.

**Training in Parasitology/Entomology**

Attachments of CMC staff members – Suriname (2), and Trinidad and Tobago (4) to the CAREC laboratory to acquire parasitological/entomological skills were accommodated. There was also one PhD student of the UWI attached to the unit.

**The Virology Unit 1977-1982**

By 1977, the Virology Unit had become involved in surveillance activities that were directed towards the investigation of central nervous system (CNS) disease, influenza, respiratory infection, febrile illness and gastroenteritis. Of special interest was the work done on dengue.

**Dengue**

When the 1977 epidemic of dengue fever (Type 1) was reported in Jamaica, CAREC notified other national authorities to be on the alert for imported cases and to adopt necessary surveillance measures. At the same time, CAREC staff received investigation requests and collected specimens for surveillance. Laboratory studies included haemagglutination inhibition (HI) for four fold increases in titres. In addition, there was acute sera inoculation into suckling mice and mosquito cell lines. CAREC laboratory coordinated with US CDC laboratory in Puerto Rico for DF diagnosis in CMCs.

In 1978, the Virology Unit of CAREC was functioning at full strength in their work in areas of cell culture and virus isolation. Training of the technical staff of CAREC was executed both locally and abroad in order to build local competencies, to meet the challenges in CMCs. There was endemicity of dengue fever (DF) in most CMCs in 1978. In addition, the CAREC laboratory performed routine tests for the detection of other febrile illnesses such as adenovirus, para-influenzas etc. as well as for poliomyelitis, encephalitis and meningitis, respiratory infection and hepatitis/jaundice.

**Dengue Fever Surveillance**

The main virus reported in the Caribbean during 1978 was DF Type 1 which caused outbreaks in many countries throughout the year. The laboratory recorded and processed 374 paired sera for antibody assay. Virus isolation was done in mice and mosquito cell lines. DF activity was identified in at least nine countries in 1978. The DF occurrence in 1979 in CMCs was much less than in the previous year. There were 14 virus isolates (Types 1 and 3) and confirmation was made from samples from Barbados, Grenada, Belize, Guyana and Trinidad. The yellow fever yellow fever epidemic in Trinidad which began with an epizootic in Alouatta sp red howler monkeys in November 1978 continued into 1979. CAREC coordinated with the Ministries of Health and Agriculture in isolating yellow fever virus from both monkeys and Haemagogus species mosquitoes. Eighteen human cases of Yellow fever were diagnosed with seven deaths. The critical role of the CAREC laboratories in surveillance, virus isolation and advances in vector control – for jungle mosquitoes and urban mosquitoes (Aedes aegypti), helped to arrest the epidemic.

The epidemic came to an end by September 1979 and this provided an opportunity for the study of Yellow fever in the inter-epizooic period. This was launched in March 1980 under the sponsorship of the Government of Trinidad and Tobago and PAHO/CAREC with funding from the International Development Research Centre of Canada (IDRC). CAREC virology laboratory also became involved in other outbreaks in CMCs such as that in Dominica from which rotavirus, adenovirus Type 1, Echovirus and Poliovirus Type 3 were identified from faecal samples. Polio antibody surveys were done in Antigua and Guyana, showing high levels of sero-positivity to polio. Interestingly, for 1980 there was no request for DF determination and no positive DF finding in the CMCs.

In 1981, the virology unit continued to assist with routine surveillance in CMCs. Approximately 12 countries submitted samples for virus isolation or for antibody detection. As in bacteriology, the majority of the samples were from Trinidad and Tobago (20%) as opposed...
to those from the other CMCs (800). Once more DF outbreaks in CMCs dominated the laboratory requests. There were specimens referred to CAREC laboratories from 11 countries. CAREC was able to isolate DF Type 4 (mainly) but also Types 1 and 2. Respiratory infections caused by parainfluenza Type 3 and influenza A were prevalent. These viruses were isolated at CAREC during 1981. Hepatitis A and B were confirmed in liver disease patients in several CMCs. Polio virus Type 2 was isolated from the stool of a 16 month old unvaccinated Trinidadian child. A survey of poliovirus immunity in 5 to 9 year olds in Trinidad and Tobago showed that over 70% had antibody to polio Type 1, over 99% to polio Type 2 and 86% to polio Type 3.

In 1982, the virology section of the laboratory continued the programme of service to CMCs for routine surveillance of viral infections. The disease which generated the largest number of referrals was DF from several countries; 301 paired sera and 394 single sera were received from Anguilla, Barbados, Grenada, Guyana, St Kitts and Nevis, St Vincent and the Grenadines, Suriname, and Trinidad and Tobago. From the Barbados samples, dengue types 1 and 4 were isolated and there were significant antibody increases to flavivirus antigens from Grenada, seven serological conversions from St Vincent and the isolation of dengue Type 2. From Suriname, dengue types 1 and 4 were isolated, while there were 17 significant haemagglutination-inhibition (HAI) antibody increases from Trinidad and Tobago from which DF Type 1 was isolated.

Other Viruses
There was evidence of the circulation of rubella, influenza A and B, rotavirus, Hepatitis B and a number of enteroviruses. Polio antibody surveys were done in school children from Grenada and St Kitts and Nevis, on pre-school children from Trinidad and Tobago and on all age groups from Curacao.

The Period of Consolidation in the CAREC Laboratories (1983 – 1987)

Bacteriology Unit 1983-1987
By 1983 the workload in bacteriology was slightly less than for 1982, with fewer specimens received from Trinidad and Tobago. However, the proportion of bacterial work originating in Trinidad and Tobago remained above 91%. Similarly, in 1984, the workload in the bacteriology unit remained steady and the trend towards increasing referral of cultures from CMC laboratories for identification at CAREC continued. There was a large proportion of these sent for Salmonella serotyping. As usual, more than 90% of submitted samples came from Trinidad and Tobago.

In 1985, as in past years, the majority of bacteriology specimens and cultures submitted from CMC laboratories originated in Trinidad and Tobago – 85% of a total of 2230. The pattern was changed in 1986 with the implementation of the planned curb in services. There was a fall in the number of requests for diagnosis and of cultures received, to 1001 samples (45% of the previous year). However, the proportion of samples submitted by the host country remained high at 82%.

In 1987, there was a large serosurvey by ELISA for tetanus antitoxin levels in Jamaican children and a number of haemagglutination tests for Salmonella typhi Vi antibody from other countries. As a result, for the first time in the history of CAREC, the majority of specimens and culturing submitted to CAREC for analysis was not overwhelmingly from Trinidad and Tobago. 74% of the 3,442 samples submitted originated in Jamaica, while Trinidad and Tobago samples only accounted for 12%.

Proficiency Tests
In 1983, CAREC continued to provide proficiency tests in bacteriology for the CMCs; laboratories in 18 countries participated. In 1984, bacterial proficiency testing replies were received from 20 (54%) of the 37 laboratories to which tests had been sent. In 1986, proficiency tests submitted to 24 laboratories in the CMCs resulted in a response rate of 75%, considerably better than in previous years.

Parasitology and Entomology Unit 1983-1987
Parasitology
GIT Parasitology Surveys
In 1983 and 1986, several GIT parasitic surveys in CMCs were executed. Among them was the survey for G.I.T.
parasites in the British Virgin Islands (BVI). The on-going survey of enteric parasitism in 5 and 9 year olds in CMCs was continued in 1983 in the BVI, where two hundred and eighty children were sampled.

In 1986, samples were received from the CMCs for diagnostic and reference purposes. In addition, the greater portion of the parasitology work involved surveys and special studies. Examples of the work done included a survey of the Toledo District of Belize. An overall 86% of all persons examined were positive for one or more helminth parasite. Unlike the situation in other CMCs, of the total helminths found (Trichuris Ascaris and hookworms), hookworm was the most prevalent with 60% of all individuals being positive.

**Lymphatic Filariasis Survey in Grenada**

In 1983, a sample of 150 blood samples from 75 individuals in south-west Grenada was giemsa-stained and examined microscopically for the presence of Wuchereria bancrofti. No parasites were found, suggesting that the parasite was not endemic in the Westerhall area. The survey was conducted at the request of the Grenadian Government who indicated that an individual from Europe had suggested that he had been infected with a filarial worm when he visited Grenada. This person had also visited Central America where he might have been infected. In 1986 the CAREC Parasitology Laboratory also participated in Parasitology surveys in:

- A Grenada Anaemia – Parasite Survey
- Malaria in the Cayman Islands (non-malaria endemic)
- Grenada Toxocara (Visceral larva migrans) study

- Venezuela Malaria serology - utilising the new technology learnt the previous year at CAREC.

**Proficiency Tests**

As an on-going measure of the competence of the various laboratories in the CMCs, in recognising various parasites, two proficiency tests were submitted to 34 participating laboratories in 1983. The summary of the results of the first test suggested that technologists in the various countries experienced problems with the identification of protozoan parasites. Two tests were forwarded to CMC laboratories in 1984. The result indicated a low participation – typical of tests which contained the more difficult to identify protozoans (as opposed to helminth parasites). In 1985 with samples containing enteric protozoa there was also low participation. Due to the difficulty in identifying enteric protozoa CAREC organised training programmes to improve the recognition of parasites. In 1984 and again in 1987, the work of the Parasitology unit was severely restricted due to the loss of the chief technician.

**New Finding**

Of interest was the first demonstration at the Centre of positive Cryptosporidium in the diarrhoeal samples from an HIV/AIDS patient. A special staining technique – the Ziehl-Nielsen method – was used to demonstrate the presence of Cryptosporidium oocysts – the first such report in the Commonwealth Caribbean. A recommendation was made to introduce this staining technique as routine in the Parasitology laboratory when processing stools from diarrhoeal patients.

**Training**

In 1985 in-country training activities such as courses in "Laboratory diagnosis of malaria" (Cayman Islands), and "Enteric Protozoans" (Belize, Cayman Islands, St Lucia) were performed by CAREC. Such training was also provided for technicians in Antigua and Barbuda, BVI, Bermuda, and Trinidad and Tobago (Fig. 5.3). In May, the British Development Division generously provided a grant for Dr C C Draper (London School of Hygiene and Tropical Medicine) to visit the Parasitology Unit to train technicians in the indirect fluorescent antibody test for the serological diagnostics of malaria. Further training at the Toronto General Hospital, the Ontario Public Health laboratory (Toronto) and CAREC resulted in CAREC being able to perform tests such as ELISA, IFA and IHA for a range of parasitic infections.

**Entomology**

In 1983, as in previous years, CAREC performed surveillance for the dengue vector, Aedes aegypti at Piarco (Trinidad) and at Crown Point (Tobago) airports. At Piarco, of the weekly sampling of 80 ovitraps (paddles), that is, about 320 per month, only 3 were found positive for *Ae. aegypti* eggs. There was no positive finding at the Tobago airport, suggesting that Tobago was still free of the mosquito. However, a positive ovitrap at the Tobago wharf was found. This suggested that the mosquito may have been an import, possibly from Trinidad. As in the past, *Haemagogus equinus* eggs were deposited in the Tobago ovitraps. In 1984, *Ae. aegypti* surveillance at Piarco demonstrated 11 mosquito-positive trapping sites, out of about 3,500, but as before, none was found to be positive at the Tobago airport, but there were several other positive loci elsewhere on the island, indicating that the mosquito was colonising Tobago. In 1985, *Ae. aegypti* surveillance in Trinidad and Tobago was continued. As before, there were positive ovitrap findings at the Trinidad airport but not the Tobago airport. Since this appeared...
to be a pattern established over the last few years, discussions were held with the Trinidad and Tobago IVCD (MOH) for the transfer of this surveillance programme to be incorporated into their routine Ae aegypti programme. However CAREC continued the Ae. aegypti surveillance into 1986, demonstrating the same pattern of infestation. Finally in 1987, CAREC’s involvement in the Ae. aegypti surveillance in Trinidad and Tobago formally ended when the Ministry of Health accepted full responsibility for this work.

New Insectary and mosquito colonies.

A new insectary was built at CAREC with funds donated by the United Kingdom Overseas Development Administration in 1983 (Fig. 5.4). Haemagogus mosquitoes were reared here, as well as Ae. aegypti. The practice of identifying and cataloguing a wide range of arthropods of public health importance continued at CAREC.

Administration

The Reference Services in Arthropod Identification was continued in 1985. Though most of the 321 submitted samples were from Trinidad, some were submitted from the Bahamas (2), Grenada (3), BVI (9) and Montserrat (2). In the museum, 367 specimens which were identified (mostly beetles) were added to the collection. The insectary continued to maintain mosquito colonies for Ae aegypti, Cx. quinquefasciatus for experimental work as well as potential biocontrol agents such as Toxorhynchites moctezuma as the larvae of this species will readily prey on other mosquito larvae.

In 1984, two interesting entomological studies were done in CAREC laboratories: one was to demonstrate whether bromeliads (epiphytes) were important in the production of Ae. aegypti. After 159 bromeliad were examined, none was found positive for production. The second study was done on the predator Tx. moctezuma, which was collected and reproduced to be evaluated as a potential biocontrol agent on Ae. aegypti. Studies were also done in the laboratory on its biology and development as well as its Ae aegypti-larval killing potential. The findings indicated that due to the large appetite of the Tx. moctezuma for eating Ae. aegypti prey, its compulsive killing behaviour and its relatively slow development would make Tx. moctezuma a suitable candidate as a biological control agent. As a result, with the limited resources available, CAREC began attempting to study as much as possible the biology of this species as a biological control agent for the dengue vector Ae. aegypti.

In 1986, studies on the biology of biocontrol potential of Tx. moctezuma were continued at CAREC. The fecundity studies of Tx. moctezuma showed that one female could lay up to 135 eggs. The control of Ae. aegypti by Tx. moctezuma could be achieved by newly-emerged Tx. moctezuma being predatory on Ae. aegypti larvae, at the right densities of predator and prey. In 1987, the Tx. moctezuma colony – a potential biocontrol agent for Ae. aegypti – and its prey colony Ae. aegypti were significantly increased. The objective for this was the upcoming field trial of the predatory efficiency of Tx. moctezuma.

Biological efficacy of mosquito coils sold in Trinidad and Tobago

For the first time, CAREC’s entomology laboratories got into evaluating the efficacy of a commercial mosquito coil against the common mosquitoes, Ae egypti and Cx. quinquefasciatus on behalf of the Trinidad and Tobago
Bureau of Standards (TTBS), and concluded that none of the coils met the TTBS standards. Possible reasons could be that there was insufficient insecticide (pyrethrin or allethrin), or that high temperatures, direct sunlight or high humidities and long storage times may have affected the potency of the insecticides.

*Aedes albopictus* - a new mosquito threat to the Caribbean

The mosquito, *Ae. albopictus* is a vector of dengue in Asia, but had been spreading across the globe and had reached the southern United States. To prepare for the expected arrival in the Caribbean of this new threat, CAREC, in association with the PAHO office, convened a regional workshop to familiarise the heads of the anti-*Ae aegypti* campaigns with the *Ae. albopictus* threat. Twenty-nine participants from 21 CMCs attended the workshop. Surveillance for the immigrant dengue vector, *Ae. albopictus*, continued. CAREC maintained a reference service for the identification and training for CMC – for recognition of the “new” mosquito *Ae albopictus* and in 1987, two larvae of this mosquito were detected in Barbados in a container of tyres from Japan.

**Virology Unit 1983-1987**

In 1983, the mumps virus was isolated while influenza activity (H3N2) and (H1N1) was also identified in Trinidad and Tobago. Sero-surveillance work continued, e.g. the Suriname sero-survey for polio: from 245 samples from children, results showed 78% of the children were immune to polio Type 1; 87% to polio type 2 and 71% to polio Type 3. The Virology Laboratory continued to provide epidemic investigation assistance and diagnostic services as needed to the CMCs as well as the surveillance of viral disease in CMCs, in 1984. The number of specimens received between November 1983 and October 1984 was 5,873, of which 76% were from Trinidad and Tobago. An increased number of specimens was received from Belize, Grenada and St Kitts and Nevis, due in part to CAREC’s involvement in epidemic investigations in these countries. In 1984, while virus isolation was carried out as before in primary and continuous cell cultures, Immunofluorescence (IF) was increasingly used. Also in 1984, compared to the previous year, there was a decline in requests for dengue fever (DF) isolation with the few isolates obtained originating in Trinidad and Tobago and Suriname (DF Type 1).

**New Policies on Diagnostic Test Performance**

By 1985, financial constraints and the high cost of many virological techniques necessitated a closer examination of the services offered to the CMCs. Some tests were retained, some expanded — such as the evaluation and development of new techniques of potential usefulness at CAREC and in CMC laboratories. But the policy was established that while capability should be retained, actual work on issues such as the following would be discontinued: TORCH titres, herpes diagnosis from STD clinics, viral cultures from infant diarrhoea, and some febrile respiratory diseases.

Laboratory support for epidemic investigation included work on hepatitis in St Kitts, Grenada and Trinidad and Tobago. Influenza A and B outbreaks in Trinidad and Tobago and Suriname were further investigated. DF investigations included samples from Aruba, Barbados, Dominica and Trinidad. HTLV-1 antibody testing was done on sera from Barbados, Grenada, St Lucia, and Trinidad and Tobago. The Virology laboratory also processed serum samples for HTLV – 3,882 from Trinidad, and 192 from other CMCs, e.g. Barbados, Grenada, St Kitts and Nevis, St Lucia and Suriname.

**Training**

The virology unit continued to be instrumental in training various laboratory staff and other health professionals of CMCs on virological techniques through attachments and short courses at CAREC, and courses in CMCs. This was the time when the HIV/AIDS epidemic was becoming established and CMCs looked to CAREC for leadership in diagnosis. In 1986, the Centre convened a workshop for laboratory directors of CMCs on HIV antibody screening methods. Sixteen laboratory directors and senior technologists from 14 CMCs attended in order to gain up-to-date information on HIV from the laboratory perspective.

**Routine surveillance virological work in 1986**

Epidemic investigations for 1986 were executed in the following areas:

- Dengue fever investigations were done for: Suriname (DF Type 2), Trinidad and Tobago (DF Type 2) and Barbados
**HIGHLIGHTS OF THE CAREC LABORATORIES (continued)**

- Influenza Investigations were done for Suriname (A1, N1), Trinidad and Tobago (A1 H1N1) and Cayman Islands (B).
- Hepatitis Investigation was performed for Montserrat (Hep A and B) and Suriname (Hep A).
- HIV samples from 1376 persons were screened by ELISA, referred from patients on clinical grounds, contacts of antibody-positive persons, blood donors, etc.

In 1987, the virological services were much utilised for HIV work. During the year, the capacity to process suspect poliomyelitis specimens was enhanced through the receipt of supplies and equipment from the PAHO Regional programme to Eradicate Polio. In December, specimens were received from the Dominican Republic in accordance with the arrangements to undertake testing for Hispaniola.

Dengue Type 2 epidemics in Trinidad and Tobago as well as Suriname continued into 1987. Also, small numbers of cases were detected in Barbados (9), and Grenada (7), where Dengue 2 was also isolated.

### The Period of Transition in CAREC Laboratories (1988 -1993)

#### Laboratory Planning and Organisation

During 1990, a start was made on a five-year strategic plan for CAREC laboratories. An analysis was made of external and internal forces affecting the laboratory and a number of goals and objectives were formulated. Much more was to come in the area of “Strategic Planning” for the Laboratory and indeed the whole Centre which would culminate in the “Transformation Process” in 1997.

**Laboratory Administration**

The year 1991 saw considerable progress in the area of rebuilding in the Laboratory. The Training Laboratory which was built at the start of CAREC, together with ancillary laboratory rooms and adjacent Mouse Colony areas, were renovated. The Training Laboratory was completed in time for the hosting of a Laboratory Training Workshop in June 1991 and subsequent courses were held in this facility later in the year. The facility was named the “Wilbur Downs Training Laboratory” in honour of the late founding director of the TRVL.

Upgrading of laboratory equipment was a major priority in 1991, particularly with regard to those items of equipment which influence safety in the Laboratory. A new autoclave, biosafety cabinet and a soft water plant were purchased and installed. Equipment maintenance and preventive maintenance received a welcome boost with the recruitment of a well-qualified Maintenance Superintendent who worked closely with laboratory staff to improve equipment and plant maintenance and safety. Preventive maintenance for specialised equipment including microscopes and autoclaves was addressed.

**The Caribbean Laboratory Action News (CLAN).**

In November of 1991, the Centre launched the Caribbean Laboratory Action News (CLAN), a newsletter designed to meet a long-felt need for enhanced inter-laboratory communications among Member Countries. This medium of communication had been strongly recommended by the National Laboratory Directors’ meeting in July 1990.

The Immunology Unit (as recommended by SAC and Council in 1991) was set up in the former Streptococcal Unit. A technician was recruited and temporary professional assistance was acquired to provide support in the setting up of Immunophenotyping services.

**Laboratory Safety:** The CAREC Laboratory Safety programme addressed a variety of areas in 1991. The accident/incident reporting system was reviewed and implemented. There was collaboration with the Maintenance department, laboratory inspections continued and staff was advised on a variety of safety precautions and practices. There was an enhancement of laboratory safety training and education activities.

### The Laboratory Directors’ Meeting

The Laboratory Directors’ Meeting was re-established in 1990 after a break of five years. This meeting allowed CAREC and CMC laboratory staff to have direct contact so that discussions and interaction could help the CAREC laboratory be aligned with the needs of the CMCs. This meeting would later become an annual event. One of the highlights in the CAREC laboratories in 1993 included the official opening of the new Thomas Aitken Parasitology/Entomology Laboratory.

**Laboratory Technical Committee**

In 1992 the Laboratory Technical Committee (LTC), met on a range of subjects pertinent to the efficient management of laboratories in the CMCs, including:

- Strategic planning issues relating to the Laboratory Division and the Centre as a whole
- Safety issues
- Responses to CMC outbreaks including...
diarrhoeal diseases, cholera, dengue, rubella and malaria.

- HIV confirmatory testing for CMCs.

Operation of the Technical Units of the Laboratories

Bacteriology/Microbiology Unit 1988 - 1993

The requests for leptospirosis confirmation from CMC laboratories continued to increase – this important diagnostic capability was being fulfilled with the close collaboration of the Leptospira Laboratory (LL) in Barbados. The links between CAREC and the LL had been further strengthened by the appointment of a CAREC Associate Scientist. By 1990 requests for leptospirosis serology continued to be the major part – 75% of investigations in bacteriology for 1980-1990 – of the work of the unit. There were 777 sera received from 10 CMCs for this investigation.

Other notable examinations undertaken in Bacteriology included that of specimens from Suriname, mostly for identification and serotyping of *Shigella* and *Salmonella*.

With the arrival of a new microbiologist, there was a 110% increase in workload in bacteriology during 1991, mainly due to the introduction of a programme to address the “Antimicrobial Resistance Patterns of Bacteria” as recommended by the National Laboratory Directors during 1990. The susceptibility patterns of gram-negative bacteria isolated in Trinidad and Barbados were tested.

The workload in bacteriology during 1992 continued to be heavy due to the large number of samples referred to the special programme on opportunistic infection from Trinidad and Tobago laboratories. There was also the ongoing work in the “Antimicrobial Resistance Patterns of Bacteria.” Other issues addressed in 1992 included:

- Salmonella isolates (320) which were sero- and phage-typed
- Leptospira serology performed on 685 sera received from 10 CMCs
- *V. Cholerae* confirmation and vibriocidal antibodies identified in 27 samples

The Bacteriology Section continued its reference and referral activity in 1993 as well as a programme of “Antimicrobial Susceptibility Patterns of Bacteria in CMCs”. Two thousand, one hundred and twenty-six specimens (cultures and serum samples) were referred from 15 CMCs to CAREC in that year. Training in bacteriology in the CMCs continued in 1993. With the continuing high alert of the risk of cholera in the region, CAREC held workshops on the laboratory diagnosis of *V. cholerae* in the Bahamas, Guyana, and Jamaica.

Virology Work 1988 -1993

During the height of the HIV epidemic and other viral infections in the CMCs, a total of 9960 specimens from CMCs, Haiti, and the Dominican Republic were referred to CAREC for viral diagnosis in 1990. Apart from requests for HIV diagnosis, the following were some of the viral infections investigated at CAREC’s virology laboratory:

- Dengue fever (DF) samples for virus isolation and serology were sent from the Bahamas (Type 2), Barbados (Type 2), Dominica, Trinidad and Tobago (Type 2) and Montserrat
- *Hepatitis A* (Trinidad and St Vincent and the Grenadines)
- *Hepatitis B* (Grenada, Guyana, Suriname)
- Poliomyelitis (Dominican Republic, Haiti, Jamaica, St Vincent and the Grenadines).

The virology laboratory continued to support national programmes monitoring diseases of public health importance such as *Hepatitis A* and *B*, HIV and HTLV-1. The virology laboratory also continued to provide primary diagnostic services requiring techniques not readily available such as EBV and CMV and to assist in the investigation of epidemics such as DF and rubella. DF activity (Types 1, 2 and 4) was identified from samples from the CMCs in 1990. This was an important finding, for 3 years prior to this; only DF Type 2 had been isolated in Trinidad. In 1991, the virology laboratory continued to provide reference services for support of national surveillance programmes in viral infections of public health importance, diagnostic services and to assist with investigations of outbreaks such as rubella and Hepatitis A.

**Hepatitis**

A total of 1485 samples for hepatitis A and B diagnosis were referred from 9 CMCs, of which 185 were positive for hepatitis B surface antigens and hepatitis IgM antibody. Increased activity of Hepatitis A was observed in Trinidad due to an outbreak in a children’s home.

Other virological reference work done at CAREC in 1991 included:

- Human T-Cell Leukemia virus (HTLV-1) serology from 10 CMCs
HIGHLIGHTS OF THE CAREC LABORATORIES (continued)

- HIV serology by ELISA, IFA and WB done on 1204 samples from 16 CMCs
- Rash diseases
- Dengue fever: sporadic activity

Other Diagnostic Services not Available in the Sub-region

The Virology laboratory continued to investigate other infections such as Cytomegalovirus (CMV), Epstein-Barr virus (EBV), Lymphogranuloma venereum (LGV), Toxoplasma gondii and Varicella Zoster for clinical diagnosis of suspected cases. The laboratory confirmed the first case of Subacute sclerosing panencephalitis (SSPE) in Trinidad in 1991.

In 1992, the Virology laboratory continued to provide reference and diagnostic services for support of CMC national surveillance programmes in viral infections of public health importance and to assist in investigations of outbreaks related to viral infections. More than 5500 specimens were received and processed from CMC laboratories. Routine serology investigations demonstrated a range of viral infections in CMCs:

- Hepatitis A and B from 10 CMCs
- HTLV-1 serology from 1318 samples
- HIV serology (ELISA, IFA and Western Blot). 1360 samples were received from 15 CMCs for confirmatory testing
- Dengue Fever (DF) – 653 samples were processed. In 1992, DF types 1, 2 and 4 were recorded in the CMCs.

By 1993, the requests and referrals submitted to the Virology laboratory had reached as many as 8,558. Indeed, the virology laboratory was actively supporting regional programmes for control and eradication of diseases such as polio in non-CMC countries e.g. the Dominican Republic, Haiti, Honduras and Mexico. Still, it was in areas such as the HIV epidemic that the majority of the virology laboratory’s resources of were being utilised. In 1993, 1825 samples were received from 14 countries for serological investigation for HIV.

Support for the Expanded Programme on Immunisation (EPI),

The Centre also continued to provide essential virology support to the EPI programme in the context of the measles elimination initiative and efforts to confirm the apparent elimination of indigenous poliomyelitis, as well as carrying out investigations into vaccine preventable diseases not formally included within the EPI programme at that time (e.g. hepatitis B, rubella).

Laboratory Advisory Services

This area focused on laboratory diagnosis of HIV. By this time all 19 CMCs had suitably trained technologists in laboratories equipped to perform HIV ELISA tests. However, there were still deficiencies in laboratory diagnosis of opportunistic infection and the need for an HIV rapid assay, especially when no blood bank HIV system was maintained. These needs were addressed in laboratory workshops run by CAREC. Another laboratory workshop on the new technology of Polymerase Chain Reaction (PCR) was held as a collaborative effort between the Pasteur Institute (Guadeloupe) and CAREC. Participants from Barbados, Bahamas and Trinidad and Tobago attended.

Parasitology and Entomology 1988-1993

Diagnostic Services for CMCs. In 1990, there was a 65% increase in the number of samples processed over that of 1989 (1272). There was also a greater diversity of parasitisms investigated, of gastro-intestinal tract, blood and other tissue parasites. Some of these were at the request of the CMC laboratories but others were for the establishment of baseline parasitological endemicity levels of CMCs.

Training and Proficiency Testing.

Training in parasitology techniques was executed in CMCs and technologist competence in these techniques was assessed through proficiency tests for 19-31 participating laboratories in the CMCs.

In 1992, the Parasitology Unit undertook some operational research programmes at the request of the CMC laboratories which were not at the time able to execute such work. Among these were the characterisation and diagnosis of opportunistic parasitic infections that were becoming so prevalent in the CMCs. With the help of funds from the World AIDS Foundation, CAREC laboratories initiated studies at Caura Chest Hospital and Queen’s Park Counselling Centre and Clinic, Trinidad, to measure the occurrence of infection such as Pneumocystis carinii infection in HIV and AIDS patients. Data from this study of HIV/AIDS patients demonstrated only a 2% prevalence of P carinii infection in this population. This study on opportunistic parasitic infections was the first such study executed in or for the CMCs. At the same time, studies were done to characterise and measure the occurrence of parasitic infections in patients with Tropical Spastic Paraparesis (TSP) in association with HTLV-1 infections.
Medical Entomology

Yellow Fever Surveillance
In 1990, monthly collections were made of the three most likely vectors of Yellow fever – Haemagogus janthinomys, H. leucocelaenius and Sabethes chloropterus. However, no Yellow fever virus was detected in any of the mosquitoes.

Early insecticide resistance in Aedes aegypti studies
Work in the new insecticide resistance laboratory showed resistance in Aedes aegypti in the following CMC mosquito strains:
- Antigua (fenthion; temephos, chlorpyrifos)
- Jamaica (fenthion, chlorpyrifos)
- St Lucia (temephos)
- Trinidad (temephos)

Conclusion: Resistance to organophosphorous insecticides could be one of the reasons for poor mosquito control.

The following year, the Unit continued its studies on monitoring for insecticide resistance development. Nineteen strains of Aedes aegypti from 14 countries were evaluated for susceptibility to malathion and temephos, two commonly used insecticides. The data showed only modest levels of resistance.

The new insecticide resistance testing facility at CAREC continued to progress with the examination of 14 Caribbean strains of Aedes aegypti, demonstrating the insecticide-resistance phenomenon in both adult and immature stages of the mosquito. This technology was extended by training CMC technicians for in-country surveillance. The insecticide-resistance status of virtually all Caribbean Aedes aegypti (larval and adult stages) was assessed for a range of insecticides.

Appropriate Technology for the Control of Blood-sucking Insects
Expanded polystyrene beads/balls placed on the surface of mosquito production sites (such as septic tanks) resulted in a drastic reduction of emergent adult mosquitoes. In 1991, the Entomology Unit exerted much effort in the area of methods development for the management of arthropod pests of health importance. Biological control of Aedes aegypti mosquitoes took primary place in the studies. Thus, there was the evaluated efficacy of a range of biocontrol agents against Aedes aegypti and Culex quinquefasciatus, the major pest species.

Among the biocontrol agents were:
- The fungus Metarhizium anisopliae
- Predatory arthropods: The larvae of Corethrella appendiculata – a predator mosquito showed promise in the fight against container breeding mosquitoes.
- Toxorhynchites moctezuma: the old strain was studied for its prey finding and predation in urban environments. During the year, four releases and detection studies were executed. One of these was done in collaboration with the Port of Spain Health Department at locations in St James. Because of an apparent laboratory adaptation a new strain of this predator was developed and mass-produced in the laboratory, for a comparison of its efficacy for predation, versus that of the old strain.
- The copepods Mesocyclops sp: Local stains of copepods were found to be efficacious as predators of mosquitoes.
- Mosquito fish: local fresh water fish, Mollienisia sphenops and Poecilia reticulata were evaluated for their consumption of mosquito larvae.

In 1993, there was a continued evaluation of new biological control tools for the vector, Aedes aegypti. The various Caribbean strains of Mesocyclops (copepods) were evaluated for their predation on Aedes aegypti and their tolerance of adverse environmental conditions and sub-lethal insecticide levels. The efficacy of mosquito fish (Poecilia spp) and larvivorous arthropods (Toxorhynchites sp) for Aedes aegypti control were further studied.

Dengue Vector Surveillance
The unit recorded an increase in testing over previous years attributed to the 1990 dengue epidemic in Trinidad. Work was done to support the MOH, Trinidad and Tobago’s fight against dengue virus transmission as well as research to demonstrate transovarial transmission (TOT) of dengue virus in the local Aedes aegypti populations.

The Knowledge, Attitude and Practices (KAP) of our various Caribbean populations with regard to Aedes aegypti production was measured to attempt to get answers as to how Caribbean communities could become further involved in the fight against mosquito production.

The New Immunology Unit
In 1992, the recently formed Immunology Unit at CAREC focused its attention on setting up the system for immunophenotyping services with special reference to HIV-infected individuals. In 1993 the immunology programme was further strengthened and continued to offer immunophenotyping services, which then...
enabled better characterisation of AIDS and other conditions in the Caribbean setting. The capacity for full immunophenotyping had now become a routine service at CAREC. In addition, HLA – A, B, C and DR typing as well as cross-matching services were provided on a cost-recovery basis for patients awaiting organ transplant surgery.


Special Recognition Award
The College of Arts, Science and Technology (CAST), Kingston, Jamaica, awarded a special Recognition Award to CAREC for its contribution to the development of the BSc (Health Sciences) programme in the area of Virology and Parasitology.

The Transformation of the Laboratory

Organisational Development
An external evaluation of the CAREC Laboratory was undertaken in December 1994. The evaluation team comprised Dr Fraser Ashton, Director, Bureau of Microbiology, Laboratory Centre for Disease Control (LCDC), Canada; Dr Philip Mortimer, Director, Public Health Laboratory Services (PHLS), United Kingdom; Dr Joyce Essien, Centers for Disease Control and Prevention (CDC), USA; and Dr Nigel Gibbs, Professor Haematology, University of the West Indies, Jamaica. The evaluators’ report indicated that, while in general the Laboratory Division was performing its currently defined functions with adequate quality, there was a need to redefine its products and strategies. Based on the recommendation of this evaluation team, the Laboratory Division undertook a strategic planning exercise early in 1995. Divisional managers defined the approach required by the laboratory in support of public health in the region as proactive, responsive to customer needs, based on emerging trends, and reflecting a broader programmatic public health focus. These strategies were defined by the Division as being critical to its future service to CMCs. These ideas apparently sowed the seeds of the ideas for “Transformation of Laboratory Management” which was to come in 1996.

Transformation of Laboratory Management
1996, CAREC’s 22nd year of operation, was probably the year of greatest structural change since the inception of the organisation. This was the year of structural adjustment known to staff as the “Transformation”. For the CAREC Laboratory Division, there were significant changes that ushered in the design and implementation of a new laboratory structure. As a result, instead of the original four independent Units – Virology, Parasitology/Entomology, Bacteriology and Immunology – six units or ‘pods’ were then introduced which were to be represented in the new structure. These pods were:

- Virology
- Microbiology and Medical Entomology
- Immunology and Serology
- Molecular Technology
- Customer Services/Information
- Laboratory Support Services

Each “pod” was managed by a Senior Technologist designated a Technical Coordinator (TC).
In the eyes of the Director, Dr Steve Blount, and the decision-makers, this new arrangement created the possibility for better functional coordination of resources, including personnel, equipment, reagents and facilities. It was also thought that this structural arrangement identified critical divisional and organisation competences including some functions that had not been acknowledged before in a formal sense.

Significantly, the role of the PAHO senior scientists at the CAREC laboratory was modified. Their day-to-day administration and technical management of laboratory functions were removed to allow them to function as part of a newly defined team, called the Public Health Intelligence Unit (PHI), which included other professionals at CAREC such as the Epidemiologist and Statistician. There would remain, however, a close collaborative relationship with the laboratory staff to whom the scientists would provide technical oversight.


The Laboratory Division’s activities in 1994 and 1995 continued to focus on strengthening national laboratory capabilities in support of disease surveillance and control through provision of reference and referral services, training for improvement of in-country laboratory services and promotion of quality improvement.

**The Virology Unit**

Throughout this period, the virology laboratory continued to provide diagnostic and reference services for the support of patient management and national surveillance programmes for viral diseases. For example, in 1994, 7,904 specimens were received for viral serology investigation. The principal investigations included serology for:

- Hepatitis
- HTLV-1
- HIV
- Dengue Fever (DF). 896 samples were received from 12 CMCs. DF virus isolates were obtained from Trinidad and Tobago (types 1, 2 and 4); Suriname, Barbados, Montserrat, St Kitts and Nevis and St Vincent and the Grenadines (type 4)

The virology laboratory continued to provide immediate attention and priority to outbreaks of viral diseases. However, due to experiences of overload of the system during the sub-regional dengue epidemic in 1995, the CAREC Laboratory and Epidemiology Divisions formulated and instituted policies to guide CMCs in the future on the use of CAREC’s laboratory services for outbreak investigation and surveillance.

Outbreaks of dengue virus infection occurred in several member countries during 1995. A total of 1,782 specimens from 18 countries were processed for virus identification during 1994-1995. Dengue virus Type 1 was the common type, isolated in nine countries; followed by Dengue Type 2 in Barbados, Dominica, Trinidad and Jamaica; and Dengue Type 4 in Montserrat, and Antigua and Barbuda. Laboratory confirmed cases of DHF/DSS occurred in Dominica (D1), Barbados (D1), and Jamaica (D2) during 1995. Several pools of mosquitoes were processed for isolation of flaviviruses as part of special projects for the surveillance of dengue virus infections in Trinidad.

The virology laboratory identified all four dengue fever serotypes in CMCs in 1997. Dengue virus was confirmed from:

- Type 1 – Jamaica, St Vincent and the Grenadines, Trinidad and Tobago, Barbados
- Type 2 – St Vincent and the Grenadines, Trinidad and Tobago, Barbados
- Type 3 – Belize
- Type 4 – Trinidad and Tobago

The virology laboratory was actively involved in the determination of aetiologic agents in a number of outbreaks during 1998. These included:

- Dengue in the Bahamas, Jamaica, Suriname, Guyana, St Vincent and the Grenadines and Dominica
- Hepatitis A in the Turks and Caicos Islands
- Rubella and Rabies in Suriname
- Acute haemorrhagic conjunctivitis in Suriname, Trinidad and Tobago, Antigua and Barbuda, the British Virgin Islands, and St Vincent and the Grenadines.

Testing services provided by the Laboratory Division continued to augment in-country testing capabilities for identification of outbreaks, information essential to the implementation of appropriate control measures. In addition, the laboratory continued to provide confirmatory tests for surveillance of diseases of public health importance such as HIV and hepatitis, as well as to provide access to unique testing services in support of HIV clinical management and organ transplant programmes in the sub-region.
Parasitology and Entomology

The dengue epidemic of 1995 was one of the busiest periods. Staff were involved in surveillance of the disease and assisted in strengthening mosquito control activities in CMCs. At the same time, efforts continued to improve appropriate diagnostic techniques and surveillance for parasitic infections such as blood-borne and gastrointestinal tract (GIT) pathogens.

Activities in Medical Entomology and Vector Control were focused on the evaluation of biocontrol agents for *Ae. aegypti* control. Copepods – small crustaceans of the *Mesocyclops* and *Macrocyclops* species – were collected from around the Caribbean, mass-produced and characterised as biological control tools for the mosquito. Three copepod strains native to Trinidad, *Me. albicus*, *Me. aspencormis* and *Me. longisetus*, proved very effective in suppressing both *Ae. aegypti* and *Cx. quinquefasciatus* larvae in laboratory and field studies. This demonstrated the value of copepods for integrated mosquito control in drum habitats. Though the main message for *Ae. Aegypti* control continued to be source reduction, the copepods offered promise for use in situations where storage of water in containers was unavoidable.

During the dengue epidemic in Jamaica, CAREC participated in an evaluation of aerial insecticide spray treatment for *Ae. aegypti* in Kingston. The data suggested that insecticide penetration into homes following aerial spraying was not significant as mosquito prevalence after the treatment was unchanged. The cost of such an intervention did, however, prove to be significant.

Late in 1995, there was collaboration with the Trinidad and Tobago Vector Control Division for surveillance of forest mosquitoes for possible yellow fever transmission to primates. As a result of the then discontinued, onboard aircraft aerosol treatment of mosquito control, SAC recommended that CAREC work with interested CMCs to enhance mosquito surveillance in airports of the Caribbean. Sampling for mosquitoes by ovitrapping was initiated. In the Normal Manley Airport, Kingston, all traps were negative for mosquitoes, but 20% of traps near Montego Bay airport were positive for *Ae. aegypti* eggs. Positive traps were also found at airports in Antigua and Barbuda, Grenada, and St Kitts and Nevis, confirming the need for enhanced surveillance and control of mosquitoes at ports of entry into some CMCs. In the Vector Control area, novel insecticiding strategies were evaluated, showing the efficacy of intra-domiciliary approaches, while the entomology laboratory continued to provide insecticide resistance testing for *Ae. aegypti* from all CMCs to aid cost-effective use of pesticides.

In Medical Parasitology, testing was performed in support of a number of research projects, including:

i. The identification and prevalence of parasitic organisms causing diarrhoeal syndrome in children in Trinidad and Tobago and Jamaica (160).

ii. Serology for Chagas disease in Trinidad and Tobago (133), and malaria microscopy in Trinidad (808).

iii. Parasites in stool samples from Trinidad and Tobago soldiers returning from sojourn in Haiti (129).

iv. Possible zoonotic infections from zoo animals in Trinidad (144).

In the Parasitology Laboratory, a programme implemented in 1998 for testing water from the Water and Sewerage Authority (WASA), Trinidad and Tobago – for water-borne parasites such as *Cryptosporidium*, *Giardia* – was continued throughout 1999. Other significant areas of investigation included serological and microscopic testing for toxocariasis, leptospirosis, toxoplasmosis, Chagas disease and malaria. Training programmes at CAREC and in CMC laboratories in vector control and in the update of the diagnosis of parasitic diseases continued. An increased number of tests were done as part of reference and referral services for CMC laboratories, totalling 4,389 in 1995 compared to 2,531 in 1994.

Immunology

The Immunology Unit continued to provide referral services to CMCs in the areas of autoimmune serology and syphilis confirmation, in addition to providing regional access to technology such as histocompatibility testing and immunophenotyping, which were not otherwise accessible to the majority of potential users in member countries. Five hundred and twenty-five requests for testing were received on 422 samples in 1995.

As physicians attempted to define and manage autoimmune disorders in the Caribbean, it was clear that a more comprehensive range of autoantibody screening tests was desirable. Apart from established testing for anti-nuclear factor (ANF) and anti-double-stranded DNA, used to assist in differential diagnosis of Systemic Lupus Erythematosus (SLE), and immunoglobulin and complement levels used to determine the onset of active immune-mediated pathology in these patients, requests were received for additional screens not yet established at CAREC.
Regarding CD4/CD8 immunophenotyping, determination of the levels of CD4+ T-cells in the peripheral blood remained the single most reliable marker of progression and prognosis in HIV-infected persons. Syphilis confirmation was formed by the Fluorescent Treponemal Antibody Absorption Test (FTA-abs), and was requested during 1995 primarily from Anguilla, Antigua and Barbuda, Montserrat, and St Kitts and Nevis.

The new Immunology Unit increased its output in the areas of HLA, ABC and DR typing for organ transplant (50 samples) and HLA ABC only (21 samples). These samples and requests were received from Trinidad and Tobago, Antigua and Barbuda, and Grenada. Some of these tissue-typing services were provided on a cost-recovery basis, netting US$14,000.00 from the patients that were typed for organ transplantation.

Other types of work being done in the Unit included ANF/ANA and ANTI-DS-DNA, for autoimmune disease studies, and complement studies and serum levels of complement components (C3 and C4) for autoimmune studies.

Sustainability – Funding Initiatives
There was in increased demand for Immunology testing offered on a cost-recovery basis, in particular, tissue typing which accounted for 88% of the total income from these services.

Approximately 43% of the testing in immunology during 1995 was provided on a cost-recovery basis, and comprised cellular immunological investigations, histocompatibility typing and immunophenotyping by flow cytometry. The implementation of this pilot cost-recovery project over the two years highlighted the need for adequate financial management support for such initiatives at the Centre in order to ensure future success. A total of US$9,333 was recovered in 1995 for performing histocompatibility typing, leukemia phenotyping and CD4/CD8 counts. Tissue typing service at CAREC laboratories continued to be provided on a cost-recovery basis. This generated an income of ranging from approximately US$20,000.00 in 1997, to US$16,135.81 in 1999 to CAREC for these services. Samples for tissue typing were received from Trinidad and Tobago, Antigua and Grenada.

Molecular Biology Laboratory
The molecular biology (MB) unit was started at CAREC in 1997 with the aim of providing access of more modern technologies to the CMCs. Priority areas identified in MB for 1999 were dengue fever and HIV.

Kits for HIV testing by PCR proved very difficult to source for the CMCs. In 1999, this sourcing problem meant that the infant HIV testing programme at CAREC was delayed, negatively affecting the HIV mother to child transmission (MTCT) programme for the CMCs.

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Laboratory Information System (LABIS).
The computerised Laboratory Information System (LABIS) was implemented in the first quarter of 1996. The information related to every specimen arriving at CAREC was entered into the system, which used CAREC’s local area network (LAN) to make the information immediately available to internal users in the laboratory.

Bacteriology
During 1995, in addition to the continued provision of reference and referral laboratory service, the Bacteriology Unit initiated the establishment of in-country and sub-regional networks for the surveillance of *N. gonorrhoeae* and *M. tuberculosis* (M.Tb). A total of 1,764 samples and/or isolates were sent to CAREC for reference testing from thirteen CMCs and the Dominican Republic. During the year, 537 isolates were referred to CAREC for *Salmonella* and *Shigella* serotyping and phage typing. Of these, 527 were of human and 11 were of animal origin. Of the 722 specimens received for serological testing for the diagnosis of leptospirosis from 11 CMCs, 96 were confirmed positive (13%) and 72 (10%) were of doubtful diagnostic significance. The positive rates in Suriname and Trinidad were 17% and 12% respectively.

One hundred and ninety three *N. gonorrhoeae* isolates were received from Trinidad and Tobago, Guyana, Cayman Islands, the Bahamas and Antigua and Barbuda for sensitivity testing. A high level of resistance to penicillin and tetracycline was noted in some of these countries. There was a significant level of chromosomally-mediated resistance to penicillin and tetracycline but no recorded resistance to spectinomycin, ceftriaxone and ciprofloxacin. A referral service for the identification and antibiotic susceptibility patterns for *M. tuberculosis* and Mycobacteria other than tuberculosis (MOTT) was established between CAREC and LCDC. A Level 3 laboratory for the diagnosis of M.Tb was established at CAREC for the antibiotic resistance-monitoring programme in the Caribbean. Similar work and outcomes were pursued in 1996 and 1997.

In 1998, the major areas addressed included TB, diarrhoeal disease surveillance (typing of *Salmonella* and *Shigella*) and identification. A cost recovery programme was implemented for the testing of environmental swabs for enteric pathogens.
In 1999, mycobacterial testing at CAREC was enhanced through the incorporation of the BACTEC method. This facilitated greatly improved service to the CMCs in terms of clinical management and public health impact. Problems with shipping of such cultures to overseas referral laboratories had curtailed referral of such samples in previous years.

Another area of major achievement in CAREC laboratories in 1998 was the laboratory division’s provision of essential support to investigations of outbreaks in an increased number of countries and for an increased range of diseases. Those included Dengue (DF) in several CMCs, Tuberculosis, Malaria in a previously malaria-free country, Brucellosis, Cryptosporidiosis, Meningococcal septicaemia and acute haemorrhagic conjunctivitis.

The CAREC submission to CARIFORUM for European Union (EU) funding in support of ‘Strengthening Medical Laboratory Services in the Caribbean’ was also successful in gaining Caribbean Ministerial approval in the amount of US$10 million for funding under the second financial protocol of Lome IV.

Utilisation of Laboratory Testing Services by CMCs
The host country, Trinidad and Tobago, continued to make the most laboratory requests (for a single country). In 1998, there were 6,718 requests (45%) of total requests; Suriname 1738 (12%) was next in order of laboratory requests.

The Parasitology Unit started a new project in 1998 of gathering evidence for the “Certification of the Elimination of Lymphatic filariasis in Trinidad.” Other programmes executed included the finalisation of the measurement of the prevalence of Chagas disease in Suriname, Guyana and Trinidad and Tobago.

The unit also participated in a cost recovery project with the Water and Sewerage Authority (WASA) on testing potable and other waters for the presence of Giardia and Cryptosporidium organisms. The Parasitology unit also participated in a response to the outbreak of malaria in the Bahamas where the entomologist visited and advised on appropriate control strategies. Prompt action brought a cessation of transmission.

Laboratory-related Role of the Public Health Intelligence (PHI) Unit
In addition to the oversight role of the PHI scientists’ laboratory-based activities, the scientists were responsible for the execution of the following issues:

A. Entomologist/Parasitologist:
1. Worked on strengthening links in the anti-dengue effort between CAREC laboratories and CMCs and other Caribbean countries (French- and Spanish-speaking countries).
2. Placed special emphasis on integrated vector management for community-based participation for DF prevention.
3. Conducted surveillance activities for the presence of lymphatic filariasis in Guyana, Suriname and Trinidad and Tobago in association with CDC and MOHs.

In 1998, a major publication emerged on “Spatial distribution on insecticide resistance in Caribbean populations of Ae aegypti and its significance”. In this,
Ae aegypti populations of all CMCs were evaluated for susceptibility to the currently used organophosphorus insecticides. Advice was thus made available to all CMC vector control units about what chemicals would be likely to be ineffective for their integrated vector (Ae. aegypti) control programmes.

B. The Medical Microbiologist, worked on the following:
   1. Invasive bacterial surveillance in the Caribbean (CAR-IBIS)
   2. Mycobacterial infections in the CMCs. He developed policies and procedures for TB programmes and characterised drug-resistance status of TB in the CMCs.
   3. Non-typhoidal Salmonella infections in CMCs.

C. The Virologist participated in:
   1. The sero-epidemiology of herpes simplex Type 1 in association with the London School of Hygiene and Tropical Medicine.
   2. The sero-prevalence of Hepatitis C virus in blood donors in CMCs.

**The Period of Consolidation of Laboratory Transformation (2000-2004)**

**Introduction**

The period 2000-2004 would prove to be one of consolidation and rationalising of the "transformation" process which saw the implementation of the new Customer and Molecular Biology Units. In addition, there was further strengthening of the Laboratory Information System – LABIS (CARISURV), and expansion of the work of the Customer Services Unit which included centralised specimen receipt, laboratory report dissemination to clients, quality assurance activities and support to other laboratory departments in the area of information analysis.

In addition, with the transformation process there was active re-involvement of the PHI unit staff into some aspects of the laboratory operations.

Partnerships – In 2002, in addition to the traditional partnerships that supported the CAREC operations for priority programmes, the CAREC laboratory received additional support to address some of the shortfalls in various aspects of infra-structure required to meet demands. Some of these new partners were: The US CDC, The Walter Reid Army Institute of Research (WRAIR), Health Canada, and the Pan American Institute for Food Protection (INPPAZ/PAHO/WHO).

**Programme on Strengthening of Medical Laboratory Services in the Caribbean**

This 4-year project was developed by CAREC in collaboration with the CMC Ministries of Health and was started in 2002. The project was designed to strengthen medical laboratory services and to accelerate a process that had been initiated by CAREC to support quality improvements in medical and public health laboratories in the CMCs. It was funded by the European Union and was designed to enable CAREC to depend on and expand its technical, advisory, training and advocacy roles in all aspects of medical laboratory quality assurance and laboratory management within the CARIFORUM countries. Past CAREC Laboratory Manager, Ms Valerie Wilson, was appointed Project Manager.

In 2003, the Project activities were focused on:
- The development of standards and a regional accreditation system for regulation of medical laboratories
- The training of senior laboratory staff in laboratory and quality management
- The review of medical laboratory curricula used by Caribbean training institutions
- The establishment of project databases and collection of baseline data
- The development of national plans for laboratory services improvement in participating countries

By 2004, when this project was in its second year, it was able to:
- Finalise an agreement on the standard for medical laboratories in the region
- Produce a guidance document for implementation of the standard and its translation into French, Spanish and Dutch
- Make agreement on details of the regional accreditation mechanism and initiation of the regional cooperation for accreditation of medical laboratories, among other achievements

**Work of the Various Laboratory Units 2000 – 2004**

The work of the laboratory continued to grow in comparison to previous years. For example, in 2000 the number of requests grew to 11,448 from the CMCs with 44% of these coming from the host country.

The Laboratory Information System (LABIS) Unit experienced increased demands for services in the area
of daily information management in the testing process as well as for epidemiological surveillance. By 2000, these requests had outstripped the optimum performance events of the then current database platform. In addition, the Public Health Information Systems (PHLIS), was developed, co-ordinated and implemented collaboratively by the Laboratory and Epidemiology Divisions.

The Virology Unit continued their routine yet critical role of reference and diagnostic services for the CMCs. The CAREC laboratory became involved in supporting the HIV candidate vaccine trials conducted in the region. The laboratory received “high marks” from the US FDA assessment team.

By 2001, the Virology Unit played a major role in providing support to the HIV vaccine trial which began in Trinidad and Tobago during 2001, as well as conducting evaluations of HIV and dengue kits.

CAREC prepared guidelines for West Nile Virus prevention and control in preparedness for the introduction of West Nile diseases in the CMCs. Proposals were also prepared and funding accessed through the US CDC. Training was delivered as part of the annual Virology Course at the School of Medicine, University of Suriname and the annual course on Veterinary Virology given at the University of the West Indies.

In addition, an Action Plan for Laboratory Containment of Wild Polio Viruses in the English-speaking CMCs, French and Dutch territories was developed. This was initiated in 2002.

Two funding proposals were prepared and presented during 2002, for the surveillance of Emerging Infectious Diseases and surveillance of vampire-bat rabies in the Guyanese shield.

The Bacteriology Unit focused on areas of mycobacterial and diarrhoeal disease surveillance (typing of Salmonella and Shigella) in addition to the routine work of diagnosis of organisms. The study of anti-microbial resistance of enteric pathogens was executed in six countries in collaboration with the Canadian Laboratory Centre for Disease Control (LCDC) and PAHO. There was also a study of gonococcal anti-microbial susceptibility. From these studies, information was provided to help guide treatment in CMCs. The Bacteriology Unit continued to function as the major reference centre in the region for mycobacterial identification and susceptibility testing, diarrhoeal disease surveillance and identification of organisms.

Training
In 2002, the bacteriology Unit held two workshops in-country in support of laboratory diagnosis of TB and other opportunistic infections. This resulted in CMC staff being trained and able to report these pathogens in a timely manner. A global Salmonella Surveillance Level 1 workshop was held to support the food-borne disease programme. CAREC serotyped 203 Salmonella isolates in 2002; findings of S. enteritidis (20%), S. typhimurium (18%) and S. Mississippi (10%) accounted for 50% of the total.
The Parasyitology Unit

Significant areas of interest pursued in 2000 included testing of samples from CMCs for toxocarasis, leptospirosis, toxoplasmosis, Chagas disease and malaria – by serological and other means. The Unit continued to function as a reference centre for identification of rare parasitic organisms for CMCs. Continuing the work which began in the previous year, the Parasitology Unit in 2001 and subsequent years executed a survey on the prevalence of Cryptosporidium in surface water in three locations in North Trinidad, as well as in pipe-borne water. This survey was done in association with the Water and Sewerage Authority (WASA) of Trinidad and Tobago.

In 2000 the Entomology Unit initiated a landmark activity for dengue fever (DF) prevention and control in the midst of a major DF epidemic in Trinidad and Tobago. The Entomology Unit partnered with the Kiwanis Service Clubs throughout Trinidad and Tobago, the private sector, the IVCD unit of the MOH, and communities – especially the school child population – for the reduction of Ae aegypti production and thus DF transmission. Financial support from the private sector energy company – Atlantic LNG – was available to help meet the threat of West Nile Virus infection in the country. Biological control of Ae aegypti was also continued. Training CMC laboratory personnel in areas of parasitology and medical entomology in 1994 was a significant contribution of CAREC to the CMCs.

In the vector control area, novel insecticiding strategies were evaluated, showing the efficacy of intra-domiciliary approaches, while the laboratory continued to provide insecticide-resistance testing services for Ae aegypti mosquitoes to CMCs to aid cost-effective pesticide use.

Insecticide-Resistance Studies

A major part of the work of medical entomology continued to be an evaluation of insecticide susceptibility/resistance status in various Caribbean strains of Ae aegypti. The data showed widespread moderate levels of resistance to commonly used insecticides such as temephos and malathion. These studies were funded through the CCH grant made by the Italian government through the PAHO Caribbean programme Coordinator office. Other activities included insecticide-resistance studies indicating that in 2002, insecticide resistance existed in several Caribbean strains of Ae aegypti to pyrethroid insecticides such as permethrin, deltamethrin and others. Interestingly, these insecticides had not been commonly used by Public Health authorities for Ae aegypti management in any Caribbean country. Biological control of Ae aegypti by the use of small predacious copepods was also continued. Training CMC laboratory personnel in areas of parasitology and medical entomology in 1994 was a significant contribution of CAREC to the CMCs.

Preparation for the Threat of West Nile Virus Transmission

To help meet the threat of West Nile Virus infection in the CMCs, a workshop was held for vector control personnel of the CMCs in association with the US CDC.

Other Laboratory-Based Activities in 2003 and 2004

In 2003, laboratory operations continued in much the same vein as in previous years. The laboratory received over 14,000 test requests from CMCs for reference and referral testing. Again, a high proportion of those (62%) originated in the host country.

The various units – Bacteriology, Virology, Parasitology and Entomology – were active in meeting the requests of CMCs. A few items were of special interest:

• The threat of Yellow Fever Transmission: In response to an alert of Yellow Fever epidemic/epizootic in Columbia, Venezuela and Brazil in 2003, the Ministry of Health (MOH) in Trinidad and Tobago conducted Yellow fever surveillance in seven sentinel sites in the country. The activities included surveillance of dead monkeys and the collection of mosquitoes from the sites. CAREC collaborated with the MOH in processing these samples and analysis for Yellow fever virus. The results of the surveillance showed no indication of Yellow fever virus in Trinidad during this period.

• Dengue Fever Type 3 was the prevalent type in 2003 in the CMCs, though Types 1 and 2 were also detected. Of the 675 sera tested at the CAREC laboratory, 215 were found to be positive serologically for dengue.

• Severe Acute Respiratory Syndrome (SARS). In response to the world alarm for risk of SARS transmission, the CAREC laboratory received several specimens for aetiological investigation of atypical pneumonia. No virus was detected in these specimens.
In 2004, work in support of surveillance in CMCs continued as in the past. There were 14,204 requests submitted to CAREC from CMCs, with 62% coming from Trinidad and Tobago. Preparations were made for the accreditation of the CAREC laboratories, an important aspect of which was the continued education of several members of the technical staff, especially those in the area of molecular testing.

The Public Health Intelligence (PHI) Unit (2000 -2004)

In 2000, the Public Health Intelligence (PHI) scientists, in addition to their role as oversight for the respective laboratory units, developed and initiated major programmes for the CMCs. These programmes were run in association with the CAREC Laboratory. The microbiologist coordinated the “Invasive Bacterial Infection Surveillance in the Caribbean (CAR-IBIS)”, which serotyped the distribution of *S. Pneumoniae* isolates from invasive and non-invasive infections; and managed the Antimicrobial Resistance Monitoring programme for the CMCs. The Virologist gave technical support to various CAREC laboratory activities, collaborated with the pilot study on West Nile Disease in the Caribbean, collaborated with National Institutions in Trinidad and Tobago and taught Veterinary Virology at the University of the West Indies. The Entomologist/Parasitologist initiated and managed the integrated programme for the management of Dengue by private and public sectors, community groups for environmental sanitation for *Ae aegypti* control, worked on West Nile Virus surveillance, worked with US CDC and the MOH to characterise the then current levels of lymphatic filariasis (LF) in Guyana; measured LF antibodies in children in all geographical areas of Trinidad and Tobago; managed the water-borne parasite study in Trinidad in collaboration with WASA and CAREC laboratories and produced the CAREC Vector Control Bulletin for the CMCs.

**Climate Change Affecting DF Studies**

CAREC’s entomologist was a co-project leader in the regional project with the University of the West Indies (Mona) on “The Threat of Dengue Fever – Assessment of Impacts of and Adaptation to Climate Change (AIACC) in Human Health in the Caribbean”. This project on AIACC was funded in the sum of $215,000 (managed at UWI, Mona) and started in 2002. Retrospectively, during El Niño years such as 1995 and 1998 it was slightly warmer and there was more rainfall in the CMCs. There was also high DF occurrence during these years.

**Laboratory Funding**

In 2002 was that the laboratory received support of US$100,000 worth of essential equipment, courtesy of the US CDC. However, the International Air Transport Association (IATA) regulations posed continuing challenges to specimen and quality control shipments. By 2002, the annual cost of these shipments had reached $50,000 which severely impacted the CAREC budget.

In 2002, the expansion of the HIV Mother-to-Child-Transmission (MTCT) programme was the focus of the laboratory support efforts. This involved initiatives for provision of anti-retroviral drug treatment for HIV-infected persons in many Caribbean countries. Another laboratory-based focus was that of emerging infectious disease in light of the global response to bioterrorism.

The PHI laboratory units instituted a special programme to enlist and establish partnership with a human behaviour (social science) and communications expert in the fight against dengue fever and its vector. Thus in 2002, all communities in the CMCs were persuaded to become involved in the environmental sanitation fight against *Aedes aegypti*.

**Lymphatic Filariasis**

In 2002, CAREC, in association with the Trinidad and Tobago Ministry of Health, set out to gather data to determine whether LF transmission had been interrupted. A nationwide survey was launched for circulating antigen in 2.597 8-12 year old school children in all administrative regions of the country, including the north-coast village of Blanchisseuse which was previously shown to be an active LF transmission site. The result was that of the 2,597 children examined, not one was found to be positive. The conclusion was that LF transmission in Trinidad and Tobago had been interrupted. In 2003, there were field investigations into the possible occurrence of West Nile virus cases regionally, especially in the Bahamas, and the provision of technical support for Emerging Infectious Diseases (EID).

**Virology**

In collaboration with the Epidemiology Division the laboratory established a network for the surveillance of Emerging Infectious Diseases (EIDs) initially with five CMCs, using multiple surveillance approaches. The first phase of the project was initiated in the Eastern Caribbean countries of Dominica, Grenada, St Lucia, St Vincent and the Grenadines, and St Kitts and Nevis. An integrated surveillance system in the OECS countries was piloted from January to May 2004. The scope of the pilot involved a network of 13 sentinel sites including general hospitals and peripheral health centres in 5 OECS countries: Dominica (2), Grenada (3), St Kitts and Nevis (2), St
Lucia (3), and St Vincent and the Grenadines (3). These represented a population base of about 450,000 people.

Laboratory Safety
In 2003, training was conducted in safety and shipping of specimens according to international guidelines for personnel in CMCs.

The Final Period of the CAREC Laboratory: 2005 and Beyond

2005

Accreditation
An internal review of laboratory functions was initiated and following extensive deliberations it was decided that the laboratory should move towards accreditation. This attempt at accreditation would involve copious documentation for streamlining of laboratory operations. It was decided that a Quality Manager would be identified to lead the process and an application for formal accreditation would be made by the end of 2006.

External Quality Assessment (EQA) - CMC laboratories.
In 2005, CAREC Laboratory provided EQAs for CMC laboratories in the following subject areas:
- Parasitology
- General Bacteriology
- Blood Transfusion laboratory Practice
- Blood Bank Serology
- Syphilis Serology
- Clinical Chemistry

Administration of these EQA programmes achieved the following benefits for CAREC and the enrolled laboratories:
- They provided a snapshot of the laboratories’ performance for the respective discipline
- They allowed for the identification of training issues or requirements for procedural changes
- The CAREC laboratories also participated in EQAs based on their disciplines.

The highlights of the Laboratory for 2005 included:
- The Laboratory’s response to two major outbreaks – RSV in Barbados and Echovirus infection in 30 aseptic cases meningitis in Jamaica. Using rapid methodologies, CAREC was able to give an appropriate response
- The development and incorporation of a new molecular service for Alpha virus, Herpes Simplex virus infections and Mycoplasma
- A thrust to expand and enhance TB testing with the renovation and expansion of the CAREC TB laboratory being completed under the PANCAP project
- After years of efforts, the construction of a modern molecular biology laboratory was initiated

2006

In 2006, the reorganisation and strategic planning for the Laboratory Division was the main focus of activity. After extensive discussions with internal and external stakeholders, the Laboratory Division was reorganised into three areas:
- Classical Diagnostic (Bacteriology, Parasitology and Entomology)
- Modern Diagnostic (Virology, Immunology and Molecular Biology)
- Support services (Quality Management, Customer Service, Information Technology and Operational Support Services)

The purpose of this effort was to strengthen the level of laboratory diagnostic and training services offered to CMCs by cross-training staff within these areas.

Key Areas of Achievement of CAREC laboratories in 2006 included:
- The continued provision of laboratory support for the care and treatment of HIV/AIDS patients in the region. The primary strategy adopted was the decentralisation of testing services. A number of basic tests that should have been performed at the country level were identified and regional workshops were conducted at CAREC to train CMC laboratory personnel in these methodologies. This included CD4 testing (with CAREC providing quality assurance and advocacy).
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The Role of CAREC laboratory in Public Health Surveillance in support of International Cricket World Cup (CWC) in 2007

CWC 2007 was a mass gathering where large numbers of individuals would come together in nine CMCs over a period of 47 days for 51 international matches. This could cause a risk of transmission of ordinary communicable and other exotic diseases. The Public Health laboratories in the nine CMCs and CAREC laboratories prepared for rapid diagnosis of diseases of public health importance, diagnosis of exotic diseases not endemic in the region, upgrading the support to routine surveillance and outbreak investigations. In addition to leadership of this programme, CAREC provided support for confirmatory tests. This resulted in an overall improvement in laboratory support to surveillance activities and outbreak investigations. While no unusual pathogens were identified, during the period, dengue Types 2 and 3 were identified in Guyana, Dengue Type 4 in Grenada, and Dengue Type 3 in Trinidad and Tobago. Additionally, influenza virus A (H3N2) was identified in Dominica. The region’s laboratories were well prepared and equipped to respond to any unusual disease situation that may have occurred during the tournament.

2008

During 2008, the CAREC laboratories continued to fulfill the important role of surveillance of communicable diseases in CMCs as it had done in the previous years. In this regard, the laboratory provided reference and referral services for CMCs, as well as provided training and technology transfer. Staffing was an issue of concern. Due to CAREC’s status in transitioning to CARPHA, recruitment of staff slowed considerably and was in fact “frozen” pending review of the needs of CAREC and approval of a Human Resource plan for congruence with the new organisation. Thus, in the laboratory, there were 12 vacancies out of a total staff...
of 40 (30%). However, despite a reduction of laboratory staff of 25% at the beginning of the year, specimens and requests continued to be referred from CMCs, as the remaining staff was cross-trained to fill the gaps. In 2008, 11,158 specimens and requests were received in the laboratory which marked a decline from previous years. 

External Quality Assessment (EQA) at CAREC laboratory. EQA in the disciplines of Bacteriology, Mycobacteriology, Immunology, Virology, Molecular Biology and Parasitology were received from external expert sources and processed by the appropriate CAREC staff.

Other Laboratory Services
Specimens referred to the classical diagnostic laboratories were processed in Bacteriology, Parasitology and Medical Entomology as in previous years. Of the total 1,939 virological investigations performed in 2008, Dengue Type 2 was found to be the predominant serotype responsible for outbreaks in all CMCs, except for St Kitts and Nevis from where DF Type 4 was isolated.

CD4 Testing
Despite the much heralded transfer of technology of CD4 to CMCs (in particular in Trinidad and Tobago) in 2007, the Ministry of Health (MOH) experienced some difficulty with reagent procurement and with CD4 testing equipment. CAREC assisted in the processing of 884 samples from treatment sites in Trinidad and Tobago. CD4 testing was also done for Dominica (75), Antigua and Barbuda (24) and Montserrat (2).

2009
By 2009, the CAREC Director had declared, that “The laboratory facilities in CAREC are presently suitable for operation requiring Biosafety Level-2 level of containment (only). Two independent expert assessments reported serious problems in design, structure, equipment and practice within the facilities that precluded their characterisation as BSL-3 laboratories according to the BioSafety guidelines of the WHO. Implementing the recommendations resulted in discontinuation of activities such as culture, isolation and characterisation of multi-drug resistant strains of tuberculosis (TB) bacilli as well as the processing of monkey organs for the culture of yellow fever virus and the preparedness to handle avian influenza. This would result in the development and introduction at CAREC of molecular procedures to maintain some level of service to its member countries even in the face of these serious facility limitations...”

Based on the above Director’s statement, certain activities previously pursued at CAREC were terminated. These included work on TB and any activity that required BioSafety level above BSL-2 level of containment. Suffice it to say that this represented a major shift in the productivity of CAREC laboratories.

In 2009, the CAREC laboratory received 10,538 specimens for processing, which represented a five percent (5%) decrease from that of 2008. This reduction was expected as some clinical/diagnostic testing was transferred to CMCs.

Influenza virus testing
As a result of the influenza pandemic, influenza virus testing accounted for one third of the total number of specimens for which reports was produced. In order to build capacity in CMCs, there were workshops and attachments of CMC personnel to CAREC. For example, there were:

- A series of five day workshops in five CMCs to conduct laboratory training in the isolation of food-borne pathogens and stereotyping techniques for Salmonella and Shigella
- There was the continuation of performing HIV viral load and DBS HIV DNA, PCR testing. 1,613 viral load and 27 DBS specimens were tested
- Continued testing for antibiotic resistance in a range of bacterial organisms

2010
By 2010, when there was much discussion on the establishment of the CARPHA, it was decided that the CAREC laboratory would stick to its main role, that is, to support surveillance activities and the strengthening of laboratories in CMCs. However, CAREC would still continue to provide some primary testing services for those CMCs which had limited laboratory testing capacity.

The reassignment of CAREC’s testing activities in 2010 meant that over 90% of tests done related to the category of high public health impact as opposed to 60% in 2008. The laboratory facilities at the Centre were still at the level of BSL-2 containment, but there was on-going discussion concerning the upgrade to BSL-3 through a modular extension or retrofitting a section of the then laboratory. It was intended that when BSL-3 status was achieved, CAREC would be able to restart the services of culture, isolation and characterisation of multi-drug resistant strains of tuberculosis bacilli, as well as the processing of monkey organs for the culture of yellow fever virus and
the handling of haemorrhagic fevers. To help achieve this upgrade, a fact-finding visit was made to CAREC laboratory by the Public Health Agency of Canada.

The technical support of the laboratory to CMCs in outbreak situations in 2010 occurred in 2 main areas:

- The influenza pandemic declared in 2009 and which continued into 2010. The CAREC laboratory continued its support in this area.
- Dengue fever. There was technical support to CMCs during the dengue outbreaks when CAREC received approximately 1,000 requests. The serotypes identified were:
  - Dengue 1 from Bahamas, Dominica, Grenada, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, and Suriname.
  - Dengue 2 from Bahamas, Cayman Islands, Grenada, Jamaica, St Kitts and Nevis, St Lucia, and St Vincent and the Grenadines.
  - Dengue 4 from St Lucia and Suriname.

Food-borne illness
There was the introduction of phage typing for *Salmonella enteritidis*, facilitated with the training of 4 laboratory technologists. *Salmonella* serotyping was conducted at CAREC for Barbados, Jamaica, Trinidad and Tobago, Bermuda, Cayman Islands and Dominica. *Shigella* serotyping was conducted for Jamaica and Trinidad and Tobago.

2011
While the staff complement for the CAREC laboratory was still quite low, diagnostic service for TB surveillance was enhanced by the donation of new equipment from PAHO – the TB Gene Xpert platform. This equipment had recently become available internationally for rapid TB and MDR-TB diagnosis. It could simultaneously detect, in sputum specimens, gene sequences specific for *M. tuberculosis* and its resistance to rifampicin which served as a marker for MDR-TB.

Services requiring Biosafety Level- 3 (BSL-3) containment
In 2011 the laboratory made focused efforts towards the restart of services requiring BSL-3 containment. The proposal for the acquisition and commissioning of a modular BSL-3 laboratory was submitted to the Ministry of Foreign Affairs and International Trade (DFAIT), Canada and a visit was made by a team from DFAIT to CAREC to discuss the emanating issues.

Cholera Preparedness Activities.
The Laboratory conducted cholera preparedness activities by hosting a laboratory workshop – “Improved Preparedness for Cholera and Outbreak of Other Diarrhoeal Diseases” – in March 2011, at CAREC. This workshop was conducted to ensure CMC laboratories had the capacity to perform isolation and identification of *Vibrio* species.

Entomological Services.
Entomological services for the identification of mosquito species and the assessment of the insecticide resistance status of *Ae aegypti* populations from CMCs were once more available at CAREC in 2011. Tests done at CAREC on *Ae aegypti* strains from Trinidad and Tobago and St Vincent and the Grenadines demonstrated resistance to organophosphorous insecticides such as temephos and malathion. Such information could assist CMCs in the integrated control of the dengue vector.

Usage of Laboratory Services
In 2011, 3,341 test requests were received from CMCs. The ten most frequently requested tests for this period were influenza (24%), rash and fever (21%), TB ID/AST (11%), acute flaccid paralysis (10%), *Salmonella* serotyping (10%), leptospirosis (10%), *Salmonella* phage typing (4%), bacteriology ID (4%), antibiotic susceptibility (3%), norovirus (2%) and enterovirus (1%).

Laboratory Capacity Survey
A laboratory capacity survey was conducted in CMCs in April 2011, to determine the status and capacity of the laboratory services of CMCs and to ensure that this was consistent with the revised “surveillance package of services”, and to identify gaps and to prioritise areas for capacity building. This survey aimed to fulfill the 2009 and 2010 recommendation for CAREC arising out of resolutions from the 10th CAREC National Epidemiologists and Laboratory Directors Meeting as well as the 35th CAREC Council Meeting.
Conclusion
Fulfilling its mandate for 38 years

Even at the last available Annual Report statement (CAREC, 2011), the Laboratory Division affirmed that “The Laboratory Division continued to evolve and be relevant to the member countries.” Indeed, there had been the finalisation of the laboratory core functions, changes in the range and types of services provided, as well as changes in management structure as CAREC moved along the path to the new CARPHA. By and large, CAREC Laboratory has lived up to its mission:

“To lead, energise and support Caribbean laboratory staff and stakeholders to provide the highest quality information for clinical care, disease surveillance, health policy formulation and personal safety through a commitment to technological and technical relevance, appropriate research and performance-driven training – recognising the importance of medical laboratory services to Caribbean economies”.

During the opening years (1975-6) and the formative period (1977-82) of the operation of the CAREC laboratories, CAREC in association with the CMC laboratories, had essentially succeeded in defining and characterising the public health challenges that the new organisation would face. Thus by the end of these periods, the laboratories had acquired baseline data on the current risk factors affecting public health in the CMCs. The laboratory was in a good position to energise and to support CMC laboratory staff to provide high quality information for clinical care and disease surveillance.

By the end of the Period of Consolidation (1983 – 87), the majority of CAREC laboratory staff were advancing in technical and scientific expertise and were highly equipped to provide most of the functions required to make a success of the running of a public health laboratory, including the competence to formulate health policy for CAREC in support of CMC laboratories.

The Transition Period (1988 – 1993) saw the largely indigenous staff mature and join in the strategic planning for the future of the organisation. New units such as the Immunology unit were of critical timing to better characterise the fight against the HIV epidemic which was impacting all CMCs and competing with other public health issues for precious and limited resources. The CAREC laboratory was nonetheless able to help identify deficiencies in CMC laboratories and to strengthen them to meet these challenges. Most importantly, CAREC laboratory staff was able to pass on new competences to a new generation both at CAREC and in CMCs. These competences included traditional medical laboratory skills but also those for the strengthening of environmental health issues such as those which affected the fight in integrated vector control – with the addition of biological and insecticidal resistance measurement for appropriate vector management. The regional programme on antibiotic resistance definition was also strategic.

The Transformation Period (1994 – 1999) saw some of the largest structural changes ever in the organisation, when the management of the various laboratories was handed over to a new generation of local staff. This new challenge was met and executed efficiently and the support for CMCs based on the mission statement – was as good as before.

The Consolidation of the Transformation Period (2000-2004) saw the Laboratory strengthening programmes at CAREC and in CMCs – evolve, despite significant challenges both recurring ones and new alarms such as the emergence of West Nile infection, SARS and new influenza challenges. All these with the on-going threat of Dengue fever in the region had to be addressed in CMCs and CAREC laboratories.

The Final Period (2005 – 2012) saw the CAREC laboratory becoming smaller in numbers of staff – leaner and meaner! This period saw the transfer of some technology where appropriate, e.g. CD4 technology, to some CMCs. Yet, the CAREC laboratory remained ready and able to assist should there be need for further support. Indeed, it could be genuinely said that CAREC laboratories remained committed to technological and technical relevance recognising the importance of medical laboratory and public health services to Caribbean economies.

This should be an excellent foundation for the new CARPHA Laboratory.
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During the lifetime of CAREC staff members were called upon to investigate a variety of disease outbreaks, such as the periodic occurrence of yellow fever in Trinidad and pan Caribbean epidemics of dengue fever. Dengue indeed is endemic in CAREC Member Countries (CMCs) even though at one time the Cayman Islands was free of *Aedes aegypti*. Malaria is still present in some CMCs such as Belize, Guyana and Suriname. It is also present in Haiti. Food-borne illnesses were common due to the lack of proper hygienic standards and there were periodic outbreaks in the countries. Some of the outbreaks investigated are highlighted below.

Yellow Fever

Yellow fever was once a scourge in the West Indies and has been documented since the 1600s. The disease, however, has been eradicated from all the Caribbean islands except Trinidad and Tobago where it has remained an enigma. There are two types of yellow fever – urban and jungle. In the urban cycle *Aedes aegypti* is the vector, but in the jungle the virus is maintained between *Haemagogus* sp. mosquitoes and monkeys (*Alouatta seniculus*). Humans become infected when they enter the forest where the virus is active. Monkeys have been long known to be associated with yellow fever. The famed English author, Charles Kingsley noted in his book “At Last: A Christmas in the West Indies” that the death of monkeys in the forest, followed by an outbreak of the disease in humans was a well-known folklore of the local people. Later Balfour noted an outbreak of yellow fever amongst oil drillers in the forests near La Brea where no *Aedes aegypti* was present. Dr Wilbur Downs, the first Director of the Trinidad Regional Virus Laboratory (TRVL), pointed out that these two episodes were the first suggestions that a “jungle yellow fever” existed. The existence of “jungle yellow fever” was proven some 30 years later in Brazil. Dr T H G Aitken, entomologist at the TRVL, suggested the possibility of the existence of a 10-15 year cycle in the upsurge of yellow fever activity in Trinidad (Aitken 1991), if not in humans, certainly in monkeys.

The report of dead Howler monkeys (Fig. 6.1.1) in the Guayaguayare forests of south-eastern Trinidad in November 1978 set alarm bells ringing. A team of staff members of the Veterinary Public Health Unit, Insect Vector Control Division, Forestry Division and CAREC visited the area to determine the veracity of the reports. A dead Howler monkey was found, as well as other evidence to suggest more than one monkey had died.

Mosquito collections were made on this reconnaissance visit – 20 *Haemagogus* were collected from which the yellow fever virus was isolated. The recovery of that isolate marked a frenzy of activities, the first of which was intense surveillance of human febrile cases from hospitals and clinics by staff of the Ministry of Health. This intense surveillance resulted in the discovery of 18 cases which occurred in two phases: eight in the period December 1978 to March 1979, and 10 cases from August to September 1979. Seven of the eighteen died. Seventeen of the 18 had visited the forests and there was no record that they had been vaccinated. Yellow Fever virus was isolated from 14 of the 18 cases.

Meanwhile, there was also surveillance of sick and dying monkeys in the forests of Trinidad by workers of the Forestry Division of the Ministry of Agriculture and the Veterinary Public Health Unit of the Ministry of Health. Subsequent to the Guayaguayare epizootic, sick and dying monkeys were discovered westward to Moruga.
and northwards through Biche to the Northern Range, and then again westward to the Chaguaramas Peninsula of Trinidad. This surveillance resulted in the collection of 32 sick and dead Howler monkeys which were brought to CAREC for processing for virus isolation. Sixteen monkeys yielded yellow fever virus.

It should be noted that species of Cebus monkeys also exist in Trinidad, but yellow fever virus is yet to be isolated from this species. It is not known whether they are affected by the virus.

To determine the species of mosquito involved, captures were done where sick and dying monkeys were discovered. Adult mosquitoes were collected off human bait and in the laboratory, then sorted by species and pooled according to date and location of capture. A total of 19 isolations were made: 17 from Haemagogus janthinomys from six localities; and two from Hg. leucocephalus collected from one locality, Mamoral. The discovery of a case of sylvatic (or jungle) yellow fever resulted in mass immunisation programmes. The Government had declared Trinidad (but not Tobago) an infectious area for yellow fever and the Ministry of Health with CAREC and PAHO ordered sufficient vaccines for its population. In addition, 20,000 doses were ordered to assist the islands of the eastern Caribbean to facilitate travellers wishing to enter Trinidad.

The campaign started with the yellow fever vaccines in stock. Vaccination centres included schools, health centres, government offices and many other designated places. The Government of Colombia had also loaned five pedo-jet injectors to assist in the campaign. The Immunisation Officer at CAREC, Mr Henry Smith gave “crash courses”, to government workers on how to operate the injectors. These trainees were able to vaccinate as many as 500 persons per hour. Following the training they were sent out to centres with high-density populations. All individuals, one year and over, were vaccinated – a total of 868,066 persons. People vaccinated between 1972 and 1978 totalled 178,929 and were deemed to be protected. Thus a total of 1,046,995 people or 94.7% of the population were vaccinated.

The yellow fever cases were of the jungle type. However, those humans that were infected in the jungle came back to live at their homes where Aedes aegypti were known to occur and it was this species that had been responsible for the urban spread of yellow fever in earlier times. Accordingly, the Ministry of Health, Insect Vector Control Division with senior workers, Drs E Laurent, A Le Maître and Mr Dave Chadee, adopted methods to prevent the spread of the virus in urban areas. Adult Ae. aegypti were collected through house searches in areas where suspect cases had occurred and were then forwarded to CAREC for possible isolations of the virus, but none yielded the virus.

Houses bordering the forests where there were cases or suspect cases were treated residually with 55% fenthion (EC) at 1.6gm/m² using Hudson sprayers. In high risk areas, aerosol spraying and ULV spraying applications were done. In the end, no urban case of yellow fever was reported.

One of the consequences of this episode of yellow fever was that the Trinidad and Tobago Government mandated that all children entering primary school must show a certificate of immunisation against yellow fever.

Transovarial Transmission Studies

Why is there periodic epizootic yellow fever activity in the forests of Trinidad? One theory is that it is passed on from generation to generation in mosquitoes, that is, transovarial transmission and when there is a susceptible population in monkeys the mosquitoes infect them. Such studies have already been demonstrated in the laboratory for Aedes aegypti and Haemagogus equinus mosquitoes. However, fieldwork was yet to be done for yellow fever although Drs Hull, Tikasingh, et al., had demonstrated such a possibility for dengue in field collected material. It seemed a good idea to attempt such a study in Trinidad when the yellow fever virus was active.

The attempts at this time were done with adult mosquitoes caught in the field, larvae collected from bamboo pots and reared to adults, as well as eggs and larve collected from ovitraps (Fig.6.2) and reared to adults. A total of 9,368 adult Hg. janthinomys and 5,964 H. leucocephalus were tested but the virus was not recovered.

Fig. 6.1.2. Bottles painted black containing a small amount of water with a wooden paddle about 15 cm long and 2 cm wide called ovitraps, were hung on trees to attract Haemagogus mosquitoes to lay their eggs. The mosquitoes find the moistened paddles attractive areas in which to lay their eggs. Photo: Elisha Tikasingh
During an outbreak, it was also possible to demonstrate the usefulness of a mosquito tissue culture derived from the larvae of *Aedes pseudoscutellaris* (AP-61) in the primary isolation of arboviruses. The traditional method of isolation of arboviruses had been by inoculation of infant mice. The AP-61 cell line was introduced to CAREC by Dr R Varma of the London School of Hygiene and Tropical Medicine. It was shown that the AP-61 cell line was more sensitive than infant mice: 11.7% of 725 specimens of the former and 7.9% of 725 specimens of the latter.

**Yellow Fever in the Inter-epidemic and Inter-epizootic Years**

There are periodic epizootics of the yellow fever virus involving Howler monkeys in Trinidad. The question arises: where does it go in inter-epizootic years? Is there a silent cycle involving other vertebrates? Is the virus transmitted transovarially, i.e. carried from adult infected mosquitoes through its progeny in succeeding generations? To answer some of these questions, CAREC obtained a grant from the International Development Research Centre (Ottawa) for a two-year study. The project was supervised by Barbara Hull and Elisha Tikasingh.

The areas chosen for the study were the areas where the yellow fever virus had been active in the previous year. In this study, 8059 *Haemagogus* sp and 34,300 other species of mosquitoes were processed for virus isolations. The yellow fever virus was isolated on two occasions from *Haemagogus* mosquitoes collected in July 1980, both times from the Chaguaramas area. These isolations were made four months after the last virus activity in the Chaguaramas area. Could these isolates be the result of transovarial transmission of the virus over the dry season or could it be that an infected adult mosquito survived the dry season? Fifteen mammalian species were tested, but no virus was recovered. Likewise, in attempting to demonstrate transovarial transmission of the virus 42,815 larvae and adults were reared from field collected material; again, no virus isolations were made.

**The 1988 – 1989 Epizootic**

And yet another epizootic appeared in Howler monkeys in the Guayaguayare forests in December 1988. It spread westward to Moruga and northwards to Fishing Pond. Through the Government’s Veterinary Public Health Unit, a search for sick and dying monkeys was launched while the Insect Vector Control Division collected *Haemagogus* mosquitoes for possible virus isolation. A total of 36 pools of *Haemagogus janthinomys* were tested and five isolations of yellow fever virus were recovered. In another species of mosquito *Sabethes chloropterus* one isolate was made from eight pools tested. Of seven monkeys tested, two from the Moruga Forest and one from the Fishing Pond Forest were positive. Human surveillance was based upon a case definition of fever with a history of recent forest exposure. In addition, persons with jaundice, vomiting, anorexia and generalised pain were given priority in laboratory investigations. Thirty-six persons were investigated and none yielded the yellow fever virus. The fact that there were no human cases was attributed to the extensive immunisation coverage during the 1978-1979 outbreaks and the continuing vaccination of young children.

Following this episode, there were reports of epizootics in monkeys during in 1998 and October 2008-March 2009 in the Insect Vector Control Division collected *Haemagogus* mosquitoes for possible virus isolation. A total of 36 pools of *Haemagogus janthinomys* were tested and five isolations of yellow fever virus were recovered. In another species of mosquito *Sabethes chloropterus* one isolate was made from eight pools tested. Of seven monkeys tested, two from the Moruga Forest and one from the Fishing Pond Forest were positive. Human surveillance was based upon a case definition of fever with a history of recent forest exposure. In addition, persons with jaundice, vomiting, anorexia and generalised pain were given priority in laboratory investigations. Thirty-six persons were investigated and none yielded the yellow fever virus. The fact that there were no human cases was attributed to the extensive immunisation coverage during the 1978-1979 outbreaks and the continuing vaccination of young children.

**Dengue Fever**

Dengue fever is endemic in the Caribbean. The disease is characterised by sudden onset of fever with severe headaches, retro-orbital pain, and pain in the joints and muscles. Other symptoms include a maculopapular rash, lymph node enlargements and haemorrhagic manifestations. Dengue fever is caused by an arbovirus of the Flavivirus Group. The virus exists in four serological forms: Den-1, Den-2, Den-3 and Den-4 and these are transmitted by infected *Aedes aegypti* mosquitoes which breed around houses in the Caribbean. Humans are believed to be the vertebrate hosts for the virus.

Dengue 2 was the first strain to be isolated in the Western Hemisphere in 1953 by the TRVL, the forerunner of CAREC. Subsequently, the other 3 types were isolated by other laboratories in the Caribbean. Dengue 3 appeared in the Caribbean in 1963 and was isolated in Puerto Rico during an outbreak; other islands were also affected. It is worth noting that Trinidad and Tobago was not affected because the twin island state was free of *Aedes aegypti* at that time, although not certified free by the WHO. In 1977, a Pan-Caribbean epidemic due to Den-1 first appeared in Jamaica. All countries in the Caribbean were affected...
with the exception of the Cayman Islands where the vector mosquito *Aedes aegypti* was eliminated. PAHO/WHO organised and sponsored a meeting of health workers in the countries of the Caribbean which was held in May 1978 in Jamaica to discuss and record various aspects of the epidemic. A report on the proceedings of this conference was subsequently published in 1979 by PAHO as “Dengue in the Caribbean” (PAHO Scientific Publication No. 375).

Following the 1977-78 Pan Caribbean epidemic of dengue, there have been periodic outbreaks of the disease in the countries as shown in Table 6.1.

### Table 6.1. Outbreaks of dengue fever including types (where known) and number of cases in the Caribbean.

<table>
<thead>
<tr>
<th>Date</th>
<th>Countries</th>
<th>Types (when known) and Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977 – 1978</td>
<td>Pan Caribbean</td>
<td>Den-1</td>
</tr>
<tr>
<td>1981</td>
<td>Pan Caribbean</td>
<td>Den 4 noted for the first time</td>
</tr>
<tr>
<td>1982</td>
<td>Antigua</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Barbados</td>
<td>54 cases</td>
</tr>
<tr>
<td></td>
<td>Belize</td>
<td>473 cases</td>
</tr>
<tr>
<td></td>
<td>Jamaica</td>
<td></td>
</tr>
<tr>
<td></td>
<td>St Lucia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suriname</td>
<td>25 cases</td>
</tr>
<tr>
<td></td>
<td>Trinidad and Tobago</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>Antigua and Barbuda</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>Trinidad and Tobago</td>
<td>2 and 4</td>
</tr>
<tr>
<td>1985</td>
<td>Puerto Rico</td>
<td>1, 2 and 4</td>
</tr>
</tbody>
</table>
Table 6.1. Outbreaks of dengue fever including types (where known) and number of cases in the Caribbean. (continued)

<table>
<thead>
<tr>
<th>Date</th>
<th>Countries</th>
<th>Types (when known) and Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>1855 cases with 56 DHF in 24 CMCs.</td>
<td>1, 2 and 4</td>
</tr>
<tr>
<td>1996</td>
<td>Trinidad and Tobago</td>
<td>3,983 cases. 1 predominated</td>
</tr>
<tr>
<td>1997</td>
<td>Trinidad and Tobago</td>
<td>1, 2 and 4. There were 13 confirmed DHF/DSS with 2 deaths</td>
</tr>
<tr>
<td></td>
<td>Jamaica</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>St Vincent, Barbados</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Belize</td>
<td>3</td>
</tr>
<tr>
<td>2000</td>
<td>Suriname</td>
<td>In November 1999, the hospital Nickerie on the west coast reported an increase of compatible dengue cases from 8 per 1,000 to 50 per 1,000 in December 2000.</td>
</tr>
<tr>
<td>2001</td>
<td>Belize</td>
<td>Type 3 for the first time since 1997.</td>
</tr>
<tr>
<td></td>
<td>13 CMCs</td>
<td>4,999 cases of dengue of which 106 cases were DHF/DSS.</td>
</tr>
<tr>
<td>2002</td>
<td>Barbados, Guyana, St Vincent and the Grenadines, Suriname and Trinidad and Tobago.</td>
<td>8231 cases, 97.2% occurred in countries listed in Column 2. There were 303 DHF/DSS cases.</td>
</tr>
<tr>
<td>2003</td>
<td>Ninety one per cent of the cases occurred in Barbados, Suriname, and Trinidad and Tobago.</td>
<td>Trinidad/Tobago alone had 2464 cases.</td>
</tr>
<tr>
<td>2005</td>
<td>There was an outbreak of dengue fever in Suriname with 2853 cases</td>
<td>Mainly of 2 and 3</td>
</tr>
<tr>
<td></td>
<td>Belize reported 380 cases</td>
<td>Mainly of 1, but also of 2 and 3</td>
</tr>
<tr>
<td></td>
<td>St Lucia</td>
<td>4</td>
</tr>
</tbody>
</table>

Date | Countries | Types (when known) and Cases |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>The 2006 figure could not be compared with data of other years because there was no distinction between ‘suspected’ and ‘confirmed’ cases.</td>
<td>2 and 4</td>
</tr>
<tr>
<td>2007</td>
<td>Guyana</td>
<td>Grenada</td>
</tr>
<tr>
<td></td>
<td>Trinidad</td>
<td>3</td>
</tr>
<tr>
<td>2008</td>
<td>Most CMCs</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>St Kitts-Nevis</td>
<td>4</td>
</tr>
<tr>
<td>2009</td>
<td>Aruba, Belize</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Bahamas, Dominica, Grenada, St Kitts and Nevis St Lucia, St Vincent and the Grenadines, Suriname</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bahamas, Cayman Islands, Grenada, Jamaica St Kitts and Nevis, St Lucia, and St Vincent</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>St Lucia and Suriname</td>
<td>4</td>
</tr>
<tr>
<td>2011</td>
<td>Suriname</td>
<td>2 and 4</td>
</tr>
<tr>
<td>2012</td>
<td>Barbados, Jamaica</td>
<td>1</td>
</tr>
</tbody>
</table>
There are no vaccines for dengue fever so that control efforts were directed to the control of the mosquito. The habitat of this species of mosquito is peri-domestic and it breeds in clean water so that any water holding container around one’s house is a potential breeding site. Since there is an inadequate pipe borne, potable water supply in many CMCs, people resort to storing water in barrels, drums, cisterns, tanks and nearly anything that can hold water (Fig. 6.2.1.)

Malaria

Malaria has been eradicated from the Caribbean, except for Haiti. However, it is still present in CMCs on the mainland – Belize, Guyana and Suriname. In March 1978, CAREC received blood films from two persons in Grenada suspected of having malaria. One had been ill for months. The two blood films showed the presence of \textit{Plasmodium malariae} parasites. Since neither of the individuals had ever left the island, there was a suspicion that there might have been a resumption of malaria transmission in the area of their residence. The Ministry of Health of Grenada, with the assistance from CAREC conducted mass thick blood films surveys at Westerhall (Fig. 6.3.1), the focus of the first two cases, and other places where it was possible for transmission to occur. Of the 362 blood films examined, 67 were positive for \textit{P. malariae}. In addition to the blood films, capillary blood on absorbent paper was collected for testing by the indirect fluorescent antibody test (IFAT), by Dr C C Draper at the London School of Hygiene and Tropical Medicine. Dr Draper found 30 more cases using the IFAT. He subsequently introduced the test to the CAREC Parasitology laboratory. The outbreak was controlled using a combination of chloroquine and primaquine to treat persons with positive blood films.

Towards the end of 1981, two cases of malaria (\textit{Plasmodium falciparum}) were detected in the Bahamas, a country considered by WHO as “Never malarious or malaria eradicated without specific attack measure.” The two persons with malaria had never travelled outside of the Bahamas and local transmission was suspected. CAREC was asked to assist the government and house-to-house surveys were conducted taking blood smears from people about one half-mile radius from each of the two cases. From New Providence Island, blood smears were made from 1,158 persons with six persons being positive for \textit{P. falciparum}. During this survey, blood spots on filter paper for IFAT serology were done and 36 of these were per positive with high titres. On Grand Bahama, there were two positives by microscopy and an additional four by serology from 92 fever cases. Control measures consisted of radical treatment of positive cases and residual spraying with one 1% Baytex 4 and two cycles of fogging with 90% malathion. Another small outbreak occurred in February 1998. The initial cases were fatal and were classified as imported. Subsequent screening surveys utilising thick and thin blood films for microscopy, as well as blood spots for IFAT, identified four additional cases, which were classified as indigenous.

Typhoid Fever

Typhoid fever is a systemic bacterial disease caused by the bacillus \textit{Salmonella typhi} and transmitted by food and water. It is characterised by fever, which may be insidious, and sometimes sustained headaches, anorexia, malaise,
constipation or diarrhoea and cough. Typhoid fever occurs worldwide and it is endemic in some countries in the Caribbean. While typhoid is generally under control in CMCs, epidemics occur from time to time and CAREC’s staff has usually been asked to help in investigating these epidemics. The first of these was at Coulibistrie and Woodford Hill in Dominica and at Niagara, Jamaica in 1979. By 1984, 11 of 19 countries were reporting increased numbers of cases. However, most of these were investigated and brought under control by local workers. In 1986, increased cases were noted for Jamaica and St Lucia. In the former, a smouldering epidemic increased after heavy flooding. Again, in 1990, Jamaica experienced a large epidemic which occurred in two waves: 26 cases and three deaths in July - August and 158 cases and four deaths in September - October at Westmoreland. Problems in this area include inadequate water supplies and faecal disposal systems, a high water table and many poorly controlled food vendors. A CAREC epidemiologist, at the Jamaica Government’s request, visited the area and conducted case control studies. There was positive and significant association with the use of the rivers/canals, buying vegetables at the market, and eating ice/ice cream cake from vendors.

Where there was the occasional report or epidemic in some of the countries, these were investigated and brought under control by local staff. A good example of where local staff investigated an outbreak of typhoid fever entirely by themselves occurred in St Lucia in 2003. The national epidemiologist and team investigated an outbreak in Babonneau where 100 people attended a party of which 60 attendees were traced and investigated. Salmonella typhi was isolated from eight persons. Two of the eight persons from whom S. typhi was isolated were the cooks for the party and it was noted that on the day of the party there was an intermittent water supply.

Food-borne Illnesses and Gastroenteritis

Very early in the life of CAREC, staff were called upon to assist with outbreaks of food-borne and water-borne illnesses as well as acute gastroenteritis. In 1976, for example, CAREC investigated an outbreak of gastroenteritis in a rural county of Trinidad and another outbreak in 1977 also in Trinidad caused by the organism, Salmonella arechevalata. Later, in 1979, the Principal Medical Officer of Health (Epidemiology) in Trinidad when stationed at CAREC on an attachment, along with other CAREC staff, investigated an outbreak of Salmonella typhimurium, among paediatric patients in a Port of Spain hospital. There have been subsequent outbreaks of food-borne and water-borne illnesses in the Caribbean, some of which were as follows:

1981 - CAREC was asked to investigate an outbreak of gastroenteritis in a large hotel where 40 per cent of the guests fell ill. Investigations revealed that a cross-connection between the potable water system and a sewage recycling water system intended for garden irrigation and the flushing of toilets was the cause of the problem. Subsequently, CAREC was asked to undertake an independent assessment of food processing operations associated with a previous report of food-borne illness.

1983 - There was a food-borne outbreak of Salmonella typhi in Grenada, but this was investigated by Grenadian staff members.

1984 - An outbreak of Campylobacter jejuni in another large hotel in the Caribbean among two groups of tourists who had stayed at the hotel in consecutive weeks. CAREC investigated this outbreak and found that there were serious defects in a chicken-processing plant where the chilling of carcasses provided multiple opportunities for cross-contamination.

An outbreak of cryptosporidiosis occurred in another country involving 80 tourists who had developed diarrhoea on returning to the USA.

1997 - The Medical Officer of Health in Antigua and Barbuda reported to CAREC an outbreak of gastroenteritis due to rotavirus in which 4,000 persons were affected.

1998 - An outbreak of viral gastroenteritis involving 400 persons in a hotel. It was found that the hotel’s drinking water was contaminated with sewage. Norwalk-like virus was identified as the causative agent.

2001 - In Trinidad, an outbreak due to Salmonella enteritidis where more than 100 persons became ill after eating dessert (called Tiramisu) made with raw eggs.

Also in the Turks and Caicos Islands, 78 persons from Canada, USA and the United Kingdom became ill while staying in a hotel. Shigella sonnei was isolated from 15 persons.

In another hotel, one guest, on her return to her home, E. coli 0157:H7 was isolated. In Tobago, two hotels had 72 cases of gastroenteritis. Investigations started late so no pathogens were isolated.
Table 6.2. Summary of the larger outbreaks of food-borne illnesses in the Caribbean.

<table>
<thead>
<tr>
<th>Date</th>
<th>Food-borne illness</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>Staphylococcus</td>
<td>Trinidad</td>
</tr>
<tr>
<td>1984</td>
<td>Campylobacter</td>
<td>Montserrat</td>
</tr>
<tr>
<td>1987</td>
<td>Campylobacter</td>
<td>Barbados</td>
</tr>
<tr>
<td>1987</td>
<td>Gastroenteritis</td>
<td>Bermuda</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St Vincent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St Lucia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bahamas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barbados</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trinidad and Tobago</td>
</tr>
<tr>
<td>1988</td>
<td>Food poisoning</td>
<td>Jamaica</td>
</tr>
<tr>
<td>1991</td>
<td>Food poisoning</td>
<td>Bahamas</td>
</tr>
<tr>
<td>1992</td>
<td>Gastroenteritis (Rotavirus)</td>
<td>Anguilla</td>
</tr>
<tr>
<td>1992</td>
<td>Gastroenteritis</td>
<td>Grenada</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jamaica</td>
</tr>
<tr>
<td></td>
<td>Salmonella</td>
<td>Cruise Ship</td>
</tr>
<tr>
<td></td>
<td>Shigellosis</td>
<td>Cruise Ship</td>
</tr>
<tr>
<td>1997</td>
<td>Gastroenteritis (Rotavirus)</td>
<td>Antigua and Barbuda</td>
</tr>
<tr>
<td>1998</td>
<td>Gastroenteritis (Rotavirus)</td>
<td>Bermuda</td>
</tr>
<tr>
<td>2000</td>
<td>Salmonella enteritidis</td>
<td>Jamaica</td>
</tr>
<tr>
<td>2000</td>
<td>Gastroenteritis (Norwalk virus)</td>
<td>Bermuda</td>
</tr>
<tr>
<td></td>
<td>Food-borne illness (Salmonella oranienburg)</td>
<td>Tobago</td>
</tr>
<tr>
<td>2001</td>
<td>Salmonella enteritidis</td>
<td>Trinidad and Tobago</td>
</tr>
<tr>
<td>2001</td>
<td>Salmonella enteritidis</td>
<td>Jamaica</td>
</tr>
<tr>
<td>2002</td>
<td>Gastroenteritis</td>
<td>Cruise Ship</td>
</tr>
<tr>
<td></td>
<td>Food-borne illness</td>
<td>Turks and Caicos</td>
</tr>
<tr>
<td>2003</td>
<td>Gastroenteritis</td>
<td>Cruise Ship</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jamaica</td>
</tr>
<tr>
<td>2004</td>
<td>Shigellosis</td>
<td>Tobago</td>
</tr>
<tr>
<td>2005</td>
<td>Gastroenteritis (Enterobacter)</td>
<td>Turks and Caicos</td>
</tr>
<tr>
<td></td>
<td>Salmonella oranienburg</td>
<td>Aruba</td>
</tr>
<tr>
<td></td>
<td>Norwalk-like</td>
<td>Turks and Caicos</td>
</tr>
<tr>
<td></td>
<td>Campylobacter</td>
<td>Bahamas</td>
</tr>
<tr>
<td></td>
<td>Salmonella enteritidis</td>
<td>Jamaica</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St Vincent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grenada</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dominica</td>
</tr>
<tr>
<td>2005</td>
<td>Gastroenteritis</td>
<td>Bermuda</td>
</tr>
<tr>
<td></td>
<td>Gastroenteritis</td>
<td>British Virgin Is.</td>
</tr>
<tr>
<td></td>
<td>Gastroenteritis (Salmonella group D)</td>
<td>Jamaica (Dec.)</td>
</tr>
<tr>
<td></td>
<td>Gastroenteritis</td>
<td>St Vincent and the Grenadines</td>
</tr>
<tr>
<td>2006</td>
<td>Gastroenteritis</td>
<td>Anguilla</td>
</tr>
<tr>
<td></td>
<td>Gastroenteritis (aetiology undetermined)</td>
<td>Dominica</td>
</tr>
<tr>
<td></td>
<td>Enterococcal infection</td>
<td>Bahamas</td>
</tr>
</tbody>
</table>
Other Epidemics Investigated

Apart from the foregoing epidemics, CAREC was called upon to investigate a wide variety of disease outbreaks some of which included non-communicable diseases. Indeed, one such episode occurred when CAREC was one year old and it was asked to investigate an insecticide poisoning episode in Jamaica. This occurred in January 1976 when 79 persons were acutely poisoned by the organophosphate insecticide parathion. There were 17 deaths. Dr P Diggory investigated this episode and followed the trail to a Western European port where insecticides and foodstuffs were stored in the same building and where the contamination most likely occurred.

The following Table 6.3 shows some of the types of epidemics investigated and countries involved.

Table 6.2. Summary of the larger outbreaks of food-borne illnesses in the Caribbean. (continued)

<table>
<thead>
<tr>
<th>Date</th>
<th>Food-borne Illness</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Salmonella enteritidis, S. Rubislaw, S. Welteveren, Shigella sonnei; Norovirus</td>
<td>Barbados, Bahamas, St Lucia, Jamaica, Suriname, Trinidad and Tobago and Turks and Caicos Islands</td>
</tr>
<tr>
<td>2008</td>
<td>Norovirus</td>
<td>Barbados, St Lucia</td>
</tr>
<tr>
<td>2010</td>
<td>Norovirus</td>
<td>Dominica</td>
</tr>
<tr>
<td>2011</td>
<td>Ciguatera, Shigella dysenteriae, Shigella sonnei, Salmonella Group D</td>
<td>Jamaica</td>
</tr>
<tr>
<td>2012</td>
<td>Norovirus</td>
<td>Barbados, Bermuda, Turks and Caicos Islands</td>
</tr>
</tbody>
</table>

Table 6.3. Other epidemics investigated by CAREC’s staff

<table>
<thead>
<tr>
<th>Date</th>
<th>Epidemics investigated</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>Parathion poisoning</td>
<td>Jamaica</td>
</tr>
<tr>
<td>1978</td>
<td>Tetanus</td>
<td>Trinidad and Tobago</td>
</tr>
<tr>
<td>1978</td>
<td>Diphtheria</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>Measles</td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>Start of HIV/AIDS programme</td>
<td>Antigua Barbuda</td>
</tr>
<tr>
<td>1987</td>
<td>Jaundice</td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td>Thallium intoxication (false positive)</td>
<td>Guyana</td>
</tr>
<tr>
<td>1987</td>
<td>Scabies</td>
<td>Trinidad</td>
</tr>
<tr>
<td>1987</td>
<td>Rabies</td>
<td>Belize</td>
</tr>
<tr>
<td>1988</td>
<td>Hepatitis A</td>
<td>Trinidad</td>
</tr>
<tr>
<td>1988</td>
<td>Influenza</td>
<td>St Vincent</td>
</tr>
<tr>
<td>1988</td>
<td>Scabies</td>
<td>Trinidad</td>
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<td>1990</td>
<td>Measles</td>
<td>British Virgin Islands</td>
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<td>1990</td>
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<td>Jamaica</td>
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<td>1990</td>
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<td>Tobago</td>
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<tr>
<td>1991</td>
<td>Pertussis</td>
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<td>1992</td>
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<td>Belize</td>
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<tr>
<td>1992</td>
<td></td>
<td>Guyana</td>
</tr>
<tr>
<td>1993</td>
<td>Hepatitis A</td>
<td>Turks and Caicos</td>
</tr>
<tr>
<td>1996</td>
<td>Legionnaire’s disease</td>
<td>Antigua</td>
</tr>
<tr>
<td>1996</td>
<td>Acute Renal failure</td>
<td>Haiti</td>
</tr>
<tr>
<td>1998</td>
<td>Nosocomial septicemia</td>
<td>Dominica</td>
</tr>
<tr>
<td>2000</td>
<td>Eosinophilia meningitis</td>
<td>Jamaica</td>
</tr>
<tr>
<td>2000</td>
<td>Klebsiella pneumoniae</td>
<td>Guyana</td>
</tr>
<tr>
<td>2000</td>
<td>Legionellosis</td>
<td>Barbados</td>
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</table>
In investigating all outbreaks CAREC used the opportunities presented to assist local staff in developing surveillance and investigation capabilities and thus helped to build local capacity in outbreak investigation. Over the years, staff of CMCs were able to do their own outbreak investigation, depending only on telephone consultations with CAREC when necessary. In some instances CAREC also assisted with providing supplies needed for the investigations.
RESEARCH PROJECTS

Research work at CAREC was quite varied and was mainly determined by the interests and competence of its staff. The Caribbean countries presented unique opportunities for field and ecologic studies. The results of numerous and varied research topics were published in peer-reviewed journals. The lead story in this section is the St James Cardiovascular survey in St James, Trinidad, conducted by Doctors George Miller, Gloria Beckles and Neville Byam. Other research projects included a study on rabies in Grenada where mongooses were transmitting the rabies virus to humans and animals; filariasis in Trinidad; leptospirosis in Trinidad and Barbados; the role of the rotavirus in causing gastroenteritis in children; a study in infantile gastroenteritis in Guyana, St Vincent, and Trinidad and Tobago; the development of tissue cultures using toad cells and mosquito tissues; and biological control of mosquitoes and streptococcal disease. All the research projects were supported by external funding. Summaries of some of these projects follow.

7.1 The St James Cardiovascular Study: Achievements and Legacy.
by Gloria L A Beckles

Background
The St James Cardiovascular Survey was a prospective cohort study conducted in Trinidad between 1977 and 1986. When the study was initiated, the population of Trinidad and Tobago was approximately one million, young (35% were aged <15 years), and most people were of African or Asian Indian (hereafter ‘Indian’) descent. The previous two decades were associated with rapid economic change, improved standards of living and increasing life expectancy. By the late 1960s, the population was well into the epidemiologic transition, as evidenced by a change in the pattern of mortality from childhood and communicable diseases to the emergence of cardiovascular disease (heart disease, stroke) and diabetes mellitus as principal causes of death. Additionally, clinical and population surveys had suggested the importance of heart disease and diabetes mellitus for the Trinidad population, notably, that both conditions were more common among Indians than adults of other ethnic origins.

Meanwhile, epidemiologic studies in technologically advanced countries had established high cholesterol, high blood pressure, diabetes and cigarette smoking as major risk factors for coronary heart disease (CHD) and that these factors were associated with low levels of high density lipoprotein (HDL). In 1975, Dr G J Miller, et al. proposed that low plasma concentration of HDL was strongly predictive of the development of CHD. Shortly after publication of this ground-breaking research, Dr Miller was assigned as a member of the UK Medical Research Council (MRC) scientific staff at CAREC. His task was to lead a prospective study to determine whether the inverse association between HDL cholesterol and risk of CHD observed among adults of European descent was also present among adults of non-European origin. This study, hereafter the St James Survey, was supported by the Government of Trinidad and Tobago, the MRC, and PAHO/WHO.

Baseline study
The study was conducted in a defined geographic area of the city of Port of Spain, consisting of the suburb of St James and part of Woodbrook (Figure 1). Survey staff conducted a household census and identified 2,598 adult residents aged 35-69 years. Baseline data were collected during an early morning home visit and a clinical examination at the survey office based at CAREC/PAHO. Of the 2,491 available for baseline examination, 89% completed both parts of the baseline examination. (Table 7.1.1).

Using a standard questionnaire respondents were asked about demographic and socio-economic characteristics, medical history, including pain of angina pectoris or possible myocardial infarction, hypertension, diabetes mellitus, current medications, and cigarette and alcohol consumption. Blood pressure was measured and fasting blood samples were collected for assay of lipid-lipoprotein and glucose concentrations. During the clinical examination, blood pressure and anthropometry were measured, and a resting electrocardiogram was performed. Ethnic origin was based on self-reported origins of three or more grandparents (African, Indian, European, Chinese, Syrian/Lebanese); otherwise, respondents were classified as ‘Mixed’. Blood pressure readings were averaged to estimate the prevalence of hypertension. Lipid lipoprotein fractions were separated and stored at CAREC for later shipment and analysis at St Thomas’ Hospital, London, UK. The fasting blood glucose assays were performed at the Government Nutrition Laboratories, Trinidad.

Follow-up study, 1977-1986
Baseline respondents were contacted annually to ascertain vital status and current health status, including history suggestive of CHD. All survivors were recalled for repeat clinical examination at the 5-year anniversary follow-up visit. Blood pressure, fasting blood glucose, weight, and resting electrocardiogram were repeated using the same techniques as at baseline. Deaths and morbid events were traced through interviews with family and medical practitioners, obituaries, hospital records (clinical, laboratory, post-mortem), and death registries. Incident coronary events were identified by independent review of all documentation by two physicians.

Outcomes
Coronary Heart Disease
At Baseline. Among men, Indian men were 3-4 times more likely than African/other men to have evidence of CHD at baseline, even at ages younger than 55 years.

At Follow-up. As expected, incidence of fatal and nonfatal CHD was higher in men than women; however, Indians of both sexes had a 2- to 5-fold higher risk of developing CHD than their compatriots of other ethnicities (Fig. 3). Regardless of age and sex, the risk of death from cardiovascular disease for Indians and Europeans was more than twice that for Africans (Fig. 4).
Risk factors for Coronary Heart Disease

Diabetes mellitus (WHO criteria, 1980).
At baseline, Indian men (20%) were 2-3 times more likely to have diabetes mellitus than men of African (8.1%), Mixed (7.8%), or European (4.3%) origins (Fig. 5). Respective estimates for women were 23%, 17%, 8%, 11%. The risk of developing diabetes was also higher in Indians than other ethnic groups, with men showing a 2-fold higher incidence rate (Fig. 6).

Dyslipidemia. Figs. 7 and 8 show that lipid levels predictive of CHD were common in men and women of all ethnic groups in the study population. Although low levels of HDL cholesterol were more common among men than women, Indians of both sexes were more likely than other ethnic groups to have low HDL cholesterol.

Hypertension (WHO criteria, 1978). Prevalence of hypertension was high in all subgroups of the study population. Among men, age-adjusted prevalence of hypertension ranged from 33 % among Africans to 24% among Europeans; among women, prevalence ranged from about 28% among African to 26% among Mixed, respectively. (Fig. 9). During follow-up period, hypertension developed at a higher rate in men than women in all ethnic groups (Fig. 10). There was no statistical difference between the ethnic groups in the prevalence or incidence of hypertension in either sex.

Cigarette smoking. About 2 out of 5 men were current cigarette smokers, with heavy smoking (≥20 /day) more common among Indians (23%) and Europeans (27%) than Africans and Mixed men (17%) (Figure 11). Both current and heavy smoking were very infrequent among women.
Association of Risk Factors with CHD
Regardless of age and ethnic group, diabetes, systolic blood pressure, LDL cholesterol concentration, low HDL cholesterol concentration and abstinence from alcohol were significant independent predictors of the risk of developing CHD in men.

The follow-up study also provided evidence of increasing secular trends in fasting blood glucose, body mass index, excess incidence of diabetes among Indians; and low cardiorespiratory fitness was a risk factor CVD mortality and morbidity in men.

So, what did the St James Survey add?
1. The St James Survey confirmed earlier clinical reports from Trinidad that CHD and diabetes mellitus were more common among Indians than adults of African or other ethnic origin.
2. The St James Survey also provided support for the HDL hypothesis by demonstrating that the inverse association between HDL cholesterol and increased risk of CHD observed in industrialised countries was also present among non-Europeans in a developing country, such as Trinidad.
3. The survey further provided population-based evidence that established risk factors for CHD were common in all subgroups of the study population, with Indian men at especially high risk due to dyslipidemia and heavy cigarette smoking. Unlike reports from elsewhere, no ethnic differences in hypertension were observed in either sex.

7.2 Rabies
Human deaths due to the rabies virus are not common in CARICOM Member Countries (CMCs). There was, however, a serious epidemic of this virus in the 1920s and early 1930s when 84 humans died of rabies in Trinidad. It was during this outbreak it was determined that the vampire bat, Desmodus rotundus was the vector in transmitting the virus. In 1960, three Amerindian boys in Guyana died from rabies which was confirmed by virus isolations at the TRVL. The boys had a history of being bitten by bats. Then in 1963, a boy in Grenada died having been bitten by a rabid dog. Apart from vampire bats the rabies virus does exist in domestic animals such as cattle in Trinidad and in wild animals in Grenada, such as the mongoose. In Grenada, the rabid mongoose becomes very aggressive, attacking domestic animals and even humans.

Mongoose rabies had become such a serious problem that the Grenada Government, with assistance from PAHO in 1955-56, started a control programme by systematically poisoning the mongoose. By 1967, however, it was clear this programme was not working. Apparently, a control programme was started without having some basic knowledge of the biology, behaviour, home range and movement, and population structure of mongooses in Grenada. In 1968, C. O. R Everard, a mammalogist with the MRC was transferred to the TRVL to work in the arbovirus programme, which at this time was being reduced. It was suggested to Mr Everard that the mongoose-rabies problem in Grenada needed attention. He applied to the MRC for, and received, a grant to conduct research on the mongoose-rabies problem in Grenada. This grant provided funds for the payment of technicians, materials and the maintenance of a laboratory in Grenada.
Prior to this work in Grenada, suspect rabies cases were sent to the TRVL for study. Subsequently, however, a technician from Grenada came to TRVL to be trained in the fluorescent-antibody (FA) technique for the diagnosis of rabies. In 1968, PAHO provided a FA microscope to Grenada for the study of rabies so that all subsequent work was done in Grenada. Thus, when the project started, there was a trained technician to collaborate with CAREC in the study of the mongoose and rabies.

The mongoose-rabies project lasted ten years, from 1968 to 1977 and spanned two administrations – TRVL and CAREC. Not only was the rabies problem studied, but also the biology of the mongoose. There was collaboration with David Nellis of the Division of Fish and Wildlife Service of the US Virgin Islands in writing a comprehensive 162 page monograph on “The Biology of the Mongoose in the Caribbean.”

A surveillance programme of rabies in wildlife was maintained for ten years with the trapping of mongooses at weekly intervals for at least 45 weeks in the year and examining them for rabies using the FA technique. In this programme, 11,917 mongooses were trapped, of which, 156 (1.3%) were positive for rabies. A total of 385 rabid mongooses were found attacking other animals which were subsequently killed and found positive for rabies. Other animals found positive for rabies included dogs, cats, bovine animals, goat, sheep, pigs and equines.

As a measure of control, mongooses were trapped and destroyed, and dogs and cats were vaccinated. Humans, when exposed to the rabies virus by bites or scratches from animals were given anti-rabies treatments. In the ten-year period, 208 persons were given such treatments. By the end of the programme local staff were well-trained to continue with the poisoning of the mongoose and other aspects of the programme.

### 7.3 Filariasis in Trinidad

Towards the end of 1974, Professor George S Nelson of the London School of Hygiene and Tropical Medicine visited Trinidad to study the filarial parasite *Mansonella ozzardi* which was known to be present on the north coast of Trinidad. With assistance from the Insect Vector Control Division of the Ministry of Health, and Dr John B Davies, an entomologist employed by the MRC and stationed at the Trinidad Regional Virus Laboratory (TRVL), a prevalence survey was conducted in four villages on the north coast. Thick blood smears were taken from residents in these villages and studied at the TRVL. Of 1,203 persons examined, 16% were positive for *M. ozzardi* larvae, higher prevalence than anticipated.

In order to determine what species of insects was transmitting the parasite, collections of two species of sand flies, *Culicoides phlebotomus* and *Leptoconops bequaerti*, as well as black flies *Simulium metallicum* and *S. incrustatum* were allowed to feed on volunteers harbouring *M. ozzardi*. Infective 3rd stage larvae were recovered from *C. phlebotomus* only.

A totally unexpected discovery during this project was the presence of *Wuchereria bancrofti* in 19 of 595 blood smears which were supposedly taken during the day. This filarial worm was not thought to be present in Trinidad.
RESEARCH PROJECTS (continued)

These findings were of a preliminary nature by Professor Nelson and Dr Davies. Later, in 1976 Dr Michael B Nathan, a UK MRC entomologist, arrived at CAREC and, working with Dr Elisha Tikasingh, continued the studies with a grant from the MRC. A nurse, Sherlyn Monteil, was hired along with technician Joseph Ou Hing Wan and other supporting staff to carry out this project. The Ministry of Health of the Government of Trinidad and Tobago through its Insect Vector Control Division also participated in the study. The first objective was to determine the extent of the problem in the villages of the north coast of Trinidad. The original four villages of Maracas, Las Cuevas, La Fillette and Blanchisseuse studied by Professor Nelson and Dr Davies were re-studied, as well as six other villages along the north-eastern coast. A total of 4,486 persons were examined which represented 45% of the total population in these villages according to the 1970 Government census. Prevalence rates for Mansonia ozzardi varied between 0.0% at Cumana, Sans Souci and Monte Video in the northeast, to 23.0% at Blanchisseusse, with an overall rate of 4.8%. However, higher rates were found in adults 20 years and older, with males having a rate of 6.0% and females 3.4%. The 20 years and younger group had lower prevalence rates of 0.7% for males and 0.8% for females. Dr Nathan et al. suggested that the higher prevalence rates in adult males might be associated with fishermen and ex fishermen. He studied the prevalence rates of this group of fisherman at Las Cuevas in a repeat study and found 12 of 16 fishermen infected with the parasite. This high infection rate was associated with the men who went out early in the morning to tend to their fishing nets and boats at a time when the sand fly vector Culicoides phlebotomus activities were high.

Some workers in Brazil had suggested that the microfilariae of M. ozzardi could be found in bloodless skin snips. In a study to compare the presence of the filarial in peripheral blood with bloodless skin snips, Nathan and his co-workers found there was no difference in microfilariae counts in blood from the two sources. With regard to the pathogenicity of M. ozzardi it was found to be associated with articular pains.

Vector

In an attempt to determine a vector, Nathan (1981) used a variety of techniques to collect blood-sucking insects at the Las Cuevas area where M. ozzardi was present. He collected 19,155 insects in which Culicoides phlebotomus made up 96.1% (18,399) of the catch. Other blood sucking insects collected were 17 other species of sand flies, 3 species of mosquitoes, one species of black fly (Simulidae) and one species of horse fly (Tabanidae). Analysis of blood meals of C. phlebotomus revealed that 47% fed on man. When dissected, filarial larvae were found in 0.8% of 6,767 females and of the positive sand flies 0.08% had infective larvae. C. phlebotomus was deemed to be an efficient vector of M. ozzardi, but its presence in humans is of little pathogenic significance. The vector, however, breeding in sand bars at the mouth of rivers near some of the beaches in northern Trinidad is a serious pest to humans. It was suggested that physical control of the rivers where they enter the sea and larviciding might offer some control.

The discovery of the filaria of Wuchereria bancrofti at Blanchisseusse was a significant finding as it was found in blood smears taken during the day. The filaria of this parasite is normally found in peripheral blood during the night which is correlated with the biting habits of the vector mosquito Culex quinquefasciatus. Accordingly, Nathan concentrated his studies at Blanchisseusse, but in addition, he surveyed other coastal districts in the north coast for the presence of W. bancrofti. This survey, however, was done during the day using a provocative test; that is, administering 100 mg of diethylcarbamazine citrate (DEC) orally 30-60 minutes before taking a blood sample. This provocative test stimulated the microfilaria to appear in the peripheral blood during the day so it was not necessary to conduct the surveys during the night. It was found that W. bancrofti was present in five of ten coastal villages surveyed: Blanchisseusse, Matelot, Grand Riviere, Toco and Cumana.

Most of the work on W. bancrofti was concentrated at Blanchisseusse, a rural community of 650 people consisting of African, Indians, Chinese and Europeans. The microfilaria of W. bancrofti was found in 15% of the resident population. The prevalence rates, however, were higher in males (19%) than in females (15%). The microfilaria was not detected in children less than five years. In children older than five years and adolescents, the prevalence rate was 12%.

A clinical investigation was carried out after the parasitological survey. Of 59 men examined, 43 (73%) showed early acute signs of lymphatic filariasis (epididymitis, funiculitis, orchitis). The majority, however, were in men 20 years and over. With the females, six per cent had lymphoedma of the legs and in four cases, elephantiasis was noted. Chyluria was noted in 12 % of males and 3% of females.
The mosquito *Culex quinquefasciatus* was the only significant vector at Blanchissesse. The species was studied in detail. The workers in this project found that the species were breeding in pit latrines, in blocked drainage ditches and water storage vessels. Using both nesting boxes catches and human bait collections, they found peak densities in the rainy season - 122 mosquitoes per man night in November, 1978 and 104 mosquitoes in 1979. Based on these results, they calculated that humans were exposed to 17,948 bites by this species per man night and 14 mosquitoes were harbouring infective larvae. Biting activity of *C. quinquefasciatus* started around 17:00 hours and reached peak density at midnight.

A mass chemotherapy programme was initiated in March 1980 and completed in February 1981. Pregnant and breast-feeding women, as well as children under five years were excluded from this programme. The rest were given DEC citrate at 6 mg/kg body weight in 12 monthly doses. A follow-up study showed that of 81 with microfilariae, 73 became negative, seven had reduced microfilaria, and one person refused to cooperate. The workers noted that of the 147 originally negative, none had become positive.

Twelve years later Chadee et al. (1995) conducted mass chemotherapy of the population with diethylcarbamazine for the control of filariasis. Follow up studies showed that the area was cleared of filariasis.

Later in 2000 Rawlins and co-workers studied the prevalence of *Wuchereria bancrofti* antigens in various communities in Guyana, Suriname and Trinidad. The study was conducted on school children and found prevalence rates ranging from 1.7 % to 33.2 % in Guyana, 0.22 % overall in Suriname and 0.0% in Trinidad, indicating that *W. bancrofti* seemed to still be circulating to an appreciable degree in the population in Guyana.

### 7.4 Rotavirus in Trinidadian Children with Gastroenteritis

In 1976, the death rate in children in the Caribbean due to diarrhoeal disease was 103.8 per 100,000 and in Trinidad and Tobago it was 214 per 100,000 in children under five years. While *Salmonella*, *Shigella* and rotavirus were detected in children during routine diagnostic work, no coordinated studies had been done to determine the relative importance of these microorganisms, as well as organisms such as enterotoxigenic *Escherichia coli*, *Yersinia enterocolitica* and faecal parasites as causative agents of gastroenteritis.

The bacterium, *Salmonella* was isolated from 22 cases, but only three from the controls, while *Shigella* was isolated from 12 cases and none from the controls. Both *Salmonella* and *Shigella* showed a significant association with disease. Enterotoxigenic *E. coli* were isolated from 12 (4.3%) cases and 5 (1.7%) from the controls, while enteropathogenic *E. coli* was isolated in about equal numbers from cases and controls. Intestinal helminth eggs and protozoa were rarely seen. The frequency of rotavirus isolations is strongly associated with disease. Rotavirus was isolated throughout the year, but infection rates were higher in the dry season (28.1%) when compared to the rainy season (17.9%). The study also showed that the CIEP method detected 90% of rotavirus when compared to 95.7% by electron microscopy suggesting that it is a good system for laboratories not having an electron microscope.
7.5 Infantile Gastroenteritis in the Caribbean

In 1977, Dr Barbara Hull started a study on infantile gastroenteritis in three Caribbean countries: Guyana, St Vincent and the Grenadines and Trinidad and Tobago. The study was conducted in collaboration with the various Ministries of Health and the paediatricians in the leading hospitals, and with funding from the IDRC of Canada.

The subjects were under three years admitted to hospitals with a diagnosis of gastroenteritis. There were equal numbers of age and sex-matched controls. Faecal samples were collected from 297 children with gastroenteritis and 396 without gastroenteritis. Examination of the faecal samples showed that the agents associated with gastroenteritis were the rotaviruses, *Salmonella* and *Shigella*. In Trinidad and St Vincent and the Grenadines, rotavirus was the major pathogen while in Guyana, there was a higher percentage of *Shigella* isolated (Table 7.5.1).

<table>
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<tr>
<th>COUNTRY AND CATEGORY</th>
<th>ORGANISM</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>ROTAVIRUS</td>
</tr>
<tr>
<td>Trinidad with Gastroenteritis n = 300</td>
<td>71 (23.6)</td>
</tr>
<tr>
<td>Trinidad without Gastroenteritis n = 300</td>
<td>2 (0.7)</td>
</tr>
<tr>
<td>Guyana with Gastroenteritis n = 55</td>
<td>7 (12.7)</td>
</tr>
<tr>
<td>Guyana without Gastroenteritis n = 54</td>
<td>1 (1.9)</td>
</tr>
<tr>
<td>St Vincent with Gastroenteritis n = 42</td>
<td>9 (21.4)</td>
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<td>St. Vincent without Gastroenteritis n = 42</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7.5.1. Occurrence of microbiological agents in children with and without gastroenteritis

More than 60% of the study group were under one year old. Clinical dehydration was present on admission in 47.1% of Trinidadian patients, 56.6% in Guyana and 71.5% of St Vincentian children. These children were treated with intravenous rehydration, but there were some uses of oral fluids. The death rate varied from 2.4% in St Vincent and the Grenadines to 6.3% in Trinidad and 9.1% in Guyana.

It was noted that the children infected with rotavirus spent fewer days in hospital and were readmitted less often, and the death rate was lower than those infected with *Salmonella* and *Shigella*. The gastroenteritis agents were rarely seen in household contacts of the patients, but the household contacts had a high percentage of parasitic infestation. Children with gastroenteritis had low birth weights and had poor nutritional status. Such children came from homes with poor water supply and sanitary facilities and were breastfed for less than one month.

7.6 Leptospirosis

Leptospirosis is a disease of animals transmitted to man and is widely distributed throughout the world. Developing countries, however, generally lack the facilities for the proper diagnosis of leptospirosis and in the Caribbean only two of the CMCs had such facilities: in Jamaica at the University of the West Indies, and in Trinidad and Tobago through the TRVL. Dr C Everard, external staff of the MRC undertook a project to study the “Epidemiology of leptospirosis in Barbados and Trinidad and Tobago” with funding from the MRC and the respective governments during the period September 1979 and December 1982. Before Dr Everard’s work, however, Dr Wilbur Downs had already found leptospires in Trinidad during studies on arboviruses and recorded the following species through serological tests in Trinidad: *Leptospira grippotyphosa*, *L. canicola*, *L. icterohaemorrhagiae*, *L. medinensis*, *L. naan* and *L. samarang*.

Later, with Mr Arthur Green, TRVLs Chief Laboratory Technician, isolations were made from human cases. These isolations were *L. kremastos*, *L. grippotyphosa*, and members of the *L. icterohaemorrhagiae* group. Between 1977 and 1982, Dr Everard tested 1,756 sera from hospital patients with pyrexia of unknown origin for leptospiral antibodies. Of the 1,756, one hundred and fifty-six (156) were confirmed cases giving an infection rate of 8.9%. Twelve of the patients died, of which five were confirmed cases of leptospirosis; three cases were inconclusive and four were negative by serology. When analysed by
age and sex, it was noted that 74% (116) were males and 26% (40%) were females. Most of the males (60%) between the ages of 15 and 35 were positive for leptospirosis, while 72% of the females were evenly distributed between 29 and 59 years.

During this study, it showed that ten different serogroups of leptospires were involved in 156 cases: L. icterohaemorrhagiae, L. canicola, L. automnalis, L. hebdomadis, L. panama, L. bataviae, L. ballum, L. Farassovi, L. grippotyphosa and L. pyrogense. There were also cases where individuals were infected with two or three serogroups. About one third of the cases, however, were of the icterohaemorrhagiae serogroup which is known to cause severe illness. Apart from these hospital cases, a sero-survey was conducted on 541 school children and 9.6% of them were positive to titres between 1:50 and 1:400. And in another survey done in one urban community (Arouca) and two rural communities (Frederick Settlement and Orange Valley), 503 sera were tested. The result showed that in Arouca 12%, in Frederick Settlement, 4.7% and in Orange valley 12% of the sera reacted positively to the antigens used. The study was extended to other Caribbean islands. In Grenada, for example, it was found that out of 123 febrile patients, 20 (16%) were positive for leptospiral antibodies and in another 182 afebrile outpatients, 25 (14%) showed exposure to leptospires. The most common serogroup of leptospires was that of icterohaemorrhagiae (38%) followed by L. Panama (24%), L. canicola (11%), L. pyrogense (9%), L. automnalis (7%), and the rest belonged to L grippotyphosa, L. ballum, L. bataviae, L. javanica and L. shermani.

Since work on leptospirosis in the Caribbean was done mainly on adults or specific occupation groups, information was lacking on the status of leptospirosis in children. To address this situation, there was an examination of 827 children between the ages of five and 14 in five Caribbean islands including Trinidad (but not Tobago) and Bermuda. The children of all the countries had leptospiral immunoglobulins with the highest rate in Barbados (36.6%), followed by the Turks and Caicos Islands (15.81%). For the other countries the rates were: the Bahamas 6.0% (111/184), Bermuda 7% (8/114), the British Virgin Islands 8.3% (4/48) and Trinidad 7.5% (15/200). These studies highlighted the presence of leptospirosis in CMCs as a probable human health hazard. Subsequent to this, more countries developed the capability for diagnosing leptospirosis.

### 7.7 Studies on the Ecology of Dengue and other Arboviruses

This project was an extension of another on “The Ecology of Yellow Fever and Other Arboviruses” which was funded by the Canadian International Development Research Council. The extension was sponsored by the Government of Trinidad and Tobago with the lead investigators being Dr. Barbara Hull, Dr. E. Tikasingh, Mr. Mark de Souza and Mr. Raymond Martinez. One of the objectives of this study was to conduct active surveillance of human cases of fevers of unknown origin to determine the presence of dengue, other arboviruses that might be circulating in the population of Trinidad and Tobago. In order to carry out this project, Medical Officers of health and sentinel physicians were asked to submit blood samples from febrile cases through the Trinidad and Tobago Public Health Laboratory to CAREC for virus isolations and antibody determinations. In this study, 724 specimens were received and dengue virus was isolated from 111. While transmission of the virus occurred throughout the year, most of the isolations came in the rainy season. Dengue cases occurred throughout the country, both urban and rural.

In a study to determine the presence of antibodies to arboviruses in the population, 450 sera were collected from children under 20 years and tested serologically to specific arbovirus antigens. Of the 450 sera, two had antibodies to Mayaro virus and seven to Venezuelan equine encephalitis (VEE). An important aspect of this study was the successful attempt to demonstrate the natural transovarial transmission of dengue in the Aedes aegypti mosquito. The dengue virus is maintained by transmission among susceptible humans. It is also postulated that during inter-epidemic periods, the virus could be maintained in natural setting in the mosquito, and transmitted through the eggs to adults. The transovarial transmission of the virus has been demonstrated in the laboratory and from field collected material for dengue 2.

Mosquito larvae and eggs of Aedes aegypti were collected around homes of confirmed dengue cases. The eggs and larvae were brought to the laboratory and reared to adult, and were then processed for virus isolation. Likewise, the adults were pooled by locality and tested by virus isolation. From one of 158 pools, dengue 4 was isolated for the very first time, which gave further evidence that transovarial transmission of dengue virus might be a naturally occurring phenomenon.
7.8 Black Flies (*Simulium* sp.) in Guyana

The Government of Guyana considered that the enormous numbers of "Kabowras" (subsequently identified as *Simulium* black flies) in the Rupununi Savannahs were hindering the development and settlement of the area. These savannahs cover about 13,000 km² and are inhabited by 15,000 persons, mainly Amerindians, who live in small villages. Ranching is the main occupation. In addition, the Government considered the foothills of the Kanuku Mountains to be fertile agricultural lands which needed to be developed, but people were reluctant to live in the area because of the intense biting of these insects. There have been reports that some persons were forced to return to Georgetown, the capital city, to seek medical attention because of severe reactions to the bites of these insects and the development of secondary infections.

Species of *Simulium* are well-known vectors of "river blindness" or onchocerciasis in West Africa as well as Central America. There had also been reports of the presence of onchocerciasis in the Brazilian-Venezuelan border. The Government of Guyana, however, was more interested in the control of these biting flies which had been hindering the development of the area. The government sought assistance from CAREC. Dr John B Davis, a UK Medical Research Council entomologist stationed at CAREC, visited the area and conducted some preliminary work. After his departure from Trinidad, Dr E Tikasingh applied for and received a grant from the UK Medical Research Council in March 1975, to continue this work jointly with the Guyana National Science Research Council. A biologist, Mrs Shirley Humphrys, living in Rupununi, was hired as supervisor/technician along with two other supporting staff to conduct the routine daily work.

The project was undertaken to study the species’ composition, density of biting, diurnal activities, breeding habitats, and to conduct trials for the control of these biting flies. The study area was concentrated within a 16 km radius of Lethem, the seat of administration for the Rupununi Savannahs, which is located in the southwestern section of Guyana bordering Brazil and is about 12,600 km² in area. Annual average rainfall between 1972 and 1977 was 109.5 cm. There is a long dry season of about seven months from about September to May, but during the rainy season flooding occurs and many villages become isolated.

In order to compare fly densities at different times of the year and to provide baseline data against which the effects of any control scheme could be compared, 24 stations were identified in four groups. Each group was called a Fly Round. Sixteen stations were located near river banks and the others were located in the open savannahs. Flies were collected by two to four persons as they attempted to bite. Catches were made for 15 minutes at each station and six stations (one Fly Round) were worked per day. Flies collected by all workers were pooled by station and flies caught per catcher-hour were calculated.

Prior to this study, six species of *Simulium* were known to exist in Guyana. These were *S. guianense*, *S. haematopotum*, *S. limbatum*, *S. lutzianum*, *S. rubrithorax* and *S. sanguineum*. During this study, the following
additional seven species were collected as pupae or adults: *S. incrustatum*, *S. exiguum*, *S. samboni*, *S. metallicum*, *S. minisculum*, *S. oribi* and *S. spinibranchium*. There were another six unidentified species collected in the Rupununi or elsewhere. Six man-biting species were collected in the Rupununi Savannahs, but only two of the six appeared in large enough numbers to be considered a serious nuisance. Of the two, one has been identified as *Simulium incrustatum* and the other formerly identified as *S. sanguineum*, but subsequent to these studies, the species was referred to as *S. oyapockense*.

During the period April 1975 through March 1978, the two species, *S. incrustatum* and *S. oyapockense*, were caught almost exclusively in the Fly Rounds. *S. incrustatum* predominated at these Fly Rounds where 49,888 (91.8%) were associated with small streams and creeks. A total of 11,573 *S. oyapockense* were collected, but 72.5% were found near Lethem and the larger Takutu River.

The two species were highly seasonal and associated with periods of heavy rainfall. Populations of *S. incrustatum* started to increase approximately three weeks after a continuous weekly rainfall of 1.5 cm or more while *S. oyapockense* started to increase after a shorter interval of one to two weeks. Peak densities were reached 7-10 weeks after the beginning of rainfall, but there was a drop in densities for the two species as the rainfall declined and, in the height of the dry season, no fly could be found at some stations. At the height of the rainy season, *S. incrustatum* reached a peak density of 884 flies per man hour in 1976 and 928 per man hour in 1977. For *S. oyapockense*, the peak was 764 per man hour in 1976 and 652 man hour in 1977 near Lethem.

*Simulium* black flies are normally day-biting, but in order to determine what time of the day was the peak activity, collections were made for 10 minutes at hourly intervals, starting at 05:45 hours and continuing until 18:55 hours. These collections were made one day per week during the rainy season over a period of three years. During this period, 15,643 *S. incrustatum* and 14,865 *S. oyapockense* were collected. No specimens were taken before dawn and after dusk. *S. incrustatum* increased sharply after dawn at about 06:15 hours and dropped towards mid-morning. There was a slight increase around noon, becoming rapidly more intense from 16:15 hours, and peaking about dusk. Peak biting activity for *S. oyapockense* occurred between 07:15 and 09:15 hours. There was a drop in the late morning, an increase in the early afternoon, and a sharp drop again towards dusk.

With these basic data, control trials were done for the two species. For *S. incrustatum*, the San Jose River was selected and four trials were conducted – two in 1979 and two in 1980, using Abate 200E larvicide provided by the American Cyanamid Company. The river discharger and two in 1980, using Abate 200E larvicide provided by the American Cyanamid Company. The river discharger was determined and the volume of larvicide used was calculated to a chart provided by the American Cyanamid Company. The Abate 200E was used at a concentration of 0.1 part per million and dropped into the river for 15 to 20 minutes.

For evaluation, vegetation was examined, the number of larvae was counted per half man hour at selected points, and the counted vegetation was marked. Twenty-four hours post treatment, the marked vegetation with larvae was counted again and compared to the initial count. In the first trial, there was a reduction of 99.3% up to 2.4 km from injection of the Abate point; in Trial 2, there was a 96.1% reduction 3.5 km from injection point; in Trial 3 reduction was 98% at 2.7 km, and in Trial 4 there was a 100% reduction 3.3 km.

Trials for the control of *S. oyapockense* were done at Sawarwau River where this species was known to be present. It was not possible to use the Takatu River for the trial because this river forms the international boundary with Brazil and permission from the Brazilian Government would have been necessary. The results here, however, were inconclusive because the river was in flood and checking and counting of larvae became difficult. A full report of this project was submitted to the National Science Research Council through its Secretary, Dr P Munroe, for transmittal to the Government of Guyana. Further recommendations were made for the continuance of this project with an appropriate budget.

7.9. Biological Control of Mosquitoes

The virus of dengue fever is transmitted by the mosquito *Aedes aegypti* in the Caribbean. Since there are no medicines or vaccines to prevent the disease, the only way to control the disease is by controlling the breeding of the mosquito. In many parts of the Caribbean where pipe-borne water supply is non-existent or inadequate, people resort to storing water in cisterns, barrels and other receptacles, which are excellent places for *Ae. aegypti* to breed.

During outbreaks of dengue fever space sprays are used, but larviciding is the mainstay of controlling breeding.
However, some people object to the placing larvicides in their drinking water and there is growing resistance of the larvae to the insecticides used. Thus, other methods for eliminating the breeding of the mosquito called “source reduction” are recommended. Scientists have experimented with biological methods of control such as the use of Toxorhynchites mosquitoes and copepods both of which prey on Aedes aegypti larvae. At CAREC there was experimentation with both Toxorhynchites moctezuma and the copepod Mesocyclops.

Toxorhynchites vs Aedes aegypti: In the adult stage, the Toxorhynchites mosquito does not take a blood meal instead it feeds on nectar from plants. The larval stages however, are predatory and will feed voraciously on other mosquito larvae. We have been able to colonise and maintain this species, and study its life behaviour and experiment with it in the laboratory.

With the aid of a grant from the US National Academy of Sciences, Board of Science and Technology for International Development, we tested this system to control Aedes aegypti under field conditions. The place selected to conduct this experiment was Union Island, St Vincent and Grenadines. What made this island attractive to conduct the trials was its small size with 1,200 inhabitants residing in two villages – Ashton and Clifton. The villages are separated by a hill with a narrow coastal road separating them. There was no pipe-borne water supply. Rainwater was collected in permanent and semi-permanent containers and cisterns, which encouraged the breeding of Aedes aegypti. Ashton was the control (untreated) village and Clifton the experimental (treated).

The experiment was conducted during March – December 1988. Prior to treatment baseline data on the prevalence of Aedes aegypti was determined by indices of the two villages during the period March – June. The indices used were ovitramp index, house index, cistern/tank index, drum index, small containers index and Breteau index. These indices were calculated as a percentage of each container positive for Aedes aegypti larvae, except for the Breteau index which was calculated based on the number of positive containers per 100 houses. Eggs and larvae of Tx. moctezuma were reared at CAREC and transported by air to Union Island where they were released in cisterns, tanks, drums and other large containers during the rainy season, July – November. All indices showed a reduction of Aedes aegypti breeding in Clifton (treated village) when compared to Ashton (untreated village). This experiment showed that Tx. moctezuma can be used to control Aedes aegypti breeding after greater refinement of this technique.

Copepods vs. Aedes aegypti. Copepods are minute crustaceans distantly related to crabs and which live both in the sea and in freshwater. The freshwater group will feed on small animals such as mosquito larvae. Studies elsewhere had suggested that copepods could reduce the breeding of Aedes aegypti larvae. Thus in this first step copepods were collected from various parts of Trinidad and other Caribbean Islands. Some 15 species were tested in the laboratory to see which ones could feed on mosquito larvae. Three species, Macrocylops albidus, Mesocyclops aspericornis and Me. longisetus were effective against Aedes aegypti, but not against the other common house mosquito, Culex quinquefasciatus. Two species prevented any Aedes aegypti survival for a period of 26 weeks. What was interesting was that the copepods could withstand the normal dosage of temephos, the insecticide used for controlling mosquito breeding, suggesting that the copepods could be used with an integrated mosquito control programme. The drawback of the copepods is that they carry some bacteria pathogenic to humans and could not be used in drinking water.

These two projects are examples of research on the biological control of mosquitoes and further work must be done before they can be of practical value.

7.10. Development of Tissue Cultures: Mosquito and Toad Cell-lines

Viruses need living tissues in which to grow. Historically, arboviruses were isolated in mice or tissue culture at TRVL and CAREC. Dr M G R Varma of the London School of Hygiene and Tropical Medicine developed two cell lines: one from the mosquito Aedes pseudoscottellaris (LSTM-AP-61) and the other from a toad Xenopus laevis (XTC2). In January 1978, Dr Varma visited CAREC and introduced these two cell lines to the laboratory. The cell lines were quickly established at CAREC and staff were trained to use and maintain them. Mr Malcolm Race, the chief technician seconded from the MRC, took over the project after the conclusion of Dr Varma’s visit.

These cell lines have growth at an optimal temperature of 280 C and when infected with a virus, might cause damage to the tissue known as cytopathic effect (CPE). Preliminary studies had shown that certain arboviruses could be isolated using these cell lines. The test of this
system came later in 1977-1978 during the Caribbean-wide epidemic due to dengue type I which was a new serotype circulating in the Caribbean. Eight countries including Trinidad and Tobago, sent specimens to the CAREC laboratory for diagnosis. Of 664 specimens tested in AP-61, 238 strains of dengue were isolated compared with two isolates from 586 specimens tested in mice, demonstrating the superior method of AP-61 in isolating dengue viruses.

Further, these cells were carried in the field or to other countries and were successful. For example, in Dominica and the Bahamas the cells were inoculated in the field, incubated at room temperature for several days and then transported to CAREC. Twenty-three isolates were made from 49 specimens.

Further, in the 1979 yellow fever outbreak the AP-61 cell line showed its usefulness in the isolation of yellow fever virus.

7.11. Cervical Cancer

CAREC's first involvement with the surveillance of cervical cancer was in 1990 when statistical support was provided in a project led by the Caribbean Program Coordinator/PAHO for Barbados and the Organisation of Eastern Caribbean States (OECS). The objective of the programme was to reduce morbidity and mortality from cervical cancer in Barbados and the OECS. The project continued in 1991. In evaluating the programme, some issues were highlighted. For example, there was a lack of standardisation of grading dysplasias in two countries. This finding suggested that there were more variations in other countries. There was also a lack of coordination between the laboratory, clinical and epidemiological departments. It was noted, too, that there was no system in place to look at quality control in terms of reading smears, and timeliness in reporting feedback to clients and follow-up of women with abnormal smears. CAREC also helped with a Trinidad and Tobago study to determine women’s knowledge and attitude towards cervical cancer. This study was done through discussion amongst women in community groups in collaboration with the Family Planning Association. They found that most women knew about pap smears and its ability to detect early cervical cancer. However, there was a concern about confidentiality and post-test services offered in some centres. There was also the embarrassment of having the test done and the long wait for results.

It was not until 2002 that CAREC launched the Caribbean Cervical Cancer Prevention and Control Project (CCCPCP) in collaboration with PAHO’s Regional Project on Cervical Cancer and the Office of the Caribbean Program Coordinator. Funding for the 2½-year project was provided by the Bill and Melinda Gates Foundation through funds granted to PAHO/WHO as a member of the Alliance Against Cervical Cancer.

A Technical Advisory Group (TAG) was formed to give guidance to the project. The TAG itself was made up of representatives from Ministries of Health, PAHO/WHO (headquarters and regional offices) the University of the West Indies, National Cancer Societies the Caribbean Family Planning Affiliation, the Caribbean Association of Medical Technologists, and the specialties of pathology, obstetrics and gynaecology, and family practice (Caribbean College of Family Practitioners).
A project manager, Dr Glennis Andall-Brereton, was hired in 2003 to oversee this project. At the start of the project a Caribbean situation analysis was done which showed that most English and Dutch-speaking countries had estimated an incidence rate of cervical cancer at least three times higher than the USA and Canada. In 2004, the project developed a “Strategic Plan for Cervical Cancer Prevention and Control in the Caribbean (2005-2009)”. The purpose of the project was to strengthen the capacity of Caribbean Countries to plan, implement and evaluate well-organised, targeted and sustained programmes for cervical cancer prevention and control. This plan was subsequently endorsed by the Caucus of CARICOM Ministers Responsible for Health. Aiming out of this plan was the question of quality cytology services which were critical for achieving cervical cancer prevention and control. The Situation Analysis for the Caribbean noted a number of deficiencies in cytology laboratories. Among these were needs for standards of proficiency, training, continuing medical education, accreditation, reporting systems, information systems, guidelines and policy.

To address some of these deficiencies, 14 cytoscopists were trained in 2004 in a three-month cytology training programme at the Pathology Department, Fort de France University in Martinique through funding from French Technical Cooperation. The 14 cytoscopists came from 9 countries: Antigua and Barbuda, Dominica, Grenada, Guyana, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Suriname, and Trinidad and Tobago. Gynaecologists, too, were not left out of refresher training as one each from Antigua and Barbuda, Dominica, Grenada, St Kitts and Nevis, St Lucia, and St Vincent and the Grenadines, as well as three from Jamaica were trained in smear-taking techniques, colposcopy and management of abnormal smears. This “Train-the-Trainer” workshop on Cervical Cancer Prevention and Control was conducted at the Jamaica Cancer Society in Kingston. The workshop was for a period of five days with the majority of the funds coming from the CPC/PAHO office. Montserrat planned a National Cervical Cancer Prevention Programme and to prepare for the programme, nurses were trained in Jamaica in smear-taking techniques. A workshop was also held on the use of newly-designed data collection and reporting forms.

An important aspect of any programme is a properly planned and focused communication strategy. To this end, a workshop was held at CAREC in 2006 which was facilitated by a WHO Immunisation Advisor, with funding from the United Nations Population Fund. Six countries participated: Belize, Jamaica, Montserrat, St Lucia, Suriname, and Trinidad and Tobago. Several workshops had also been held in training in the use of the Bethesda System of reporting on cervical cytology. This system provides for the use of uniform terminology which aids in better management of cervical cancer.

7.12. Human Papillomavirus (HPV) Research

The prevalence of human papillomavirus (HPV) and its various types are generally unknown in CMCs, as only a few studies have been done. With the development of HPV Types 16 and 18 vaccines, it was necessary to know which prevalent HPV types existed in the female population in the Caribbean.

A HPV Working Group comprising CAREC staff, personnel from the Ministry of Health, Trinidad and Tobago, University of the West Indies and the Trinidad and Tobago Cancer Society was organised in 2005. The Working Group developed a research protocol titled “Prevalence of High Risk HPV Types Among Women in Trinidad and Tobago”. The first phase of the research was conducted in Trinidad and Tobago with funds provided by the Trinidad and Tobago Cancer Society. Other countries were interested in these studies, but funding was not available to expand the project.

7.13. Streptococcal Disease Unit

In 1975 CAREC inherited a number of projects that were hosted by the TRVL. These projects were not part of the core programme and were separately funded by other organisations; CAREC merely provided space for the TRVL scientists. One of these projects was a study on streptococcal disease conducted by Dr John Zabriskie and his associates Drs Vincent Fischetti, Virginia Utermohnen and Stanley Read of the Rockefeller University. The study was on acute rheumatic fever in Trinidad and Tobago and was sponsored by the Rockefeller University, PAHO/WHO and the Trinidad and Tobago Government. The local team
The group also studied acute glomerulonephritis associated with skin sores and strains of streptococci bacteria. This study included a complete clinical and laboratory evaluation of the renal status of each patient. They also conducted epidemiological and microbiologic studies to determine which streptococcal strains were prevalent in Trinidad.

In the 1990s Mr Reid also performed histocompatibility testing and immunophenotyping on a cost-recovery basis.
8.1. Quality Tourism for the Caribbean

The economies of most of the countries in the Caribbean are based on tourism. The tourism industry allows Governments to earn foreign exchange and provide employment for their people. It is, therefore, important to protect the quality of the tourism product throughout the region. There are many challenges faced by the countries, such as environmental degradation, deforestation, coastal erosion, water pollution and the risks of infectious diseases which may affect the tourism product. There was, therefore, a need to provide a safe and healthy visitor experience, ensure environmental sustainability and, importantly, to improve the competitiveness of the sector. CAREC and the Caribbean Alliance for Sustainable Tourism (CAST) formed an alliance to jointly develop and implement the Caribbean Tourism, Health, Safety and Resource Conservation Project.

The Project was guided by a Steering Committee, but managed by a Project Execution Unit (PEU) headed by Dr C J Hospedales, Director of CAREC and a Programme Coordinator. Ms Yvonne Roberts-White. The PEU consisted of a team of five persons with a budget of US$2.59M for the project. The Inter-American Development Bank Multilateral Investment Fund contributed US$1.3M, the Caribbean Development Bank US$ 370,000.00, with counterpart funding of US$0.89M by CAREC and CAST.

One of the first tasks of the PEU was the need to do a “Needs Assessment Survey.” This was the first Caribbean-wide Health and Environment Survey, which was conducted among a representative sample of 191 hotels in 33 countries and 200 food establishments. The survey was conducted in four pilot countries. The results of the survey were used in the identification of critical areas for standards development.

Standards Development

One of the outcomes of this Project was the development of standards for:

- food safety and sanitation
- guidelines for Environmental Management Systems
- solid waste Management
- water treatment, management and efficiency
- energy management and efficiency; and
- integrated pest management, and sewerage treatment management

These standards were tested in 42 tourism establishments. It is of interest to note that international tour operators have reviewed these Standards and supported them. In fact, two large tour operators contracted the Project Team to conduct re-audits of some of their properties in Jamaica and Barbados. It should be noted that while the Standards were being tested, some properties already had systems in place in the areas of health, safety and the environment, but these were not formalised and lacked documentation. Another problem noted was the cost of implementation of the Standards, particularly by small and medium-sized businesses.

The Standards were launched in 2002 in Antigua and Barbuda, Barbados, Bahamas and Trinidad and Tobago. During the launches, courtesy calls were made to top decision makers in the health, tourism and environment sectors as well as other stakeholders, thus ensuring wide acceptance of the Standards.

Capacity Building and Training Tools

One aspect of the Project was to train workers and trainers in the elements of food safety and sanitation. Over 1,000 persons were so trained and, in some cases, on Sanitary Standard Operating Procedures (SSOPs) and the development of a Hazard Analysis Critical Control Point (HACCP) System. Another 39 auditors were trained and equipped to conduct health, safety and resource conservation audits in tourism businesses. Likewise, 30 public health inspectors participated in a Food Safety and Change Management update. These public health inspectors were critical to the project and they were given up-to-date information and techniques in order to perform their role more effectively.

To aid workers in carrying out their responsibilities, manuals and guides were produced. Among these was the “Food Safety Employee Guide used in Food Safety and Training Workshops.”

One-day workshops were held for top and middle management of hotels on “Food Safety and HIV/AIDS Awareness.” A total of 85 participants from Trinidad and Tobago, St Lucia, Antigua and Barbuda, and St Vincent and the Grenadines benefitted from the workshops. Key industry personnel were sensitised to the following:

- economic importance of a food safety programme
- critical issues in food safety management
- appropriate, affordable interventions to insure food safety
• magnitude of the HIV/AIDS epidemic and the potential negative impact on the tourism industry and
• proactive measures that can be taken to protect the health of staff and guests.

In the training and capacity building exercises, there were some challenges, for example, the high turnover of staff. To reduce this problem it was necessary to have more ‘train the trainers’ programmes.

Marketing and Communication
The Project developed various communication strategies to communicate with the various groups of people. Some of these included:

• a project newsletter “Healthy Environmentally Aligned Tourism (HEAT)

• a project website - www.qtcproject.com

• a project profile brochure

• a standards brochure highlighting the need for, and benefits of Standards for the Caribbean Tourism Industry

• attendance and presentations at annual tourism conferences

• presentation at annual CARICOM meetings of tourism and health ministers

The Project also created strong public relations plans in order to develop increased awareness of the Quality Tourism for the Caribbean (QTC) product and services, promote the benefits of Standards for improved operational efficiency and better returns, build brand identity of the QTC Standards, sensitisation of the media to its Standards, and strengthen partnerships with hotels, key government officials and other stakeholders. The Project built strong alliances with many organisations such as the:

• UK Federation of Tour Operators;

• UK Communicable Disease surveillance Centre

• Chartered Institute of Environmental Health

• Caribbean Programme for Economic Development

• Pan American Health and Education Foundation

This 3-year Project came to an end in 2002 and portions of it have been absorbed in the Food-Borne Disease Programme.

8.2. Food-borne and Water-borne Illnesses

In Section 6.5 we mentioned a series of outbreaks of food-borne illnesses and gastroenteritis which occurred in CAREC Member Countries and which seem to be common. These outbreaks highlighted the need for a programme on food-borne disease (FBD) surveillance and control. While this need was recognised in the late 1970s by the late Dr Peter Diggory, there was no specific funding for the development of such a programme. In 2003, a programme on Food-borne Disease Prevention and Control was eventually started at CAREC. The intention was to develop a more coordinated, integrated and refined programme on food borne disease surveillance and food safety.

The goal/mission of this programme was, “To strengthen national and regional capacity to develop and sustain effective FBD surveillance and response programmes in order to reduce the mortality and morbidity for FBD and enhance food safety in Caribbean countries to meet WTO/SPD requirements.”

The Caribbean Cooperation in Health (CCH) Initiative had identified food and waterborne diseases as a priority, as well as the need to strengthen surveillance systems. Accordingly, CAREC, in collaboration with PAHO headquarters and Pan American Institute for Food Production and Zoonoses (INPAZ) developed a strategic plan to do so. The objectives of the programme were to develop, expand and upgrade national and regional surveillance systems for food-borne infections; investigate and report on FBD outbreaks, strengthen technical capacity and laboratory infrastructure; provide training; support and conduct applied research; and implement standards for the food and hospitality industries. This programme was multidisciplinary as well as inter-sectoral. As such, it interacted with CAREC Member Countries’ Ministries of Health and Agriculture, especially epidemiologists, laboratory directors, and Chief Environmental Health Officers. The programme also networked with other groups such as the CARICOM Secretariat, the Caribbean Food and Nutrition Institute, the University of the West Indies, the Food and Agriculture Organization, Food and Drug Administration, World Health Organization, US Centers for Disease Control, ICCA, CDSC and Health Canada.

The programme was under the leadership of Dr Lisa Indar (Fig. 8.2.1.) who, with other stakeholders, developed a 5-year plan of activities.

Programme Coordination and Planning
Much of its efforts in its first year were devoted to developing a comprehensive plan of action and conducting
workshops to sensitise key partners in CMCs through regional conferences. Very early in the programme CAREC became one of four WHO Global Salmonella Surveillance (GSS) regional training centres. As such, the FBD programmes held integrated laboratory training for 23 participants from six CMCs in 2004. And in 2005, there were three major regional Global Salm-Serv (GSS) workshops in which 52 participants from 10 CMCs participated.

In September 2003, the FBD programme took over the activities of the QTC project due to the lack of a Coordinator for the latter project. The FBD programme conducted Food Safety Training and Certification as well as “Train the Trainers” workshops for several countries. Most of the persons trained were in the hospitality industry, which ranged from food and beverage managers to cooks. A plan for in-country training in laboratory methods and techniques amongst personnel in clinical, food, veterinary and public health laboratories was developed and implemented. In-country training included laboratory training in routine identification of FBD pathogens and serotyping.

Upgrading, National and Regional Surveillance Systems
When this project started very little was known about the status of integrated FBD surveillance in CMCs. Accordingly, a workshop was held in 2004 to determine and document the status of surveillance systems at the time, both at national and regional levels. At the workshop, protocols were developed for each country to strengthen FBD surveillance which linked human, veterinary and food surveillance; as well as laboratory, epidemiological and environmental investigations. Also documented were the roles, expertise and services of regional and international agencies involved in FBD activities which included international agencies such as CAREC, CPC, PAHO-HQ, WHO, CDC, Health Canada, FDA and CARICOM, CMCs included were: Barbados, Bahamas, Belize, Curacao, Dominica, Grenada, Guyana, Jamaica, St Kitts and Nevis, Suriname, St Vincent and the Grenadines, St Lucia, Turks and Caicos, and Trinidad and Tobago. Country specific national protocols for enhanced (FBD) surveillance and response were developed for each country. They mapped out the “farm to table” approach for integrated FBD surveillance and also included FBD outbreaks and response for each country.

The project team also provided technical guidance and support in outbreaks of FBD and in disaster situations. For example, assistance was given to Trinidad and Tobago in three outbreaks that occurred in 2004 and one in St Lucia. There were also outbreaks of FBD in 2005 in Jamaica, Trinidad and Tobago, St Vincent and the Grenadines, Barbados, Bahamas, Turks and Caicos and Aruba; and assistance was given to Guyana where there was a serious flooding problem. In the 2005 outbreaks, 350 cases of illness were noted in hotels, restaurants, a day care centre, prison, a private hospital, and at a private dinner. The microbes involved in these outbreaks were: Salmonella enteritidis, S. typhimurium, S. oranienburg, Shigella, Norovirus and rotavirus. The food sources for these microbes included egg dishes, sea food, ham, turkey, chicken and fried rice. Contributing factors in these outbreaks were the poaching of eggs, undercooking of egg dishes and inappropriate holding times and temperatures. The outbreaks of FBD which occurred in Jamaica, Barbados, Turks and Caicos Islands and Aruba were hotel-based, and CAREC was notified by the CDC only after the tourists had returned to the United States.
Surveillance for Food-Borne Diseases during Cricket World Cup, 2007

The Cricket World Cup was held in eight countries (Barbados, St Lucia, Jamaica, Trinidad and Tobago, St Vincent and the Grenadines, Antigua and Barbuda, Grenada and Guyana) in 2007. It was anticipated that with the mass gatherings of people in these countries, there might have been a potential for the outbreak of FBD and that close surveillance was necessary. Accordingly, workshops were held in each of these countries to update participants on surveillance methods and to enhance their capacity in food safety, outbreak investigations, vector control, sampling, and specimen collections for mass gatherings. Food-borne disease pathogens occurring in the Caribbean, their sources and risks were reviewed in these workshops. In 2007 alone, 193 participants were involved which included Chief Medical Officers, Environmental Health Officers, Epidemiologists, Laboratories working in the clinical, veterinary and food aspects, veterinarians and surveillance officers. Fortunately, there were no serious outbreaks of FBD related to the event.

Burden of Illness (BOI) Studies

Very little was known about the prevalence of gastroenteritis, undifferentiated fevers, and respiratory illness in the Caribbean, which are key syndromes related to food-borne, water-borne and zoonotic infections. The FBD programme, together with inputs from PAHO, WHO Global Salmonella Surveillance and the Public Health Agency of Canada, conducted a survey in the Caribbean to estimate the true burden of FBD and specific FBD pathogens in the community.

There were four components in the study: population survey, physician survey, laboratory practices and microbiological studies. Countries participating in BOI surveys were Grenada, St Lucia, Trinidad and Tobago, Dominica, Guyana, Jamaica, Barbados and Bermuda. These studies were conducted by staff of the countries with technical inputs and coordination by CAREC. Prior to the start-up of the surveys, there were official launches in each country. The Minister of Health or his Designate was usually present, as were Permanent Secretaries.

In the process of conducting these BOI surveys, the FBD programme sensitised 883 persons to the project, trained 337 in population surveys; 71 were trained in enhanced diagnosis and 18 in database development and analysis. Preliminary survey results on the prevalence of diarrhoea in three countries were as follows: 6.3% in St Lucia, 11.8% in Grenada, and 8.6% in Trinidad and Tobago.

The highest prevalence rates were found in children under five years. Other findings of note were that there were long durations (more than 4 hours to days) between the collection and transport of specimens to the laboratory; 20-30% of persons with diarrhoea sought medical care; 20-25% took oral rehydration fluids; 35-60% took antibiotics; 48-51% washed hands before and after toilet use; 40-50% used soap to wash hands.

Following these studies, there have been improved specimen collection, an increase in the number of pathogens identified, and enhanced activity and cooperation between epidemiology, laboratory and environmental health. There was also enhanced inter-agency cooperation between CAREC, PAHO, Public Health Agency of Canada (PHAC), International Development Research Centre (IDRC) and universities.

Strengthening Laboratory Infrastructure and Technical Capacity for Food-Borne Diseases

In order to upgrade technicians’ ability to identify common food-borne pathogens, training was conducted in all countries. This training was given, not only to public health laboratory technicians, but also those serving in clinical, food and veterinary laboratories. Personnel were trained to identify the common food-borne pathogens, which cause illnesses such as Salmonella, Shigella, Campylobacter, E. coli 0157:H7, pathogenic S. aureus, Vibrio and norovirus from food, clinical and environmental sources using standard methods. Technicians were also introduced to internationally accepted standards in methodology, media and equipment. Methods for collecting samples for testing were also reviewed and updated. Attention was also given to the role of the laboratory in surveillance and outbreak investigations. However, participants indicated that lack of media and equipment in their countries hindered their work. There was also a gap in the proper collection of stool specimens as well as delay in the actual collection and transport of the specimens to the laboratory.

As a result of its activities the FBD programme has strengthened the ability of 14 laboratories to isolate the most common FBD pathogens.

Upgrading Food Safety at Public Health Level

The FBD programme provided training for key persons responsible for food safety in environmental health. These individuals comprised the environmental health officers (EHOs) from CMCs. The EHOs were trained in FBD microbial contaminants as well as toxins and allergens. Also included in the training were: ensuring food safety from purchasing to service, food safety management, food safety regulations and regulatory compliance and
crisis management. Such training was extended to “train the trainer” personnel for CMCs.

Antimicrobial Resistance Surveillance
In 2009, the FBD project started a programme to address emerging and re-emerging infectious diseases caused by resistant strains of bacteria. The objective was to provide support and coordination to enhance antimicrobial surveillance in CMCs. There was initial training at CAREC in standard susceptibility bacteriological techniques. It was anticipated that CAREC would function as the coordinating centre for the surveillance of antimicrobial resistance, but at the closure of CAREC in December 2012 the project had still not been implemented.

8.3. Strengthening of Medical Laboratory Services in the Caribbean
This four-year project, initiated by CAREC, was approved in May 2000 under the 8th European Development Fund (EDF) Caribbean Regional Indicative Programme (CRIP). Data collected from medical laboratories in CAREC member countries and proficiency testing results revealed an unacceptably high level of error in laboratories. In addition, there were no regional standards or benchmarks for medical laboratories. There was also a general lack of laboratory regulation at national levels and lack of acceptance of accreditation as a goal for medical laboratories. Significant gaps existed in the knowledge and skills of many laboratory technologists and managers with respect to standards, quality management systems and management of laboratories. Other problems noted were weak laboratory infrastructure and limited access to continuing education and updates.

To assist in addressing some of these issues, an agreement was reached between the Commission of the European Community and member states of the Caribbean Forum of African, Caribbean and Pacific (CARIFORUM) for a grant of Euro 7.5 million (with a requirement for 2.25 million in counterpart funding) to carry out this project titled “Strengthening of Medical Laboratory Services in the Caribbean (SMLC).” CARIFORUM countries which were included in the project were: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Suriname, and Trinidad and Tobago. The Dutch and United Kingdom overseas countries and territories (OCTs), which were members of CAREC, were not initially included and separate funding had to be sought to include them. By 2006, the OCTs – which included Anguilla, Aruba, British Virgin Islands, Cayman Islands, Montserrat, Netherlands Antilles and Turks and Caicos Islands – were funded by a complementary European Commission grant of Euro 1.425 million.

The overall goal of the project was to improve national and regional medical laboratory information in CARIFORUM countries, resulting in improved patient management and disease prevention and control. A higher-level objective was to improve the health status of Caribbean populations. The project aimed to improve management of, and coordination between, public and private laboratories in the region, thus leading to more accessible, higher quality and less fragmented laboratory information.

The specific objectives of the project were as follows:
1. Establishment of regional standards for medical laboratories
2. Development of regional accreditation and national legislation schemes for medical laboratories
3. Development of improved regional training capacity for laboratory quality management
4. Provision of training for improved laboratory management in the public and private sectors
5. Improved regional coordination and information management

While preparatory work was done to establish the necessary administrative and financial arrangements between the Pan American Health Organization and the European Union in 2001, the implementation date of the project was 1 November 2002. The Project Management Unit initially included:
- Ms Valerie Wilson - Project Manager
- Ms Wendy Kitson-Piggott - Training Manager
- Mr Arthur Janneire and subsequently Mr Anthony Sylvester - Financial Comptroller
- Ms Geeta Chickooere - Administrative Assistant

Ms Hyacinth Chow joined later as Project Administrator.

Dr Ian Popplewell of the Ministry of Health of Trinidad and Tobago was appointed CARIFORUM’s representative for the project as the Deputy Regional Authorising Officer (DRAO).

In order to facilitate wide involvement of stakeholders, encourage ownership, access technical expertise, and ensure that relevant solutions were formulated based on realistic views and to support sustainability of the project, a
Committee structure was set up to assist with its guidance. These included a Project Steering Committee, Expert Advisory Committees (e.g. Legislation and Accreditation, Human Resource Management, Laboratory Information Systems, etc.), and a National Laboratory Advisory Committee within each participating country, providing support to project implementation and to the Ministry of Health’s national laboratory service improvement.

**Legislation and Accreditation**

Prior to this project, there were no agreed or common standards to support legislation or accreditation with respect to medical laboratories in the Caribbean. In 2003, the Project conducted a survey in which 68 percent of laboratories participating from 23 countries noted that there were no regulations for control of laboratory services and 25 percent said there were no requirements for registration of laboratories.

During the course of the project stakeholders agreed to a common standard - ISO 15189 - for medical laboratories within the region. The Project developed a “Guidance Document for the Implementation of ISO 15189 in Caribbean Laboratories”. This document was subsequently translated into French, Dutch and Spanish languages.

During the life of the Project, model legislation for registration and licensing of laboratories was developed. Countries such as the Bahamas, Bermuda, the Dominican Republic, Jamaica, Guyana and the Netherlands Antilles enacted legislation for the licensing of medical laboratories and/or country personnel. Several other countries were considering the enactment of such legislation.

The project collaborated with the CARICOM Regional Organisation for Standards and Quality (CROSQ) to establish the Caribbean Laboratory Accreditation Scheme (CLAS) to serve as a mechanism to facilitate access to accreditation services regionally. The project trained National Accreditation Focal Points (NAFPs) and Lead and Technical Assessors in the participating countries to support this regional accreditation mechanism, working with CROSQ and the already existing accreditation bodies in Jamaica and Trinidad & Tobago. In this regard, 72 assessors were trained from 18 project countries, and 16 NAFPs from 16 project countries.

**Human Resource Development**

Prior to this Project, assessments were done in the 1990s and again in 2003 on medical laboratories, both public and private, in the Caribbean. It was noted that there was weak laboratory management, limited compliance with requirements of globally recognised laboratory standards, and quality management systems were lacking. Further there was limited knowledge of the appropriate medical laboratory benchmarks and standards. There were also severe gaps in the curricula used by training institutions to prepare medical technologists for practice. Training curricula for medical technologists in the region were generally focused on knowledge and were not primarily focused on ensuring that technologists were competent to practise on entrance to the medical laboratory.

Accordingly, a new medical laboratory technology curriculum was developed, based on the Caribbean Regional Competence Profile (CRCRP), agreed under the Project. This curriculum was developed in collaboration with curriculum officers from training institutions in eight project countries that prepared medical laboratory
The Caribbean Epidemiology Centre: Contributions to Public Health 1975–2012

SPECIAL PROJECTS (continued)

One of the major problems affecting Caribbean medical laboratories was the lack of satisfactory models for procurement of laboratory reagents and supplies, and maintenance of laboratory equipment. The project therefore produced a procurement model for the region that was feasible and compatible with national and regional procurement policies. Guidance was also put in place for a maintenance system that ensured the upkeep of medical laboratory equipment. To achieve this goal, the Project conducted training and facilitated the establishment of a professional association of biomedical technicians and engineers known as the Biomedical Professional Association of the Caribbean (BiPAC). The BiPAC built linkages with health professionals and also formed a regional network for maintaining equipment. Other key achievements included the monitoring of key quality performance indicators, and the training of health care providers to support the outputs of medical laboratories. In addition, several cyto-screeners were trained from 11 cytology laboratories in collaboration with French Technical Cooperation.

Microbiology
This project collected data which showed that some of the methodologies used in the Caribbean region were outdated and varied from laboratory to laboratory. In order to raise the standard, the Project initiated a Standard Methods Drafting Group which harmonised microbiology methods, ensuring best practice to meet the levels of service required. The Standard Methods Drafting Group developed 27 Microbiology Technical Standard Methods supported by 5 Standard Support Methods covering the most commonly used methods for detecting microorganisms and emerging antibiotic resistance.

Regional Coordination
One of the major goals of the project was to improve coordination and integration of Caribbean laboratories, which facilitated the sharing of expertise, services and information. Databases were developed on all aspects of laboratory services, as well as management systems which supported improved networking and sharing of timely information for patient management and disease prevention and control.

A major strategy implemented by the Project in addressing the need to have medical laboratories recognise information as their primary product, was the sensitisation of country teams. Twenty seven laboratories in 10 countries received ‘Data for Action’ training intended to expose private and public sector laboratory staff, hospital administrators, information technology professionals, clinicians and epidemiologists to the concepts of process mapping as a first step, or tool, for information management, delivery improvement and meeting client expectations.

The Laboratory Information Network Advisory Committee (LINAC) was created to develop a strategic framework that supported effective laboratory information management and optimal use of laboratory information resources in the region, including meeting national and regional surveillance objectives. By doing so, the foundations of the Laboratory Information System were built and would ideally be incorporated in the National Health Information Systems (NHIS). The project also identified potential regional reference nodes within the region to address the need for testing in key areas e.g. malaria, HIV and TB reference testing, and established criteria for the selection and operation of regional reference nodes.

Project Impact
The impact of this project varied by country. In countries in which stakeholders such as the Ministry of Health, National Laboratory Advisory Committees and other government Ministries e.g. Finance, Tourism and Trade, demonstrated...
a commitment to the project, success was evident. Countries with limited resources, but strong political will and laboratory leadership made significant progress; others with considerable resources but weak political will and laboratory leadership made less progress.

Counterpart investments in laboratory services were made at the national level as a measure of country commitment, in keeping with the project requirement for counterpart contributions. Countries established functioning National Advisory Committees which oversaw the implementation of laboratory quality systems, direct resourcing of laboratory improvements, staff training and the implementation of relevant legislation.

Although this project ended in 2007, interventions showed significant improvement in the development and documentation of laboratory quality systems. For example, between 2003 and 2006, composite percentage increases were noted for the following:

- Laboratory safety policies – 28%
- Documented safety plans and programmes - 50%
- Procedure writing, new staff orientation and staff training programmes - 11%
- Document control policies and procedures - 33% and 27%
- Customer service policies and user manuals - 22%
- Criteria for acceptance of reagents and supplies and evaluation of supplies - 27%

The following excerpts are taken from the End of Project Evaluation Report which was commissioned by the European Union:

“In some cases, stakeholders gave passionately positive feedback e.g. ‘the training changed my life’. Much of the success was due to the strength of SMLC CAREC/PAHO leadership and credibility on this project. SMLC Project staff showed tremendous dedication, hard work and commitment to this project. Often far and beyond the call of duty.”

“The participation and collaboration between the private and public laboratories was effective in terms of percentage of participation thanks to an appropriate confidence of the participating labs in the implementing agency. In the same way, regional trainings were building a strong network between the both sectors that allows the hope of sustainable collaboration in regard to the accreditation journey.”

“Overall, the project’s prioritisation of the activities in view of the expected results was appropriate. Components such as training, accreditation and lab management were well integrated into the other project activities maximising their results. The main factors for achieving that were good project design and good project management. Also an extremely hard working project team, as one stakeholder said: ‘There were not enough staff on the project, project staff were working all hours on the project, 24/7’”

“By creating strong networks within the laboratory and public health stakeholders, the project has participated in the QA culture strengthening and some improvements are already felt by the direct laboratory users, the medical doctors.”

“Given the outstanding work undertaken in this regional project, the project evaluation team highly recommends that CARICOM and COHSOD be consulted regarding their potential further support to this essential work.”

At the 2007 meeting of Council for Human and Social Development of the Ministers of Health, a resolution was passed to encourage continued support for laboratory strengthening through the adoption and enforcement of legislation for licensing of laboratories and the continuing function of National Laboratory Advisory Committees.

*(EUROPEAN COMMISSION Strengthening Medical Laboratories in the Caribbean (SMLC) - Caribbean Region: Final Evaluation Report. Letter of Contract N° 008/129169)*
MISSION
To reduce the spread and minimise the impact of HIV/AIDS/STI by enhancing the capacity of CAREC Member Countries to mount an effective and sustained response.

In 1981, the World woke up to a new clinical entity called the Acquired Immunodeficiency Syndrome (AIDS). Later, it was discovered that this new clinical entity was caused by the Human Immunodeficiency Virus (HIV). The first cases were noted in homosexual males. The first two cases of AIDS in the Caribbean were from Jamaica in 1982, both homosexual males. Then the following year, eight cases were reported from Trinidad and Tobago. All of the cases were either homosexual or bi-sexual males. The number of AIDS cases increased annually and by 1986, the CAREC Member Countries (CMCs) reported 187 cases. In response, the Pan American Health Organization/World Health Organization (PAHO/WHO) provided guidelines and standardised reporting systems, which were discussed and agreed upon at a 5-day workshop for national epidemiologists from the CMCs. This workshop resulted in improved reporting by the CMCs. Increasingly, female cases were being reported, as well as paediatric cases.

From early on, CAREC’s laboratory had provided support for HIV researchers in Trinidad and Tobago. The laboratory had received samples for screening from high-risk groups, contacts of antibody positive persons and blood donors who were referred from national blood banks after preliminary screening by ELISA assays.

As AIDS cases began to soar, the World Health Organization (WHO) established its Special Programme on AIDS as part of a Global Approach. Dr P Diggory, as Director of CAREC, applied for and received a grant of USD 364,698. The Grant was to reinforce CAREC as a Centre for HIV/AIDS with a Medical Epidemiologist, Media offices and Laboratory Advisor, who would support national educational programmes, blood screening, and surveys.

Dr Diggory directed the HIV/AIDS programme, and was assisted by Dr Carol Boyd-Scobie and later by Dr James Hospedales when he joined the Centre. By November 1998, the WHO selected CAREC as an AIDS Education and Information Exchange Centre (EIEC) and provided it with funding of US$151,985.00. The Centre would become part of a Global Network of Centres for HIV/AIDS. The purpose of the AIDS EIEC was to strengthen national AIDS education programmes and included the promotion of interchange and dissemination of print, audio and video material.

Formation of the Aids Unit
There were 306 AIDS cases reported in 1987 and by September of 1988 there were 902 reported AIDS cases. Further, 19 CMCs now reported the presence of AIDS. Other aspects of this growing epidemic were the emergence of paediatric AIDS cases: 11 cases were reported in 1985 and by 1987 there were 30 reported cases. All of these paediatric cases were under five years old and represented transmission from HIV-infected mothers to their children. Also observed at this time was a shift from homosexual transmission to heterosexual transmission.

In 1987 CARICOM Ministers of Health designated CAREC as the Programme Coordinator for AIDS in the Caribbean. To meet this challenge of a growing epidemic, increased staffing was required to handle the various components of the SPECIAL PROGRAMME ON SEXUALLY-TRANSMITED INFECTIONS
AIDS programme. In 1988, the AIDS Unit at CAREC was formed with the appointment of Dr. Jai P Narain as Medical Epidemiologist and Head of the AIDS programme. Later, Dr Bilali Camara (Fig. 9.1) joined the Unit as its Head.

There was further reorganisation of the AIDS Unit in 1989 when other sexually transmitted diseases were included in the AIDS Programme. The organisation of the Special Programme on Sexually Transmitted Diseases (SPSTD) was divided into four sections:
  1. Administration and Programme Support
  2. Surveillance and Research
  3. Diagnostic and Clinical Management

The Administration and Programme Support section provided administrative support to the technological areas as well as managed funds provided by donors for assisting the National AIDS programmes (NAPs) of CMCs. The goal of the Surveillance section was to assist CMCs to develop National HIV/AIDS/STD surveillance systems to build capacity to generate appropriate data for monitoring disease trends on which decisions regarding interventions could be based. The Diagnostic and Clinical Management Services section supported the development and implementation of relevant and cost-effective systems for diagnosing and managing persons with HIV/AIDS/STDs. The Information, Education and Behaviour Intervention Services section developed the capacity to design and implement cost-effective communication and information strategies within CMCs.

In 1999 there was a change in the name of the programme to the Special Programme on Sexually Transmitted Infections (SPSTI). This was in keeping with the consideration of asymptomatic infections and the WHO recommendation for a change in terminology of sexually transmitted diseases, to a more comprehensive one, sexually transmitted infections.

In 2007, a decision was taken to close the SPSTI. This was to make way for the establishment of the PAHO HIV Caribbean Office (PHCO) which was intended to serve the wider Caribbean (including Cuba, Haiti and the Dominican Republic). CAREC retained responsibility for HIV/STI related laboratory services and epidemiology.

I. Surveillance And Research

CAREC’s Surveillance Division had been receiving quarterly AIDS reports from CMCs. To assist in the collection of more accurate data, CAREC developed an “AIDS Case Investigation Form” and distributed it to all CMCs to standardise information and interpretation of the case definition. The guide which was an outcome of a 1993 workshop addressed such issues as the components of an effective surveillance system for HIV/STIs. It also included the role of the laboratory in this system and surveillance case definitions, including STI syndromes. CAREC teams also carried out evaluations and helped to develop work plans for any weaknesses identified.

It was noted, for example, that the surveillance system was confined to the public sector in some countries while in others only two conditions, gonorrhoea and syphilis, were reported.

In an effort to strengthen HIV/AIDS/STI surveillance, CAREC created a multidisciplinary team in 1999 called the “Surveillance Cluster” to assist the regional and national HIV/AIDS/STI surveillance systems. Its purpose was to improve more timely and accurate reporting systems.

The “Surveillance Cluster” convened a regional meeting to discuss the strengths and weaknesses in CMCs’ HIV/AIDS/STI Surveillance systems and at the end of the consultation, the group concluded that a minimum surveillance package should include:
  - “Individual case reporting of new HIV-infections, AIDS cases and HIV-related deaths, using a standardised report form with clinical socio-demographic behavioural and case variables to permit individual follow-up and trend analysis of behaviour and care indicators
  - Syndrome-based STI reporting genital discharge in males; genital ulcer by age group
  - Sentinel serological and behavioural surveillance among specific groups (antenatal and STI clinic attenders, people living with HIV/AIDS, young people and MSM”)

The consultation concluded that such a system would need to research specific topics, for example, quality of care and support, environmental determinants of HIV/STI risk and societal response, human rights and inventory of behavioural research. There should also be standardised reporting and trend analyses at the regional level and regular updates in the status and trends.
To aid in the strengthening of surveillance systems of HIV/AIDS/STI, CAREC produced three documents:

1. The third generation of "HIV/AIDS/STI Surveillance Guidelines". The main components of this guideline included: Case Reporting, HIV cases, AIDS cases, AIDS deaths, STI cases, HIV and STI Trend Assessments.
2. "The Guidelines on the Evaluation of HIV/AIDS/STI Surveillance Systems." In this guideline, the essential detailed steps are provided to measure in quantitative and qualitative terms, the functions and attributes of HIV/AIDS/STI surveillance systems.

At the start of this programme, CAREC had constantly tried to improve the reliability, quality and timely collection of data by holding workshops, training and consultations with national epidemiologists and other health workers at CAREC and in the CMCs. Yet, as late as 2006, it was stated that "Surveillance systems in the regions are as diversified as the countries themselves. Case surveillance systems in many of the CMCs suffer from some critical problems, including lack of standard data collection systems and instruments and the use of ad hoc patient coding systems to circumvent perceived problems with stigma and confidentiality in the health system. (CAREC Annual Report 2006)." Some specific problems were:

1. Human resource constraints and, where present, were inadequately trained.
2. Lack of standardisation and clear operational mechanisms. There was also lack of proper monitoring as well as lack of emphasis on the utilisation of the data.
3. An inadequate IT budget.
4. Lack of appreciation of reporting to CAREC on a timely basis.
5. Increased workload.
6. Technical feedback to CMCs was inadequate.

ii. Diagnostic and Clinical Management

1. Diagnostic Services

Early in the AIDS epidemic, CAREC’s laboratory had been assisting member countries in the diagnostic aspects of the programme. The CAREC laboratory assessed test kits and conducted trainings. There was a demand for 'on-the-bench' training in the enzyme-linked immunosorbent assay (ELISA). The demand was met by CAREC through the training of technicians in medical laboratories and national blood banks. During the training, lectures and discussions were held on AIDS and HIV infections and it was because of this training that 18 of 19 CMCs were able to perform HIV screening as early as 1988.

The training on ELISA to CMCs did not escape the scrutiny of CAREC’s Scientific Advisory Council of 1988 which recommended that all Government laboratories should participate in proficiency tests conducted by CAREC. In 1988, a panel of eight sera was sent to 15 laboratories offering HIV testing. All but one replied, and all 14 identified the eight sera correctly. Subsequently, proficiency tests became a routine programme of CAREC and participating laboratories.

Despite the fact that most countries now had suitably trained technologists to perform HIV ELISA tests some deficiencies were noted in 1989. For example, there were difficulties in the laboratory diagnosis of opportunistic infections. There were also difficulties in referring samples to CAREC for HIV supplementary tests and there was a need for an HIV rapid assay, especially in emergency situations where no blood bank was maintained.

To overcome some of these difficulties, three workshops were held for "Rapid Diagnostic Techniques for Opportunistic Infections" coordinated by Dr Barbara Hull and Ms Esther de Gourville, which afforded laboratory personnel from CMCs the opportunity to gain knowledge and become experienced in three commercial HIV assays: Recombigen Latex Agglutination Test, HIV-CHECH and Serodia HIV Test. The third workshop was on the Polymerase Chain Reaction (PCR), which was a collaborative effort between the Pasteur Institute and CAREC. Because of limited space and resources, the workshop was attended only by participants from Barbados, Bahamas and Trinidad and Tobago.

In 2006, CAREC extended its training through workshops on the CD 4 technology. It not only trained technicians but also provided Fascount machines to make the CD4 technology to the region. Following the workshops, Quality
Assurance procedures were further supported through the introduction of a CD4 panel proficiency-testing programme.

Quality assurance of laboratories was an on-going project of the CAREC laboratory. The objective was to determine the availability of all the basic HIV-related tests to support HIV prevention, care and treatment of patients. It was also intended to identify gaps in quality procedures, standards and equipment. Gaps in the process were identified and feedback provided to CAREC.

2. Clinical Management

In 1992, CAREC held a workshop for participants from the CMCs to discuss how to adapt the WHO guidelines on clinical management in a Caribbean setting. A manual on this was tested in the CMCs and eventually published in 1994. In the meantime, assessments of services for the treatment of STIs in some of the CMCs were being made to determine the level of clinical capabilities available and perhaps the need for further training. In fact, two workshops/clinical update seminars were held for clinicians and nurses in the management of STIs in St Kitts and Nevis, and Guyana. Later, training was carried out in Antigua and Barbuda, Bahamas, Belize, and the Turks and Caicos Islands.

Training modules for the clinical management of HIV infections were developed in 1995. Clinicians and counsellors attended two sub-regional workshops for the clinical management of HIV/AIDS in adults and children. Participants came from all CMCs and the expectation was that the information learnt would be disseminated in their respective countries.

In the Caribbean, it was known that the interval between the first onset of symptoms and death was between two to three years. Analysis of the data in 1997 showed that this had not changed during the previous five years. To address this problem, CAREC assembled a group of regional experts drawn from CMCs, PAHO, CAREC, GTZ and FTC to review The CAREC Guidelines for Clinical Management of HIV Infection in Adults and Children. Some key issues were the use of zidovudine (AZT) for the prevention of mother to child transmission, and the use of anti-retroviral agents. The review of the guidelines also set out the best practices for the treatment and prevention of opportunistic infections. CAREC also developed an attachment programme for Caribbean practitioners on HIV/AIDS clinical management and used the Princess Margaret Hospital in Nassau, Bahamas because of the specialised care provided to HIV/AIDS patients.

Training sessions on STD case management were conducted in Grenada and St Vincent and the Grenadines. The workshops placed emphasis on history taking, examination, treatment, counselling and partner notification/contact tracing and reporting. In Grenada, a total of 38 health professionals consisting of physicians, public health nurses, nurse practitioners, counsellors and other health professionals participated in the programme. The workshop in St Vincent and the Grenadines was attended by 25 nurses involved in reproductive health programmes.

By 1999, the "CAREC Guidelines for the Clinical Management of HIV Disease", first published in 1994, was revised through consultations with a group of Caribbean physicians. This became necessary because of recent major advances in the diagnosis and treatment of HIV/AIDS. Consideration was also given to the management of opportunistic infections on an aetiological or syndromic/empirical basis, but also to treatment with anti-retrovirals with the necessary laboratory support. The Guidelines defined the minimum standards of care that should be given to people living with HIV/AIDS because of varying diagnostic and treatment capacities in the varying health institutions in the CMCs. To ensure minimum standards were met, training was given to medical students, clinicians and other health personnel.

There were other guidelines produced by CAREC:

i. Home and Community-based care for People living with HIV/AIDS.
ii. Clinical Management of HIV disease
iii. Reducing Mother to Child Transmissions of HIV in the Caribbean
iv. Voluntary Counselling and Testing

There was training and technical guidance on the use of the guidelines in CMCs, including the following aspects of quality management of
people living with HIV/AIDS:

- Treatment of opportunistic infections
- Prophylactic measure for opportunistic infections in PLWHA
- Inclusion criteria for anti-retroviral (ARV) treatment
- Different ARV regimens and their benefits
- Key markers (laboratory and clinical) to be followed up and
- Key strategies to ensure that side effects and adherence to treatment are measured and HIV resistance to ARV is prevented or minimised.

In 2004, CAREC created Listserv which connected all Caribbean HIV experts which, in turn, facilitated the sharing of knowledge and information in the area of treatment, and also created a database to monitor the number of people in treatment in 23 countries. By the end of the third quarter in 2004, a total of 6,461 of people living with HIV/AIDS were on anti-retroviral therapy. By 2006, it was estimated that about 50,000 persons needed treatment with anti-retroviral drugs and that about 24,000 had access to treatment.

Mother to Child Transmission
Guidelines were developed in 1998 for the reduction of mother-to-child transmission of HIV in the Caribbean using a short course of treatment with zidovudine and avoiding breast-feeding. Another anti-retroviral drug - nevirapine - was introduced in 1999. The WHO’s “Clinical Guide for the Management of Pregnant Women with HIV” was tested in collaboration with health workers in the Bahamas and Guyana.

3. Information, Education and Behavioural Intervention Services

As early as 1987, the WHO developed its Special Global Programme on AIDS and designated CAREC as one of its Global Networks. It made a special grant to support the “Caribbean AIDS Education and Information Exchange (EIEC) in 1988. The purpose of the EIEC was to support national educational programmes and to promote the interchange of educational experiences and materials. In 1989, the EIEC appointed an Information Officer and a significant amount of information on a wide range of issues relevant to AIDS was identified and circulated to Member Countries. This material included print or audio/video items and was regularly updated.

The EIEC also provided information on AIDS epidemiology and prevention to parent teachers’ associations, non-governmental groups and others on an ongoing basis. There was also the development of materials for radio spots which were aired throughout member countries.

Although the WHO closed all its information “Centres” in 1990, CAREC was able to continue to provide significant support to national AIDS programmes. For example, they were able to give technical assistance to member countries in the development of educational materials for special events such as carnival; the development of AIDS newsletters and continuation of CAREC’s “AIDS Window”. A technical assistance programme on communications and behavioural interventions with the US Centers for Disease Control and Prevention helped CAREC’s SPSTI to reorganise and assist NAPs in 1993. This improved Information Management System was transferred to select CMCs. This was started with Grants for community education projects in the British Virgin Islands, Guyana and Trinidad and Tobago. There was also the collaboration with the Caribbean Family Planning Affiliation in the production of two sets of radio and television spots targeting males and sexually active youths. The SPSTI also directed and produced an animated condom-use television spot, as well as a television documentary on the theme “A Time to Act.”

In order to have a basis for designing communication and behavioural interventions, Systems Caribbean, a market research company, carried out surveys on Knowledge, Attitudes and Practices in HIV/AIDS in Dominica, Antigua and Barbuda, Montserrat and the British Virgin Islands on behalf of CAREC. From the data obtained, there was a recurring theme that people perceived constant pressure to have sex and felt powerless to resist because of the expected negative consequences. There were follow-ups in these countries by CAREC with technical
assistance from the CDC in helping staff of the NAP to interpret the research data and identify areas for further investigations.

The Regional media had also been helping the public to understand the nature of the HIV pandemic and CAREC collaborated with regional media organisations such as the Caribbean Media Workers Association, the Caribbean Broadcasting Union (CBU) and the Caribbean News Agency (CANA), which resulted in increased levels of cooperation between the media and the Caribbean AIDS prevention programmes. CAREC also provided technical and financial support for journalists employed by media houses to attend a two-week course on “Responsible Reporting on AIDS/STD” which was held at the Caribbean Institute of Mass Communications. Thirteen participants from ten member countries attended. Broadcasters, too, were not omitted, as a workshop sponsored by the PANOS Institute of Washington, DC was held in St Lucia in 1995, which facilitated the production of radio materials on HIV/AIDS. The workshop was attended by 14 broadcasters from 12 countries.

In an effort to intensify its efforts to provide timely, accurate and relevant information to the media, CAREC SPSTI staff met with executives of the General Assembly of the CBU in the Bahamas as well as the executives of CANA in Barbados to advocate the production of a number of SPSTI radio and television programmes. A number of radio and television programmes were transmitted live to audiences in the Caribbean for World AIDS Day in 1998. Some of these included:

1. A one-hour programme titled, “The Caribbean Force”
2. A one-hour panel discussion on a special edition of CBU’s weekly programme “Talk Caribbean”
3. A one-hour special radio programme in collaboration with CANA and Glaxo Wellcome
4. A 15-minute segment morning programme “Wake-up Caribbean”
5. Appearances on the “Morning Edition,” “The Issues Live,” “Hard Core” and “It’s Your Turn” transmitted live to audiences in Trinidad and Tobago

Interaction with the print media resulted in full-length features on “The Economic Impact of HIV/AIDS on Caribbean Countries” and “Reducing Mother to Child Transmission of HIV”

As a consequence of this advocacy, there had been a noticeable shift in regional media from the more generic and global treatment of HIV/AIDS to the more specific and relevant situation in the Caribbean.
CAREC had been strengthening these alliances in an effort to support its information, education and communication strategies for behavioural change as essential components in reducing risk of HIV infections among vulnerable groups. CAREC’s messages on the HIV/AIDS epidemic - including its economic impact on prevention and care issues, incorporating matters such as creating a more enabling environment for people living with HIV/AIDS and the role of governments, found space in broadcasting systems in several Caribbean countries and had gone even farther afield on the Voice of America, United Nations Radio and the BBC Caribbean Service.

Together with the Association of Caribbean Media, CAREC worked to record success stories in the Bahamas and Barbados. Ten-minute documentaries were produced for each country and aired in the annual CAREC’s annual Pan Caribbean World AIDS Day as special television features.

Finally, in 2006, CAREC collaborated with the Kaiser Foundation to organise a major meeting with the executives of Caribbean electronic media to discuss ways in which radio and television could be used in reducing the spread of HIV/AIDS. The meeting was held in Barbados and more than 50 managers attended. The result was that the broadcasters themselves were spearheading initiatives to assist in the prevention and control of HIV/AIDS.

CARIBBEAN AIDS TELECOMMUNICATION NETWORK (CATIN)

In 1995, CAREC developed a new information system for National AIDS Programmes (NAP) through the formation of the Caribbean AIDS Telecommunication Information Network (CATIN). It was a fast and cost-effective manner for disseminating information on HIV/AIDS/STI. It provided storage, retrieval and dissemination of information within the NAP.

CATIN was introduced to Antigua and Barbuda and Dominica in 1996 and a further three countries by 1998. This involved advocacy in the countries, needs assessments, installation of computer equipment and software, training of staff to operate the computerised network and the development of guidelines and procedures to ensure sustainability. This enabled the countries to have the capability to electronically download and systematically store information on HIV/AIDS, which allowed better information sharing, education and communication with the wider community.

By 2006, CAREC had provided computers and training for 12 NAPs. In 2006 too, there was a shift to take advantage of all the capabilities offered by the World Wide Web and to have the CATIN website as the prime link to the NAPs.

Behavioural Change Promotion

1. Youth

From the inception of the HIV/AIDS programme CAREC had provided education with a view to altering behaviour through technical and financial assistance. Thus, in 1995, a programme was initiated to reduce the risk of HIV/AIDS transmission in children – aged 10-12 in Antigua and Barbuda. The specific aim here was to advocate the delaying of the onset of sexual activity by increasing communication skills such as negotiation, refusal and acceptance of refusal, and the building of self-esteem. This project had the full support of the Ministries of Health and Education and of parents.

In 1997, two other projects were started for adolescents and young adults. One of these projects was done in Trinidad and the other in Tobago. In Trinidad, CAREC worked with RapPort, the National AIDS Programme’s youth education and outreach centre to strengthen its programme operations as well as its school-based peer education activities. In Tobago, the project combined peer-education in schools as well as parent education and mentoring, and community outreach.

There was also community mobilisation, through the Toco Foundation, in rural villages in Toco, Northeast Trinidad. Here, young people were trained by CAREC staff in the design and implementation of research in which they identified opinions of the community leaders and the knowledge, attitudes, beliefs and practices of secondary schools on HIV/AIDS. Materials produced by CAREC were used in broadcasts on the community radio station - Radio Toco. The work of the young people of Toco and the Toco Foundation was recognised in Melbourne,
Australia with the Commonwealth Award for Action on HIV/AIDS.

Life After School Projects
In 1999, a programme called “Life After School” was started in Antigua and Barbuda. It took the form of a fair which targeted school leavers. Hundreds of children attended the fair which consisted of booths providing exposure to information on HIV/AIDS/STI, as well as information, entertainment and advice on issues of sexuality, careers, further education, sports and parenting, using games and popular theatre. CAREC provided technical and financial assistance and was a partner in planning the fair with other stakeholders.

2. Men Who Have Sex with Men
In 1995, a research initiative was started on “Men Who Have Sex with Men (MSM)” to determine the sexual practices which put gay men at risk of HIV/AIDS infection, the impact of HIV/AIDS on gay men, and to identify the problems faced by HIV-infected gay men on accessing health care and maintaining a healthy lifestyle. These studies were conducted in Antigua and Barbuda, Dominica, St Kitts and Nevis, and St Vincent and the Grenadines. One of the outcomes of this study was the production of a technical report identifying interventions and policies to prevent and reduce the spread of HIV among MSM in the Eastern Caribbean. CAREC also produced and distributed television and print materials to CMCs. Another outcome was the updating of the play “One of Our Sons is Missing” by AIDS activist and playwright, Mr Godfrey Sealy. The play deals with the issue of bi-sexuality and HIV transmission and the value of a supportive environment. In addition to the production of materials for dissemination, CAREC held workshops to build leadership and facilitation skills for the MSM community for the prevention of HIV.

3. Commercial Sex Workers
In the early days of the HIV/AIDS epidemic in the Caribbean, MSM were the ones who were affected. However, as the epidemic gained momentum increased numbers of women became infected. In 1997, CAREC targeted women in the sex trade for priority attention in the HIV/AIDS prevention thrust. Two projects, one in Guyana and the other in Barbados targeted female sex workers to promote safer sexual practices using a health promotion and risk reduction strategy through the use of condoms.

4. Campaign Against Stigma and Discrimination
CAREC had been campaigning against stigma and discrimination of People Living with HIV/AIDS since 1999. To further this cause, CAREC brought together 30 health care providers from six CMCs in a workshop to expose them to HIV/AIDS sensitisation.

5. Training of Trainers Intervention
The objective of this intervention was to achieve equity and reduction of stigma and discrimination against people living with HIV/AIDS in the health care delivery systems. Trainers became better sensitised to look at and address their own attitudes and beliefs while in contact with PLWHA. Countries which took part in this exercise included Antigua and Barbuda, Belize, St Kitts and Nevis, the Turks and Caicos Islands and Trinidad and Tobago. The Canadian Public Health Association made significant input in this workshop. A similar workshop was held in 2003 for the other member countries. Participants identified learning strategies as the most valuable tool they received. Another valuable outcome was being able to network with people from other countries, an increased awareness of the impact of stigma and discrimination on PLWHA, and the input of the PLWHA representative at the workshop.

6. Advocacy
With the HIV/AIDS epidemic showing no signs of abating, CAREC took steps in 1997 to hold advocacy consultations with national leaders to apprise them of the epidemic’s trends and the socio-economic impact in their countries. The people targeted were Prime Ministers, Presidents, Cabinet Ministers, Parliamentarians and other decision-makers from the private and public sectors. In addition to these national leaders, media representatives from the education system, youth and labour, plus other non-governmental organisations were invited to attend. The countries involved in the initial consultations were Guyana, Dominica, St Kitts and Nevis, Suriname, and Trinidad and Tobago. The presentations by CAREC dealt with the
trends of the epidemic of HIV/AIDS in each CMC, projections over the next 20 years, the value of community mobilisation, AIDS in the workplace and the role of the Media. The socio-economic impact the epidemic was having in countries was highlighted, as well as the fact that the problem was beyond the responsibility and capacity of the health sectors.

By 1998, national leaders recognised that HIV/AIDS was a growing national development issue and its impact went far beyond the realm of health. Governments began to react: Guyana doubled its 1999 AIDS budget; the Ministry of Health in Suriname allocated eight full-time positions to NGOs (for the sex workers programme); Trinidad and Tobago held the 2nd parliamentary meeting on AIDS, established an Inter-Ministerial AIDS Commission comprising six cabinet ministers, announced the deregulation of condom sales, introduced AIDS education in schools, and decided on proposed legislation to prevent discrimination and preserve the human rights of People Living with HIV/AIDS; Parliament in Dominica approved a National AIDS policy and strengthened district AIDS committees; senior staff from nine ministries in Antigua and Barbuda, as well as the private sector committed to putting HIV/AIDS high on the national agenda.

Several countries accepted CAREC’s suggestion to develop a national policy on the Prevention of Mother to Child Transmission of HIV/AIDS. CAREC also reached out to regional labour leaders in two workshops, one in Guyana and the other in Barbados. These people were sensitised to the trends and impact of the HIV/AIDS epidemic.
Introduction
The Expanded Programme on Immunisation (EPI) was established in the Americas at the XXV Meeting of the Directing Council of the Pan American Health Organization (PAHO) in September 1977. The initiative was to reduce morbidity and mortality due to common vaccine preventable diseases by developing and expanding permanent immunisation services within primary health care. These services existed to administer smallpox, tuberculosis, diphtheria, pertussis, tetanus and poliomyelitis vaccines, but the management system in the countries was unable to expand coverage to levels that would interrupt transmission of the vaccine preventable diseases. One exception was smallpox which was eliminated some decades before 1977 due to sustained compulsory vaccination over many years. In addition, vaccination coverage rates were neither recorded nor known, as there was no estimate or denominator of the population to be vaccinated. There was inadequate attention to ensure the vaccines were protected through a well-organised cold chain system to guarantee effectiveness when administered. Techniques of applying the vaccines were not always acceptable which resulted in unnecessary side effects and compromised immune response. Supervision was lacking and surveillance was not in place to determine impact of immunisation on the reduction of diseases for which vaccines were offered. Finally, there was no evaluation system in place to detect what progress was being made in increasing vaccination coverage to reach the target population.

Organisation
Shortly after the Resolution was passed by the PAHO/WHO Directing Council, Dr Ciro de Quadros, a PAHO/WHO Director of the Smallpox Eradication Programme in Ethiopia, was transferred in 1977 to set up and direct the first Expanded Programme on Immunisation Unit out of the PAHO/WHO Regional Office in Washington, DC. Among other responsibilities the office had to provide technical advice, administrative support and general guidance to the EPI programmes which were to be organised in the Region of the Americas, including the Caribbean.

In August 1977, Mr Henry Smith (Fig. 10.1), a WHO Technical Officer who had organised and managed a programme which successfully eliminated smallpox from Kenya in East Africa, was transferred to PAHO/WHO. He spent one month in PAHO/WHO Washington’s office where he was briefed and asked to develop a plan to organise and implement what was to be the birth of the Expanded Programme on Immunisation (EPI) in the Caribbean sub-region.

The late Dr Patrick Hamilton was Director of the Caribbean Epidemiology Centre (CAREC) in Port of Spain, Trinidad and Tobago at the time. He was contacted and welcomed the idea to house the EPI Office at CAREC. He agreed to provide support and cooperation in every way possible. He further reiterated that CAREC with its laboratory and epidemiological capabilities would be essential to the programme for analysis of specimens and assistance in the surveillance of the targeted diseases. He also agreed to provide some administrative support in addition to the office space.

Mr Henry Smith arrived in September 1977 and took up his assignment as Immunisation Officer for the Caribbean based at CAREC, Port of Spain, Trinidad and Tobago. The countries for which he was responsible was the same nineteen countries for which CAREC was established to serve viz: Anguilla, Antigua and Barbuda, The Bahamas, Barbados,
Belize, Bermuda, British Virgin Islands, Cayman Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Suriname, Trinidad and Tobago and the Turks and Caicos Islands. Outbreaks of paralytic poliomyelitis were detected in the Dominican Republic and the Bahamas in 1977. This was an opportune time for CAREC with the Immunisation Officer to mount a special display at the Caribbean Conference of Ministers for Health in Guyana, alerting them to the role of the EPI in disease control. This made an impact and support for the EPI in the Caribbean was increased.

Management
After evaluating the country programmes in 1978, the Immunisation Officer found that the following management requirements should be put in place and function routinely:

- Each country should designate an Expanded Programme on Immunisation Manager (EPI Manager). This person would be responsible for the management of the National Programme on a routine basis and work in close collaboration with the Immunisation Officer at CAREC. The individual should preferably be a senior public health nurse or doctor who was already working in maternal and child health care at the national level with management and supervisory skills. This was accepted and by the end of 1978, all the countries gradually designated their EPI Managers and submitted their names to CAREC. It should be noted that this individual was already a Ministry of Health staff who did not receive extra remuneration for this designation.
- The target population for immunisation should be estimated at the beginning of each year in each country. The figure should then be used at monthly intervals to monitor the progress of immunisation coverage rate and take action for improvement when progress was less than expected.
- Major efforts were made to ensure vaccines arrive from their manufacturers through a well-organized system which ensured they maintain their recommended low storage and handling temperatures at all times, prior to, and during administration (the cold chain system).
- There were occasions when children had to be turned away from health centres because vaccines were not in stock. It was therefore, necessary to carefully plan and order vaccines at the national level in sufficient quantities for distribution to all levels in a timely and orderly manner.
- Vaccine storage facilities and temperatures were inadequate and had to be improved and brought up to accepted standards.
- Cold boxes, vaccine carriers and other supplies required for transportation and storage of vaccines were insufficient, unsuitable and in some cases non-existent. This was an area where much was required to obtain funds and eventually necessary supplies. However, it should be noted that there was always a shortage of equipment and supplies in this particular area in many of the country programmes. This shortage was resolved in most cases by maximising the utilisation of what was available.
- Handling, storage and distribution of vaccines did not guarantee that efficacies were preserved, therefore, vaccine indicators and thermometers were required to monitor the process.
- Syringes, needles and sterilisation procedures were in some cases unsatisfactory. Disposable syringes with needles were gradually introduced into the various country programmes. By 1982, all countries were using disposable syringes and needles.

Yellow fever outbreak
In 1978, a yellow fever outbreak occurred in Trinidad. This resulted in the rapid introduction of yellow fever vaccine to persons living in the forested areas where the disease was detected and subsequently, within three months, over 85% of the total population of Trinidad was immunised and the outbreak had ceased. During the outbreak, the Government of Trinidad and Tobago, PAHO/WHO, CAREC and the EPI established an emergency committee, which implemented and coordinated all outbreak control measures. Weekly bulletins of progress were officially released in Trinidad and Tobago, to all Caribbean countries, and to PAHO/WHO for wider circulation.

Visitors travelling to and from Trinidad and Tobago were required to be immunised against yellow fever. PAHO/WHO, through CAREC, donated 30,000 doses of yellow fever vaccines, which were divided and distributed within seven days to all CAREC member countries to immunise would-be travellers to Trinidad. This was made possible
by Leeward Island Air Transport (LIAT) and British West Indies Airline (BWIA) who relaxed some of their rules to allow the Immunisation Officer to travel with and deliver the vaccine packages to the newly designated EPI Managers at their respective airports.

Since 1978, yellow fever vaccine became incorporated into the routine EPI in Trinidad and Tobago, and so far, there has not been any further outbreak of yellow fever in humans. Prior to 1978, local official records show that yellow fever outbreaks occurred in Trinidad every ten to fifteen years.

**PAHO/WHO revolving fund**

During the same year (1978) the PAHO Revolving Fund became operational. This fund was set up by PAHO to pool vaccines required for South and Central America as well as the Caribbean. The vaccine requirements for the entire region of the Americas, including the Caribbean, were estimated and ordered in advance by PAHO through a tender system from various reputable manufacturers. This initiative resulted in a significant reduction in the cost of vaccines. In some cases, the cost of some vaccines was reduced by 90% and the countries were assured of good quality vaccines delivered on time. In addition, the fund became a permanent system through which vaccines are still routinely purchased.

**Vaccine cold chain**

In addition to the PAHO/WHO Revolving Fund for the purchase of vaccines, it was imperative to ensure that the vaccines arrived in the countries through a well-organised cold chain system. This required that the vaccines be packed and shipped from the manufacturers to the countries at their recommended low temperatures. This was done. Manufacturers would inform countries through the PAHO/WHO Revolving Fund system three days in advance of the date when the vaccine would arrive in the country. The time and flight number of the airline on which their vaccines arrived would be forwarded to the country. In this way, vaccines could be collected promptly on arrival in their low temperature packages and taken to their respective cold chain storage facilities to ensure potency. From this point, countries distributed and administered their vaccines in a way that guaranteed potency and efficacy.

The first sub-regional meeting of senior nurses and EPI Managers was convened in St Kitts and Nevis in 1979 to explain the concept of EPI, targets and objectives, as well as to introduce and discuss in detail the contents of the five EPI Training Modules, viz: Introduction of the six targeted diseases, Vaccines, Cold Chain, Management and Evaluation. The EPI concept started with expanding immunisation services to include six diseases which were responsible for morbidity and mortality all over the world, mainly among children. The objectives were to eliminate or reduce these diseases through immunisation to the lowest levels possible. The six diseases were: diphtheria, pertussis, tetanus, poliomyelitis, measles and tuberculosis. The programme could further expand to include other diseases which were problematic in the countries and for which a safe effective vaccine was available.

**Measles vaccine introduction and USAID assistance**

Single antigen measles vaccine was introduced in the Caribbean EPI in 1979 and by 1980, all countries were administering this vaccine as part of their routine EPI effort. Also in 1979, USAID provided assistance to purchase cold chain equipment in 15 selected CAREC member countries that were unable to provide these essential requirements on a timely basis. In subsequent years (1980-1982), all nineteen countries received cold chain equipment provided through USAID.

**First EPI Managers meeting**

The first meeting for EPI Managers was held in Jamaica in 1981. This became an annual event held in a different country each year (Fig. 10.2.). The purpose of these meetings was to review their national plans of action using the group discussion approach, identify problems which affected progress, and develop new plans for the following year. Presentations and scientific updates were also given to acquaint managers with relevant developments in the area of immunisation.

**The graphic chart**

A graphic chart labelled CAREC/STAT-EPI-80-1 to monitor monthly immunisation coverage at all levels of the programme was developed in 1980 by the PAHO/WHO Immunisation Officer at CAREC. It has been accepted by PAHO/WHO as a useful tool to track and monitor immunisation coverage and was subsequently published in several PAHO/WHO documents and used in EPI programmes in many parts of the world. It has been used since 1981 to monitor immunisation coverage on a monthly basis in the Caribbean. (Table 10.1)

**Poliomyelitis outbreak**

An outbreak of poliomyelitis occurred in Jamaica in 1982 where were 58 reported cases. These were the last known cases of wild polio virus in the Caribbean sub-region. Prompt immunisation containment actions in collaboration with the Government of Jamaica and PAHO/WHO and EPI-CAREC, resulted in a successful termination of the outbreak during the same year 1982.
**THE EXPANDED PROGRAMME ON IMMUNISATION (EPI)** (continued)

**Poliomyelitis eradication launched**

In 1985, PAHO/WHO launched the initiative to eradicate poliomyelitis from the Americas by 1990 (Fig. 10.4). CAREC’s laboratory service was extended to include all Caribbean countries which required support in diagnosis through analysis of specimens. Suspected cases were investigated with containment actions as soon as possible (within 48 hours) and stool specimen submitted to CAREC within five days, if possible.

Each country was expected to provide to EPI/CAREC a report indicating whether or not poliomyelitis was suspected at the end of each week. When no suspected cases were detected, a nil report to EPI/CAREC was required to certify that there were no cases in that particular week. This was the beginning of an active sensitive surveillance system - Polio Eradication Surveillance System (PESS) - to standardise epidemiological surveillance with hospitals, health centres, health posts, etc., geographically distributed all over the countries to detect, report and investigate suspected cases with laboratory analysis and to implement necessary control measures. As a result of high vaccination...
coverage and the active sensitive surveillance, polio was last confirmed in Jamaica, and also in the Caribbean sub-region in 1982. Subsequently, PAHO/WHO certified polio eradication from the Region of the Americas, including the Caribbean, in 1994.

Measles elimination launched

In 1988, CARICOM Ministers of Health resolved to eliminate indigenous measles from the Caribbean by 1995. The Minister of Health of the Bahamas played a catalytic role. Immediately, the sub-regional office EPI/PAHO started to develop a Plan of Action with the necessary resources to achieve the objective.

One year later, in 1989, the Plan of Action was approved by the Immunisation Technical Advisory Group (TAG) of PAHO/WHO. It included promotional and social mobilisation activities to involve all health staff and communities. All children from 9 months to less than 14 years of age were to be vaccinated with the measles vaccine during the month of May 1991 irrespective of prior immunisation history or having suffered from measles. The term “Big Bang” was used by the Immunisation Officer to describe the largest number of children (1.9 million) ever targeted for immunisation within a short period (one month) in the Caribbean. During the two weeks from 1 to 15 June 1991 the countries used the time to revisit areas where children were missed due to illness or other reasons. In this way, mop-up vaccination was conducted and measles vaccination coverage was further increased. The resulting coverage was that 94% of the 1.9 million target population of children 1-14 years of age were vaccinated. Because measles transmission was occurring in the Caribbean among the children of this age group it was thought that if they were all vaccinated in the shortest possible time with measles vaccine, there would be no susceptibles remaining to sustain transmission of the disease.

After a month of promotional and social mobilisation activities by all members of the health teams, the launching took place at a special meeting held in Barbados during the last week of April 1991. Several Ministers of Health were present from the countries, as well as representatives from the EPI (PAHO) in Washington, DC, and CAREC/PAHO. Mr Paul Keens-Douglas, a well-known talk-show comedian in the Caribbean, made a humorous presentation and the Minister of Health, Barbados then formally launched the campaign.

In September 1991, an active Measles Surveillance System (MESS) of patients with fever and rash illness was set up in all the countries in addition to the already 1987 on-going polio surveillance. These two systems received reports of suspected polio and measles at weekly intervals with laboratory specimens, case investigation forms as well as actions taken by all the member countries at weekly intervals. EPI-CAREC then summarised the reports with laboratory results and submitted them to PAHO Headquarters.

The summary reports were also distributed weekly to all the countries. As a result of the campaign and measles vaccination mop-up activities, the last cases (472) of indigenous measles in the sub-region were confirmed from 12 countries in 1991 (Table 10.2).

Jamaica implemented their campaign activities in a different manner compared to other countries in 1988/89. Jamaica had an outbreak of measles in school children
and conducted measles mass campaigns (review and vaccination activities) in response. Therefore, in May 1991, they ensured that all children 9 months to 14 years had received at least one dose of the measles vaccine. There were no indigenous measles cases after vaccination activities in 1991 (Fig. 10. 6).

### Table 10.2. Last Known And Reported Indigenous Measles by Country in 1991

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>NUMBER OF CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anguilla</td>
<td>1</td>
</tr>
<tr>
<td>Turks and Caicos Islands</td>
<td>8</td>
</tr>
<tr>
<td>British Virgin Islands</td>
<td>4</td>
</tr>
<tr>
<td>Bermuda</td>
<td>2</td>
</tr>
<tr>
<td>Dominica</td>
<td>6</td>
</tr>
<tr>
<td>Grenada</td>
<td>2</td>
</tr>
<tr>
<td>St Lucia</td>
<td>2</td>
</tr>
<tr>
<td>Belize</td>
<td>7</td>
</tr>
<tr>
<td>Barbados</td>
<td>2</td>
</tr>
<tr>
<td>Guyana</td>
<td>12</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>118</td>
</tr>
<tr>
<td>Jamaica</td>
<td>308</td>
</tr>
<tr>
<td>TOTAL</td>
<td>472</td>
</tr>
</tbody>
</table>

**Immunisation coverage**

In 1978, an attempt was made to access information on immunisation coverage by country, but it was either very poor or unavailable as can be seen on Table 10.3. Subsequently, in 1994, coverage with the same vaccines in the same countries had made significant improvements as shown in Table 10.4.
### Table 10.3. Routine Immunisation Coverage in the English-Speaking Caribbean and Suriname 1978 (CHILDREN ONE YEAR OF AGE)

<table>
<thead>
<tr>
<th>Country</th>
<th>BCG 1</th>
<th>DPT 3</th>
<th>Polio 3</th>
<th>Measles 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anguilla</td>
<td>-</td>
<td>28</td>
<td>77</td>
<td>-</td>
</tr>
<tr>
<td>Antigua and Barbuda</td>
<td>-</td>
<td>60</td>
<td>53</td>
<td>-</td>
</tr>
<tr>
<td>Bahamas</td>
<td>90</td>
<td>94</td>
<td>99</td>
<td>45</td>
</tr>
<tr>
<td>Barbados</td>
<td>22</td>
<td>36</td>
<td>32</td>
<td>17</td>
</tr>
<tr>
<td>Belize</td>
<td>44</td>
<td>55</td>
<td>45</td>
<td>22</td>
</tr>
<tr>
<td>Bermuda</td>
<td>-</td>
<td>40</td>
<td>37</td>
<td>*60</td>
</tr>
<tr>
<td>British Virgin Islands</td>
<td>-</td>
<td>80</td>
<td>95</td>
<td>*85</td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>-</td>
<td>36</td>
<td>31</td>
<td>-</td>
</tr>
<tr>
<td>Dominica</td>
<td>-</td>
<td>55</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Grenada</td>
<td>-</td>
<td></td>
<td></td>
<td>15…</td>
</tr>
<tr>
<td>Guyana</td>
<td>21</td>
<td>47</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Jamaica</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montserrat</td>
<td>96</td>
<td>65</td>
<td>63</td>
<td>98</td>
</tr>
<tr>
<td>St Kitts and Nevis</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>St Lucia</td>
<td>32</td>
<td>24</td>
<td>32</td>
<td>-</td>
</tr>
<tr>
<td>St Vincent and the Grenadines</td>
<td>-</td>
<td>5</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Suriname</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turks and Caicos Islands</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Denotes vaccine not being administered in the Programme
--- Information was not available
* Measles vaccine was introduced in 1981
** MMR vaccine was in use

### Table 10.4 Routine Immunisation Coverage in the English-Speaking Caribbean and Suriname – 1994 (CHILDREN ONE YEAR OF AGE)

<table>
<thead>
<tr>
<th>Country</th>
<th>BCG 1</th>
<th>DPT 3</th>
<th>Polio 3</th>
<th>Measles 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anguilla</td>
<td>100</td>
<td>94</td>
<td>92</td>
<td>99</td>
</tr>
<tr>
<td>Antigua and Barbuda</td>
<td>-</td>
<td>100</td>
<td>100</td>
<td>92</td>
</tr>
<tr>
<td>Bahamas</td>
<td>-</td>
<td>91</td>
<td>91</td>
<td>88</td>
</tr>
<tr>
<td>Barbados</td>
<td>&gt;5</td>
<td>90</td>
<td>91</td>
<td>97</td>
</tr>
<tr>
<td>Belize</td>
<td>90</td>
<td>88</td>
<td>83</td>
<td>X 90</td>
</tr>
<tr>
<td>Bermuda</td>
<td>-</td>
<td>89</td>
<td>89</td>
<td>93</td>
</tr>
<tr>
<td>British Virgin Islands</td>
<td>97</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>97</td>
<td>95</td>
<td>96</td>
<td>93</td>
</tr>
<tr>
<td>Dominica</td>
<td>99</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Grenada</td>
<td>-</td>
<td>91</td>
<td>95</td>
<td>X 87</td>
</tr>
<tr>
<td>Guyana</td>
<td>94</td>
<td>90</td>
<td>90</td>
<td>X 83</td>
</tr>
<tr>
<td>Jamaica</td>
<td>100</td>
<td>93</td>
<td>93</td>
<td>X 82</td>
</tr>
<tr>
<td>Montserrat</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>St Kitts and Nevis</td>
<td>&gt;5</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>St Lucia</td>
<td>99</td>
<td>93</td>
<td>93</td>
<td>92</td>
</tr>
<tr>
<td>St Vincent and the Grenadines</td>
<td>99</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Suriname</td>
<td>-</td>
<td>74</td>
<td>71</td>
<td>X 69</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>100</td>
<td>85</td>
<td>85</td>
<td>86</td>
</tr>
<tr>
<td>Turks and Caicos Islands</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

>5 Denotes vaccine given to children 5 years and above in school
3 = Vaccine is not used in the national programme
X = MMR vaccine was in use. All others used MMR
Target group for measles coverage was children 12 – 23 months of age.
The Caribbean Epidemiology Centre: Contributions to Public Health 1975 - 2012

Table 10.5 shows the cases of tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis and measles reported in 1981. Table 10.6 shows the number of cases of the same diseases reported in 1994. With an active, weekly, high quality surveillance system in place to detect cases, it was possible to confirm that some diseases were no longer occurring. Poliomyelitis has not occurred since 1982, measles, since 1991, congenital rubella syndrome (CRS) since 1999 and rubella in 2001. Table 10.6 also shows no cases of tuberculosis or diphtheria detected and only six cases of tetanus and 16 cases of pertussis were reported in 1994. It is therefore, obvious that the high immunisation coverage which the countries achieved and sustained had the expected impact on disease reduction and elimination.

Expansion of the programme

Mr Henry Smith retired in 1995 after 30 years of service. He was given the PAHO/WHO Award of Excellence for serving and managing successful immunisation PAHO/WHO programmes (Fig. 10.7).

Dr Abdelmalek M Hashim took over direction of the Programme from 1996 to April 1997. He successfully ensured through his administration,
coordination and expertise from CAREC/PAHO, that all the EPI programmes in the sub-region continued to achieve their expected goals. After his tenure, Dr Beryl Irons (Fig. 2.9) took over in 1997. The Programme was expanded by the introduction of vaccines such as DPT/HepB/Hib (pentavalent) and pneumococcal. Other vaccines such as HPV were also considered, but the cost was prohibitive for the Governments of the countries. Most countries have now provided protection against at least 10 diseases in their national immunisation programmes. The ten diseases targeted were: tuberculosis, diphtheria, pertussis, tetanus, polio, measles, rubella, mumps, Congenital Rubella Syndrome and hepatitis B. Others such as haemophilus influenza type B invasive disease were also introduced.

Dr Irons subsequently became Director of CAREC in January 2010, but continued to support the EPI programme. She was assisted by Mr Primnath Riloe from Suriname and together they ensured the EPI programme maintained goals achieved and continued to progress.

After the measles mass vaccination campaign in 1991, and the two follow-up campaigns in 1996 and 2001 for children 1 – 5 years of age, it became evident that indigenous measles was eliminated (Tables 10.7 and 10.8). However, rubella persisted after 1991 in seven countries: Barbados, Belize, Bahamas, Guyana, Jamaica, Suriname, and Trinidad and Tobago. This could be attributed to rubella vaccine in the form of MR or MMR only being introduced during 1991 in some countries; and it was not until 1995 that all countries could afford to incorporate it in their national programmes. Therefore, most children had received measles vaccine up to 14 years of age, but not rubella. Consequently, rubella occurred in the children who did not receive MR or MMR. This pool of susceptibles infected a few younger ones who had no protection against rubella.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>TUBERCULOSIS</th>
<th>DIPHTHERIA</th>
<th>PERTUSSIS</th>
<th>TETANUS</th>
<th>POLIO</th>
<th>MEASLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANGUILLA</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ANTIGUA and BARBUDA</td>
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<tr>
<td>BAHAMAS</td>
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</tr>
<tr>
<td>BARBADOS</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BELIZE</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BERMUDA</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRITISH VIRGIN ISLANDS</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>CAYMAN ISLANDS</td>
<td></td>
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</tr>
<tr>
<td>DOMINICA</td>
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<tr>
<td>GRENADA</td>
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<td></td>
</tr>
<tr>
<td>GUYANA</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JAMAICA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MONTserrat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST KITTS and NEVIS</td>
<td></td>
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</tr>
<tr>
<td>ST LUCIA</td>
<td></td>
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</tr>
<tr>
<td>ST VINCENT and the GRENADINES</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SURINAME</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRINIDAD and TOBAGO</td>
<td></td>
<td></td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TURKS and CAICOS ISLANDS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>16</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A mass rubella campaign was launched in 1997 to 2001 for adults 20 – 39 years of age to catch up on those who were born before the introduction of rubella vaccine. This had an impact as the last indigenous case of rubella occurred in 2001 in Belize. The last case of CRS occurred in 1999 in Suriname.

Rubella prevalence data, rubella and CRS cost-benefit analyses and cost-effectiveness of the mass campaign were presented to the officials of the Ministries of Health of the Caribbean Community in April 1998. The Council for Human and Social Development of CARICOM, resolved that every effort would be made to eradicate Rubella and prevent the occurrence of new cases of CRS in the Caribbean Community by end of the year 2000.

The surveillance system for CRS was enhanced in 2004 when TORCH testing was added to increase sensitivity of the system. The TORCH test measures the levels of an infant’s antibodies against five groups of chronic infections: toxoplasmosis, rubella, cytomegalovirus (CMV), herpes simplex (HSV) and other infections.

The Integrated Surveillance Information System (ISIS) for Vaccine-Preventable Disease was designed to provide a mechanism for data collection, initially for cases of polio, measles, and rubella. The objective of the ISIS is to facilitate availability of epidemiological information through development of specific modules, standardised databases, reports and indicators, and electronic information transfers between different levels and countries. It also provides epidemiological analysis at different levels, promoting the use of standardised variables for person, time and place, and facilitates dissemination of epidemiological information for timely decision making.

**The six new member countries**

In addition to the original nineteen CAREC member countries, the following six Dutch-speaking islands became new members in 1999-2000: Saba, St Eustatius, Bonaire, Aruba, Curacao and St Maarten. Becoming one of the CAREC member Countries enabled them to access the technical cooperation in health that CAREC provided, such as laboratory services, epidemiology and immunisation. The 6th Annual Mini-EPI Managers’ Meeting of the Dutch Caribbean was held in September 2012 in St Maarten.

**Current Status**

The Immunisation Programme remains a priority programme of the countries of the Caribbean Community and health practitioners continue to provide the required service to achieve set goals.

The major emphasis for the last five years was the documentation and verification of the elimination of Measles, Rubella and CRS. Other areas receiving high priority for the region include:

- Maintaining and attaining vaccination coverage of 95% or greater in administered antigens.
- Advocacy for the introduction of new and under-utilised vaccines, (e.g. pneumococcal), assistance with preparatory activities and plans for introduction as necessary, and maintaining and enhancing an effective, timely surveillance system to identify suspected cases for Mumps, Rubella, CRS and Acute Flaccid Paralysis (AFP).
### Table 10.8 Summary of Achievement of Vaccination Strategies for Measles Elimination by CAREC Member Countries

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>CAMPAIGN 9 mths-14 yrs (Catch - up)</th>
<th>AVERAGE ROUTINE COVERAGE 2001-2009 (Keep Up)(%)</th>
<th>2000-2001 CAMPAIGN 1-4 yrs (Follow-up)</th>
<th>INTRODUCTION OF ROUTINE MMR2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year</td>
<td>Coverage (%)</td>
<td>Year</td>
<td>Coverage (%)</td>
</tr>
<tr>
<td>ARUBA</td>
<td></td>
<td>Not done</td>
<td>93</td>
<td>2001</td>
</tr>
<tr>
<td>BAHAMAS</td>
<td>1991</td>
<td>87</td>
<td>91</td>
<td>2001</td>
</tr>
<tr>
<td>BARBADOS</td>
<td>1991</td>
<td>96</td>
<td>91</td>
<td>2001</td>
</tr>
<tr>
<td>BELIZE</td>
<td>1991</td>
<td>82</td>
<td>95</td>
<td>2000</td>
</tr>
<tr>
<td>BERMUDA *</td>
<td></td>
<td>The group was already vaccinated</td>
<td>89</td>
<td>2001</td>
</tr>
<tr>
<td>BONAIRE</td>
<td></td>
<td>Not done</td>
<td>98</td>
<td>2001</td>
</tr>
<tr>
<td>BRITISH VIRGIN ISLAND</td>
<td>1991</td>
<td>90</td>
<td>92</td>
<td>2000</td>
</tr>
<tr>
<td>CURAÇAO</td>
<td></td>
<td>N/A</td>
<td>93</td>
<td>2001</td>
</tr>
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<td>DOMINICA</td>
<td>1991</td>
<td>95</td>
<td>99</td>
<td>2000</td>
</tr>
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<td>GRENADA</td>
<td>1991</td>
<td>98</td>
<td>95</td>
<td>2000</td>
</tr>
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<td>JAMAICA</td>
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<td>84</td>
<td>84b</td>
<td>2000</td>
</tr>
<tr>
<td>SABA</td>
<td></td>
<td>Not done</td>
<td>98</td>
<td>2001</td>
</tr>
<tr>
<td>ST EUSTATIUS</td>
<td></td>
<td></td>
<td>98</td>
<td>2001</td>
</tr>
<tr>
<td>ST LUCIA</td>
<td>1991</td>
<td>97</td>
<td>94</td>
<td>2000</td>
</tr>
<tr>
<td>ST MAARTEN</td>
<td></td>
<td>Not done</td>
<td>99</td>
<td>2001</td>
</tr>
<tr>
<td>ST VINCENT and the GRENADINES</td>
<td>1991</td>
<td>98</td>
<td>98</td>
<td>2000</td>
</tr>
<tr>
<td>SURINAME</td>
<td>1991</td>
<td>89</td>
<td>83</td>
<td>2000/1</td>
</tr>
<tr>
<td>TRINIDAD and TOBAGO</td>
<td>1991</td>
<td>95</td>
<td>91</td>
<td>2001</td>
</tr>
<tr>
<td>TURKS and CAICOS</td>
<td>1991</td>
<td>100</td>
<td>95</td>
<td>2000</td>
</tr>
</tbody>
</table>

a) Bermuda started using MMR vaccine in the 1970’s and did not conduct a “catch-up” campaign.
b) For Jamaica coverage in 2003 and 2007 was less than 80%, mop-up activities were done in 2008. Data not included in the calculation.

For countries not conducting “follow up” campaigns, coverage is calculated for “routine 2nd dose and MMR 1 dose for the Dutch Antilles.”
The initial 19 English-speaking countries and Suriname continue to report surveillance data on a weekly basis. French Guyana started in 2003 and continues to report on time. The Dutch-speaking islands started in 2001, while the French-speaking islands, including St Martin started weekly reporting in 2010.

There are 728 reporting sites in the CAREC Member Countries. The surveillance indicators for 2011 revealed that:

- 99% sites reported weekly
- 99% received laboratory results in less than 4 days
- 97% of specimens of specimens discarded by laboratory testing
- 99% of cases were investigated within 48 hours
- 96% had adequate specimens taken
- 35% had specimens received at CAREC in less than five days

Surveillance and immunisation awards

An annual Caribbean Surveillance Award was established to recognise countries that had performed outstandingly on the surveillance component of their programme during the previous year. The award is based on two main criteria: on-time reporting and the percentage of sites reporting to CAREC. The award consists of a certificate and the inscription of the name of the country on a plaque that is kept by the winning country during the following year and until a new country is selected to receive the award. The award is announced during the annual EPI Managers’ meeting.

The Henry C Smith Immunisation Award was established in 2004 in honour of Mr Henry C Smith, the first PAHO-EPI technical officer for the Caribbean sub-region. His service in the sub-region spanned 18 years from 1977 to 1995. The immunisation trophy is awarded to the country that has made the most improvement in EPI and is presented at the end of the EPI Managers’ Meeting each year. The award was established in 2001 by EPI-CAREC on behalf of the Family and Community Health, Immunisation Unit at PAHO.

In September 1994, at the PAHO/WHO Regional Office in Washington, DC, the declaration of poliomyelitis eradication from the Region of the Americas, including the Caribbean, was announced by Dr Frederick Robbins, Chairman of the International Expert Committee for Poliomyelitis Eradication.

Donor agencies

There is no doubt that the EPI office at CAREC is a success story in providing technical assistance and coordinating CAREC Member countries in improving their immunisation programmes. The countries have also benefitted significantly from donor agencies through CAREC. PAHO/WHO provided technical staff and guidance from its Regional Office in Washington, DC, as well as funding. UNICEF provided many supplies and much equipment, USAID assisted with vaccines and some cold chain supplies, Rotary International provided polio vaccines for a number of years to all the countries, and the Canadian Public Health Association (CPHA) provided a specially equipped Land Rover with amenities such as hand-washing, designed for mobile outreach vaccination programmes. (Fig.10.8). In addition,
The Expanded Programme on Immunisation (EPI) was started with the appointment of an immunisation officer to organise, coordinate and provide technical assistance and cooperation to the countries.

Revolving fund for EPI was approved to be established by PAHO. By the end of 1978, 13 countries from the English-speaking Caribbean had become members of the fund.

All countries designated a manager to implement and coordinate the effort at the national level.

First EPI Course in planning, management and evaluation was held for 34 senior nurses from 5 to 14 December in St Kitts. Sub-regional workshop for programme managers held at CAREC, Trinidad from 9-13 June 1980. The main objective was to improve immunisation coverage through better planning, management and evaluation procedures. Introduction of monitoring form for immunisation coverage throughout the English Speaking Caribbean and Suriname.

First EPI Managers' Meeting was held in Jamaica from 14 to 18 September. Suriname - last vaccine associated case of poliomyelitis in the sub-region.

Jamaica - last confirmed case of poliomyelitis reported in the sub-region.

PAHO/WHO launched initiative to eradicate poliomyelitis from the Americas by 1990. CARICOM Ministers of Health resolve to eliminate indigenous measles by 1995.

Plan of Action for measles elimination in the Caribbean approved by PAHO Technical Advisory Group.

Jamaica - social mobilisation plans developed to support the measles elimination initiative.

Measles Mass Vaccination Month "the Big Bang" to eliminate indigenous measles from the sub-region

Last two confirmed cases of indigenous measles reported in the sub-region.

Measles Surveillance System was established, commencement of weekly reporting of suspected measles cases. First measles-free year in the English Speaking Caribbean and Suriname.

The sub-region certified Polio Free by PAHO/WHO.

The Western Hemisphere certified Polio Free by PAHO/WHO.

Five years without confirmed transmission of indigenous measles.

CARICOM Ministers of Health resolve to eliminate rubella and congenital rubella syndrome (CRS) by the year 2000.

Conclusion
Governments and populations are to be commended for their commitment and for ensuring that the vaccines are provided for its people, and in maintaining their countries free of indigenous cases of Measles, Rubella and CRS. The EPI continues to make progress while facing major constraints to increase and sustain high coverage for administered vaccines. Introduction of new and underutilised vaccines are major priorities, but the financial status of countries is a limiting factor.

Countries need, too, to be on the alert for the risk for the re-emergence of Measles and Rubella, and in this regard, the recommendations from the documentation and verification for the elimination of Measles, Rubella and CRS will be implemented. All healthcare providers will be involved in regular updates and sensitisation on the surveillance system.
Since the last indigenous case of measles, seven (7) imported cases have occurred to date, 2008.

CAREC Member Countries continue to remain free of measles, rubella and congenital rubella syndrome, with a high quality active surveillance system in place.

Appendix

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>EPI MANAGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANGUILLA</td>
<td>Nurse Vida Lloyd</td>
</tr>
<tr>
<td>ANTIGUA and BARBUDA</td>
<td>Nurse Inita Wallace</td>
</tr>
<tr>
<td>BAHAMAS</td>
<td>Dr Cora Davis</td>
</tr>
<tr>
<td>BARBADOS</td>
<td>Dr Vaughan Wells</td>
</tr>
<tr>
<td>BELIZE</td>
<td>Dr William Harley</td>
</tr>
<tr>
<td>BERMUDA</td>
<td>Nurse Diane Simons</td>
</tr>
<tr>
<td>BRITISH VIRGIN ISLANDS</td>
<td>Nurse Tatica Scatliffe</td>
</tr>
<tr>
<td>CAYMAN ISLANDS</td>
<td>Nurse Jacqueline Creary</td>
</tr>
<tr>
<td>DOMINICA</td>
<td>Nurse Olivia Williams</td>
</tr>
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<td>GRENADA</td>
<td>Nurse Cynthia Telesford</td>
</tr>
<tr>
<td>GUYANA</td>
<td>Nurse Enid Cholmondley</td>
</tr>
<tr>
<td>JAMAICA</td>
<td>Dr Alma Dyer</td>
</tr>
<tr>
<td>MONTSERRAT</td>
<td>Nurse Florence Daley</td>
</tr>
<tr>
<td>ST KITTS and NEVIS</td>
<td>Nurse Diana Francis-Delaney</td>
</tr>
<tr>
<td>ST LUCIA</td>
<td>Nurse Noreen Goddard</td>
</tr>
<tr>
<td>ST VINCENT and the GRENADINES</td>
<td>Nurse Stacey McKie</td>
</tr>
<tr>
<td>SURINAME</td>
<td>Dr R Godfried-Kranenburg</td>
</tr>
<tr>
<td>TRINIDAD and TOBAGO</td>
<td>Dr Norma Andrews</td>
</tr>
<tr>
<td>TURKS and CAICOS ISLANDS</td>
<td>Nurse Thelma Taylor</td>
</tr>
</tbody>
</table>

Note: All are first designated EPI managers
CONCLUSION

CAREC served its Member Countries faithfully and diligently for 37 years from 1975 to 2012. At the beginning of that time the general impression was that health workers in the Caribbean were working in isolation in their own country doing what was necessary, but staff morale was certainly not high. A common cry among health workers was the need for more training.

CAREC remedied that by bringing various categories of staff to CAREC for training over its 37 years of existence. Training was offered to all categories of health staff including: medical doctors, medical students, nurses, public health inspectors, statistical officers, laboratory technicians, medical records clerks, nursing students, administrative assistants, nutritionists, veterinary public health assistants, food handlers, rodent control officers and agricultural extension officers. When the HIV/AIDS epidemic hit the Caribbean, training and education were not only offered to health workers, but also to the general Caribbean public. First, it was the epidemiologists who were brought to CAREC for training in epidemiology, data collection and statistical methods which became standardised and useful. Now the data could be used and compared with other CAREC Member Countries which allowed proper planning in the health field.

It was soon discovered that those designated as epidemiologists were bogged down by too many administrative duties, so senior public health inspectors and senior public health nurses were trained to become “deputy epidemiologists”. This worked for quite sometime with some country’s staff becoming quite expert in this activity. Many of them investigated epidemics in their own countries and relied only on telephone discussions with CAREC’s staff.

CAREC epidemiology and laboratory staff worked closely together to improve the health status of the countries. It was always a partnership in improving the health status of each country. For several years, in order to better achieve coordination, country staff and epidemiologists were brought to CAREC for one-week sessions where common problems were discussed and resolutions made. Caribbean Medical Laboratory technicians were able to improve their skills by being provided with training in areas such as, bacteriology, parasitology, entomology and virology. Some of these were conducted at CAREC and others in some of the countries. The CAREC-EPI immunisation programme was able to eliminate poliomyelitis and measles from the sub-region, which has been maintained to this day.

In the food-borne diseases programmes CAREC assisted staff in the CMCs to develop surveillance systems and laboratory capacity in order to promote food safety in the Caribbean, particularly as CMCs depend heavily on tourism.

Quality testing of Caribbean medical laboratories revealed an unacceptably high level of errors. To remedy this problem a grant from the European Development Fund was received to assist in improving the skills of technicians. At the end of the four-year project an Evaluation Team stated that “In some cases, stakeholders gave passionately positive feedback e.g. “the training changed my life”. Much of the success was due to the strength of SMLC CAREC/PAHO leadership and credibility on this project.

When the HIV/AIDS epidemic hit the Caribbean in the 1980s a large portion of the work and resources were diverted in that direction with a concomitant sharp rise in the Centre’s budget as the epidemic progressed.

Research that concentrated on regional problems was also spectacular as judged by the number of publications in peer-reviewed publications. At every five-year review of CAREC’s work plan the stakeholders gave it their approval until 2012 when CAREC was absorbed into the Caribbean Public Health Agency (CARPHA).

The new CARPHA has inherited a rich work ethic and professionalism which, if properly encouraged and maintained, should augur well for Caribbean health in the future.
13.1. NEWSLETTERS

CAREC Surveillance Report (CSR) and the Caribbean Communicable Disease Feedback Report (CDFR)

In March 1975, CAREC, through its Epidemiology Unit, started a publication called CAREC Surveillance Report (CSR). The purpose of the CSR was to provide information on health conditions, disease surveillance and reports on outbreaks of disease in a timely basis to health personnel in CAREC Member Countries (CMCs). The CSR was started three months after CAREC was established and was printed by a commercial printer. By July 1975, CAREC acquired its own printing facilities and printed not only the CSR, but also other documents of the Centre. Initially, about 500 copies were printed but by 1978, 2300 copies were printed, which grew to 3,000 copies. The publication was monthly and usually, there was a main article written by CAREC staff or health personnel from other Caribbean countries. It also contained a Table of Notifiable Diseases, compiled from reports from CMCs. The CSR ceased publication in 1994 but it was re-issued in April 2002 on a quarterly basis. During this period, the Communicable Disease Feedback Report (CDFR) was produced. The distribution list for these publications included Chief Medical Officers, National Epidemiologists, Surveillance Officers, Non-Communicable Disease Coordinators, Mortality Coders, Expanded Programme of Immunisation Managers, AIDS Secretariat Coordinators, National Laboratories, Private Laboratories and PAHO Offices in Washington and the Region, and many others. The publications subsequently became available on CAREC/PAHO’s website.

Epi Notes

“Epi Notes” was a periodic newsletter highlighting certain health problems as the need arose. For example, when an outbreak of yellow fever occurred in Santander, Colombia in 1979 and when CMCs had sports teams participating in another part of Colombia, an EPI Note was issued to provide information and advice on the outbreak. Another issue was devoted to the “Transport of specimens” to the CAREC Laboratory.

Fax Alert Updates

The publication “Epi Notes” was temporarily suspended and was reactivated in October 2001 as “CAREC Fax Alert Updates,” the first of which provided information on “Laboratory Safety Guidelines for Handling Suspected Anthrax Samples.” Other fax alerts included topics such as “SARS” and “Dengue Fever in the Caribbean.”

In 1981, CAREC contracted a short-term consultant who, together with a PAHO/WHO Veterinary Officer, carried out a feasibility study to set up a Caribbean Zoonoses Surveillances System. After visiting 15 countries, their report was presented at the Caribbean Veterinary Medical Officers’ meeting in Jamaica. One outcome was the publication of a quarterly “Zoonoses Surveillance Newsletter” starting in 1982. The printing of the Newsletter was done at CAREC under the editorship of Dr G A Ferdinand, Veterinary Public Health Medical officer employed with the Ministry of Health and the Environment of Trinidad and Tobago.

Caribbean Epidemiological Notes and Reports. In 1989, in collaboration with the editor of the West Indian Medical Journal and compiled by Dr C J Hospedales, Caribbean Epidemiological Notes and Reports was started. The objective of this column was to disseminate technical information to practising physicians. It was also intended to provide updates and reviews on the occurrence and causes of ill health, morbidity and mortality in the Caribbean.

Public Health Forum. Dr Franklin White started this Forum in 1989 in the Caribbean Medical Journal with agreement from the editor of the journal.

Caribbean Laboratory Action News (CLAN). 1991. This newsletter was designed to improve communication within the Laboratory Division and amongst regional laboratories. It was distributed free to all CMC Government laboratories.

The “CAREC Info” newsletter started in 1992 in order to improve communication within the Centre.

In 1994 the Centre introduced two new bulletins, a Vector Control Bulletin and one on immunisation called the EPI News Bulletin.

In 1995, the Caribbean AIDS Telecommunication Information Network (CATIN) was formed to enhance the sharing of information among National AIDS Programmes. The publication “AIDS Window” was produced and disseminated through this Network.
13. 2 BOOKS, MANUALS, DOCUMENTS

<table>
<thead>
<tr>
<th>Year</th>
<th>Title</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>Epidemiology for Public Health Inspectors.</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>Studies on the Natural History of Yellow Fever in Trinidad. CAREC Monograph Series 1. CAREC. (E. Tikasingh, ed.)</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 13.2.1 Launch of the book “The Hunt for Caribbean Viruses”. (l to r) Ms Avril Reid (Librarian), Dr Barbara Hull (Virologist), Dr Elisha Tikasingh (Author) and Dr James Hospedales (Director, CAREC).

Fig. 13.2.2 Launch of the “Public Health Surveillance” manual. (l to r) Dr Rawle Edwards, Dr Rodenca Doug Bean, Dr Barbara Hull, Dr Violet Forsythe-Duke, Dr James Hospedales.
### 13.3. Publications – in Peer Reviewed Journals

(Includes chapters in books and monographs, but abstracts and posters presented at scientific meetings are not included. CAREC staff are highlighted in bold print.)

<table>
<thead>
<tr>
<th>Year</th>
<th>Title</th>
<th>Authors</th>
<th>Journal/Publication</th>
</tr>
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<tbody>
<tr>
<td>1975</td>
<td>A review of the bloodsucking midges of Trinidad and Tobago.</td>
<td>T.H.G. Aitken, C.B. Worth, R.W. Williams, J.B. Davies, E.S. Tikasingh</td>
<td>Journal of Entomology (B), 44: 101-144, 52 figures</td>
</tr>
</tbody>
</table>


Campione, J., Ruben, M., Vaughan, H. and Morris-Glasgow, V. 2003. 20 years of dengue virus isolates from the Caribbean Epidemiology Centre. West Indian Medical Journal, 52(3):


CAREC PUBLICATIONS (continued)


SOURCES

Annual Reports. 1975 to 2012. Caribbean Epidemiology Centre (CAREC/PAHO/WHO)

Anon. 1965. Register of malaria eradication of Jamaica. PAHO/WHO.


PAHO/WHO. 1973. Resources and Needs for Expanding the Research and Service Programs of the Trinidad Regional Virus Laboratory, RD 12/9, July 1973, PAHO/WHO.

Following the recent polio epidemic, I invited Dr Ardoin, Director of the Virus Laboratory, to a private and confidential talk so that I could have a clear picture of the role which this Laboratory plays in the region and how its services might be expanded and improved.

Dr Ardoin, on the basis of his experience over the past three years, is convinced that the Laboratory should become more international, and be under the scientific supervision of the Pan American Health Organization and the World Health Organization.

To achieve this international status, financial and scientific aid would have to be sought. I am of the view that countries which are members of the European Common Market might wish to associate themselves through the normal technical assistance mechanisms with such a venture, particularly in view of the position of the French Overseas Departments and the Netherlands Caribbean Territories in the Netherlands Kingdom.

In the scientific fields, there could be an exchange of knowledge. The exchange of scientific and technical staff, and medical practitioners and students in Tropical Medicine could make use of the facilities which the Laboratory would provide.

The laboratory could then become a Communicable Diseases Centre for the entire Caribbean area, irrespective of national status or historical association. It should perhaps be entirely self-governing, divorced from all political considerations. A useful pattern might be the arrangement worked out between the Governments of Trinidad and Tobago and Switzerland in relation to the International Relations Institute.

Financial aid sought would be supplementary. At present, support comes from Caribbean Governments with assistance from the British Government.

I have approached the Common Market Governments of France, West Germany, the Netherlands, and Italy, and naturally I have advised the United Kingdom Government of this development. In due course I hope to transmit to you a more detailed statement as to the scope and functions of the proposed Centre which I have asked Dr Ardoin to prepare. The Pan American Health Organization has also been advised, and would appear to be particularly happy with the proposal to establish the second Communicable Diseases Centre in the Western Hemisphere. In our thinking, the proposed Governing Body should have representation of the University of the West Indies, particularly at the level of the departments of Medicine and Microbiology.

After consulting our Minister of Health, and holding informal discussions with a senior representative of the Pan American Health Organization, I thought this would be an appropriate moment to bring this possible development to the attention of the University.

The Wellcome Trust of the United Kingdom has also been made aware of this development and would appear to welcome it.
ANNEX 2

Recommendations from the Fifth Meeting of the Caribbean Health Ministers’ Conference
held in Dominica 5 – 9 February 1973

RESOLUTION NO. 19
CARIBBEAN EPIDEMIOLOGIC SURVEILLANCE

THE CONFERENCE,

Having studied Document No. 23/73,

Noting the fact that 20 to 30 percent of all deaths in the area are due to infectious and parasitic diseases and that one-third of these deaths are due to diseases that are preventable by immunisation,

Concerned about the occurrence of outbreaks of poliomyelitis and of dengue in the area in recent times,

Having learned that the world pandemic of cholera has reached the west coast of Africa, Aware of the fact that the purpose of epidemiologic surveillance is to have up-to-date information on the disease situation and that such information is not available in the Caribbean territories;

RECOMMENDS the establishment of a Caribbean Epidemiologic Surveillance Centre at the Trinidad Regional Virus Laboratory;
URGES the early establishment in the Caribbean area of a service for the detection of cholera and for preventing its spread;
URGES the Governments to formulate and implement immunisation programmes, taking into account the targets suggested in Part IV of the Annual Report of the Executive Secretary for 1973;
URGES every country that has a population of over 200,000 to set up an epidemiologic unit within its Ministry of Health and every other country, to assign a Medical Officer of Health the responsibility for epidemiologic surveillance and especially the information system and the collation, interpretation, utilisation, and dissemination of data;
RECOMMENDS that Governments bring up-to-date and put into effect legislation and procedures on notification of communicable and other diseases of epidemiologic importance;
URGES Governments to strengthen their laboratory services;
RECOMMENDS the training of medical and other staff in epidemiologic surveillance;
REQUESTS the Executive Secretary to pursue with PAHO/WHO and the U.S. authorities the possibility of a Caribbean Conference on Epidemiologic Surveillance in 1973; and
THANKS Dr J Sejda and the Pan American Health Organization for an extremely valuable paper.
ANNEX 3
RESOLUTION NO. 14
CARIBBEAN EPIDEMIOLOGICAL SURVEILLANCE

THE CONFERENCE,

Recalling Resolution 19 adopted at the Fifth Caribbean Health Ministers’ Conference;

Having studied the Plan for Epidemiological Surveillance (Document CHMC 9/74), the Report (RD 12/9, 1973) of the Scientific Advisory Group on the future role of the Trinidad Regional Virus Laboratory, the Report of the Conference on Epidemiological Surveillance held in Kingston, Jamaica in April, 1975, and the Report of the Chief Medical Officers,

ADOPTS the Plan for Epidemiological Surveillance, subject to the amendments listed in the attached schedule;

REAFFIRMS its recommendation on the establishment of a centre for Caribbean epidemiological surveillance at the Trinidad Regional Virus Laboratory (TRVL);

SUPPORTS the proposal that the Centre (the TRVL in the expanded role envisaged in 2 above and in Document RD 12/9) should be managed by PAHO/WHO for an initial period of ten years, with a review after five years;

RECOMMENDS the assignment to the Centre of the functions of surveillance, service, training and research;

ACCEPTS the scale of annual contributions by Governments adjusted to the UN scale, proposed by the Government of Trinidad and Tobago;

REAFFIRMS the fundamental need for each Member Country to develop its own system to support Caribbean epidemiological surveillance and inform the Secretariat by 1st August 1974, of the name of the medical officer in charge of its programme;

RECOMMENDS that each Member Country:

Accept and use standard forms for the notification of selected communicable disease when they are designed by the Centre, and

Furnish the requested weekly mortality and morbidity data and other information to the Centre;

REQUESTS the Secretariat to cooperate with the Centre in the development of customs and other procedures for facilitating the transmission of biological specimens;

RECOMMENDS that all Caribbean Islands and Countries participate in the work of the Centre as practicable;

REQUESTS the Secretariat to cooperate with the Centre in working out a mechanism for the annual evaluation of the work of the Centre;

DESIGNATES the date of adoption of this Resolution as the formal date of commencement of the Centre of the activities contemplated in this Resolution;

THANKS the US authorities and PAHO/WHO for their generous support to Caribbean epidemiological surveillance.
## ANNEX 4

### COUNCIL MEMBERS AND OBSERVERS, 1975

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Position</th>
<th>Organization/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Philip I Boyd*</td>
<td>Chief, Health Section</td>
<td>Commonwealth Caribbean Secretariat, Georgetown, Guyana</td>
</tr>
<tr>
<td>Dr Elizabeth Quamina</td>
<td>Acting Chief Medical Officer</td>
<td>Ministry of Health, Port of Spain, Trinidad</td>
</tr>
<tr>
<td>Dr Leonard Commission**</td>
<td>Chief Medical Officer</td>
<td>Ministry of Health and Local Government, St. Georges, Grenada</td>
</tr>
<tr>
<td>Dr C E Gordon Smith</td>
<td>Dean, London School of Hygiene and Tropical Medicine</td>
<td>London, England</td>
</tr>
<tr>
<td>Dr W J Maelor Evans</td>
<td>Medical Advisor</td>
<td>Ministry of Overseas Development, London, England</td>
</tr>
<tr>
<td>Mr Teasley C Tait</td>
<td>Permanent Secretary</td>
<td>Ministry of Health, Port of Spain, Trinidad</td>
</tr>
<tr>
<td>Dr Patrick J S Hamilton (Council Secretary)</td>
<td>Director, Caribbean Epidemiology Centre</td>
<td>Port of Spain, Trinidad</td>
</tr>
<tr>
<td>Professor J Webb**</td>
<td>Department of Paediatrics</td>
<td>University of Newcastle, Newcastle upon Tyne, England</td>
</tr>
<tr>
<td>Dr Karl A Western**</td>
<td>Bureau of Epidemiology</td>
<td>Centers for Disease Control, Atlanta, Georgia, USA</td>
</tr>
<tr>
<td>Dr M Martins da Silva</td>
<td>Chief, Department of Research Development and Coordination</td>
<td>Pan American Health Organization, Washington, DC, USA</td>
</tr>
<tr>
<td>Dr Miles C Williams**</td>
<td>Council Member</td>
<td>Caribbean Epidemiology Centre, Port of Spain, Trinidad</td>
</tr>
<tr>
<td>Dr David I Picou</td>
<td>Secretary, Commonwealth Caribbean Medical Research Council</td>
<td>University of the West Indies, Mona, Kingston, Jamaica</td>
</tr>
<tr>
<td>Professor R E O Williams**</td>
<td>Director</td>
<td>Public Health Laboratory Service, Colindale, London, England</td>
</tr>
<tr>
<td>Mr A Z Preston</td>
<td>Vice Chancellor</td>
<td>University of the West Indies, Mona, Kingston, Jamaica</td>
</tr>
<tr>
<td>Dr Jeffrey Wilson*</td>
<td>Chief Medical Officer</td>
<td>Ministry of Health and Environmental Control, Kingston, Jamaica</td>
</tr>
</tbody>
</table>

* Ad Hoc member for this meeting

** Observer

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*Ad Hoc member for this meeting

** Observer
## ANNEX 5

### COUNCIL MEMBERS AND OBSERVERS, 1975

**Members and Observers of the Scientific Advisory Committee, 1975**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position and Affiliation</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Pedro N Acha</td>
<td>Chief, Division of Disease Control, Pan American Health Organization</td>
<td>Washington, DC, USA</td>
</tr>
<tr>
<td>Dr. Pedro Galdino</td>
<td>Director, Gorgas Memorial Laboratory, Balboa Heights, Canal Zone Panama</td>
<td></td>
</tr>
<tr>
<td>Dr. Pedro Galdino</td>
<td>Director, Gorgas Memorial Laboratory, Balboa Heights, Canal Zone Panama</td>
<td></td>
</tr>
<tr>
<td>Dr. Hector R Acuña</td>
<td>Director, Pan American Health Organization</td>
<td>Washington, DC, USA</td>
</tr>
<tr>
<td>Dr. Gerald Grell</td>
<td>Acting Chief Medical Officer, Ministry of Health, Roseau, Dominica</td>
<td></td>
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<tr>
<td>Dr. Gerald Grell</td>
<td>Acting Chief Medical Officer, Ministry of Health, Roseau, Dominica</td>
<td></td>
</tr>
<tr>
<td>Dr. Guillermo Quevarta</td>
<td>PAHO/WHO Representative, Pan American Health Organization, Port of Spain, Trinidad</td>
<td></td>
</tr>
<tr>
<td>Dr. Patrick J S Hamilton</td>
<td>Director, Caribbean Epidemiology Centre, Port of Spain, Trinidad</td>
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<tr>
<td>Dr. Philip I Boyd</td>
<td>Chief, Health Section, Commonwealth Caribbean Secretariat, Georgetown, Guyana</td>
<td></td>
</tr>
<tr>
<td>Dr. Sheila King</td>
<td>Head, Department of Microbiology, University of the West Indies, Kingston, Jamaica</td>
<td></td>
</tr>
<tr>
<td>Dr. Philip S Brachman</td>
<td>Director, Bureau of Epidemiology, Center for Disease Control, Atlanta, Georgia, USA</td>
<td></td>
</tr>
<tr>
<td>Dr. M Martins da Silva</td>
<td>Chief, Department of Research, Development and Coordination, Pan American Health Organization, Washington, DC, USA</td>
<td></td>
</tr>
<tr>
<td>Dr. Zigman Brener</td>
<td>Professor, Department of Parasitology, Instituto de Endemias Rurais, Belo Horizonte, Brazil</td>
<td></td>
</tr>
<tr>
<td>Dr. Samuel G Owen</td>
<td>Second Secretary, Medical Research Council, London, England</td>
<td></td>
</tr>
<tr>
<td>Dr. Elizabeth Quamina</td>
<td>Acting Chief Medical Officer, Ministry of Health, Port of Spain, Trinidad</td>
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</tbody>
</table>

ANNEXES (continued)
PART I
AIMS AND FUNCTIONS
The functions of the Centre shall be:

1. To serve as a specialised technical resource, particularly in the field of communicable
diseases and their surveillance, and to cooperate in the programmes being developed
by the Governments.

2. To achieve the reduction of mortality and morbidity associated with communicable
diseases in the area.

3. To act as a centre for epidemiological surveillance for all countries in the Caribbean,
which are or will be participating in, or cooperating with, the Centre.

4. To assist and advise Governments in the development of effective surveillance.

5. To assist and advise Governments by providing visiting staff experts in the surveillance,
diagnosis and control of communicable diseases.

6. To assess the resources and needs of laboratories within the area and assist in their
development.

7. To promote collaborative relations with laboratories which may serve the area.

8. To provide selected diagnostic laboratory services and facilities needed for
surveillance.

9. To collaborate closely with Universities of the area, particularly the faculties of
medicine and agriculture, the Commonwealth Caribbean Medical Research Council
(CCMRC), and the Secretariat of the Caribbean Health Ministers Conference
(CHMC).

10. To provide training in epidemiological surveillance and laboratory diagnosis, and their
field application for personnel at various levels in health and other related services.

11. To maintain facilities for the investigation of selected animal viruses.

12. To continue:
   12.1. To carry out research both in the Centre and in the field on disease problems
       important to the Caribbean.
   12.2. To assist the Universities with teaching.
   12.3. To provide facilities for visiting workers.
   12.4. To study virus diseases and their ecology.

PART II
Programme

1. A development programme and detailed plan of activities will be prepared by the
Centre Director annually for consideration by the Council.

2. Health aspects of the plan of activities will comprise the following:
   2.1. Surveillance
       2.1.1. The Centre will receive, analyse, and distribute surveillance data
           and will develop standard procedures.
       2.1.2. This activity will be coordinated with the international surveillance
           programme of PAHO/WHO.
   2.2. Service
       2.2.1. Staff will make regular visits to advise in the development of
           national surveillance and associated laboratory operations
       2.2.2. The Centre will provide selected laboratory diagnostic services.
       2.2.3. The Centre will maintain up-to-date information concerning
           laboratory resources available to serve the area.
2.2.4. Staff will be available to provide immediate advice in the containment or control of epidemics

3. Education and training
   3.1. Intensive courses will be offered to professional and technical personnel working in the area.
   3.2. The staff of the Centre will assist participating agencies in orienting government personnel at the policy-making level and planning for practical training on particular problems and programmes.
   3.3. The Centre will assist in the development and implementation of training in collaboration with the Universities.

4. Research
   4.1. Defining specific disease problems of the area and conducting periodic surveys to assess their prevalence and levels of immunity and protection
   4.2. Investigating selected disease problems important in the area, with particular relation to causation, transmission, ecology, and control.
It is with pleasure first of all that I welcome you, distinguished visitors to our country and it is with some sense of achievement that I address you this morning on the occasion of the First Meeting of the Council of the Caribbean Epidemiology Centre.

The Government of Trinidad and Tobago and our Prime Minister, in particular, has always been in the forefront of those who seek a policy of regional cooperation within the Caribbean region. Some of you may recall that it was during my term of office as Minister of External Affairs and Minister of West Indian Affairs that the foundations of the Caribbean Community beginning with CARIFTA were laid. It was also during that period of my service as Minister of West Indian Affairs that a former Minister of Health of Trinidad and Tobago took the initial steps to call the first Conference of Caribbean Health Ministers which was held in Trinidad and Tobago in 1969.

Regional cooperation has been further consolidated under CARICOM, and Ministers of Education, Health, Labour, Foreign Affairs, Finance, Agriculture and Mines now also meet in annual conference. These meetings serve as the avenue for the exchange of information and the pooling of resources – human, physical, and financial – for their better utilisation in the interest of Caribbean peoples.

On this occasion, it is appropriate that I place for the record the background which has led up to this historic meeting which takes place today. It was in April 1972, that the Prime Minister of Trinidad and Tobago, the Rt. Honourable Eric Williams, initiated discussions with the University of the West Indies and the Pan American
Health Organization on the future role of the then Trinidad Regional Virus Laboratory. He proposed that the laboratory should become more international in scope and that international status financial and scientific aid should be sought. He went on to state, and I quote: “In the scientific field, there could be an exchange of knowledge. The exchange of scientific and technical staff, and medical practitioners and students in tropical medicine could make use of the facilities which the Laboratory will provide. The Laboratory could then become a Communicable Disease Centre for the entire Caribbean area, irrespective of national status or historical association.”

This initiative by the Prime Minister in 1972 was followed up by Caribbean Health Ministers when in February 1973, they approved Resolution No. 19 “Caribbean Epidemiologic Surveillance” which, inter alia, recommended that such a Centre as envisaged by the Prime Minister should be set up at Trinidad Regional Virus Laboratory.

Subsequently, at the joint request of the Prime Minister and the University of the West Indies, the Pan American Health Organization set up an independent high level multi-disciplinary group of consultants to consider and make recommendations on the proposal. That team was headed by Dr C E Gordon Smith, Dean, London School of Tropical Medicine, London, England, who attended the First Meeting of the Scientific Advisory Committee of CAREC held yesterday.

The fact that the period between concept and realisation of this Centre has been so brief is a tribute to all who participated in the discussions. It is also evident that all the persons and organisations concerned were motivated by a spirit of cooperation and the desire to improve health conditions in our countries and provide the necessary training and scientific facilities for the good of our peoples.

I desire, at this stage, to place on record my highest tribute to two honourable men, whose effort in this achievement are well known. The first is the Prime Minister of Trinidad and Tobago, The Rt. Honourable Dr Eric Williams, whose foresight and vision for a high-powered research centre for the Caribbean has been realised today. Secondly, to Dr Abraham Horwitz, who recently retired as Director of the Pan American Health Organization. His personal interest and zeal, and his ability to act decisively and effectively have played a major role toward the realisation of this occasion. It would be remiss of me not to mention my colleagues, the Ministers of Health of the Caribbean, whose urgent support was also received. I take this opportunity to also congratulate them for the part they have played in the 5th and 6th Health Ministers’ Conference in overcoming all difficulties and ensuring that the decisions which led to the establishment of this Council were made and acted upon without a delay.

Traditionally, several groups and research agencies have been accommodated within the walls of the Trinidad Regional Virus Laboratory and this practice will continue. Medical Research Council personnel, who have a long list of excellent work in the Region and the technical representatives of the United Kingdom and United States Governments, i.e., representatives of the Overseas Development Ministry and the US Centers for Disease Control, Atlanta, Georgia, USA, are ensuring this continuity of activity and interest both by their presence here this morning and their financial contributions.

It is therefore against this background of cordiality and cooperation that we proceed this morning to examine the proposed programme for CAREC. I am advised that already there has been much activity encompassing all the main functions of the Centre; that is, surveillance, service, training and research.

CAREC is charged with setting up a surveillance system for the Caribbean. Standardised reporting cannot be established overnight but already staff members are examining individual country reporting systems and, commencing in Trinidad and Tobago, hope to establish a working model which will be applicable throughout the region. Setting as highest priority the evaluation of immunisation programmes, in Trinidad and Tobago, blood samples will be tested for the presence of antibodies to polio virus types 1, 2, 3, in order to find out whether children who have been immunised before entering school have responded by developing an adequate antibody level, and the monitoring of prevalent disease such as gastroenteritis, and those which occur less frequently – but are always with us – typhoid fever, dengue, diphtheria, encephalitis, meningococcal meningitis, and the ever-near, but so far not present, cholera.
Yellow fever requires special mention. The work of the former Trinidad Regional Virus Laboratory in this field is well known throughout the world and the staff at CAREC will continue their monitoring operations in order to provide Health Ministries with an early warning of any likelihood of the occurrence of the disease in human subjects.

In all these endeavours, I am pleased to note the close collaboration established between the new Centre and the Public Health Laboratory of my Ministry, and I look forward to continued partnership and mutual involvement in projects.

However, the Caribbean region has already moved rapidly forward in the control of communicable disease and we in Trinidad and Tobago are mindful that our mortality and morbidity statistics reveal that certain non-communicable diseases take not only a drastic toll on human life, but also make large demands on health resources; I refer specifically to Diabetes and Cardiovascular diseases. We are requesting the Centre assist us in studies relating to the epidemiology of these diseases. Meanwhile, my Ministry is proceeding to establish new programmes to improve the delivery of health care to the persons who are suffering from these illnesses by utilising nurses in an expanded role as “nurse practitioners.”

In these programmes we hope to have the assistance of not only the Pan American Health Organization but the benefit of research projects by the United Kingdom Medical research Council, the Overseas Development Ministry of the United Kingdom, and the University of the West Indies. Such programmes, I am assured, will utilise local personnel to the greatest extent and provide an excellent training environment for our young doctors, scientists, and other health professionals.

Training programmes have already been planned and I am cognisant that in May there will be an organisation meeting for designated epidemiologists in the Region to be followed by a seminar on sexually transmitted diseases. I would congratulate PAHO and the Director of the Centre on their speedy attention to this latter health problem, which is causing my Government great concern. It is my wish that the Council give favourable consideration to the entire proposed training programmes.

The Government of Trinidad and Tobago has always encouraged research which will have a meaningful effect on the quality of life of our people, and my Ministry will endeavour to support fully the research projects of the Centre both by encouraging our personnel to participate and by making health facilities available. We are particularly concerned by the high incidence of chronic nephritis as a result of streptococcal infections, and research programmes in this area are continuing within my Ministry with the help of Northwest University, Chicago, the UK Medical Research Council, and Overseas Development.

My advisers have reported that meetings have commenced, under the aegis of the Centre, to bring together those engaged in the related areas of zoonosis control. I am aware that investigation involving both human and veterinary health sciences is necessary in order to overcome the problem of gastroenteritis in Trinidad and Tobago in the region. An accurate diagnosis is the first step in any system of disease control and the involvement of the Centre in coordinating and upgrading laboratory functions is welcomed. The functions of these laboratories need to be coordinated at all levels to avoid duplication and fragmentation.

Above all, however, the whole organisation of this Centre must be geared not just to diagnosing, reporting, monitoring, training, but to producing in our health care systems the positive results which will give the consumer – the citizens of the region – a freedom from disease which will enable the territories to achieve the social and economic objectives and realise their full potential.

Ladies and gentlemen, for all the reasons stated above, I am delighted to declare open this first meeting of the Council of the Caribbean Epidemiology Centre here in Trinidad and Tobago. I wish you all success in your deliberations and I know that the confidence and the effort displayed so far in our work towards achievement of our objectives are not misplaced.

In formally inaugurating the first historic meeting of the Council, I hereby designate Mr Teasley Taitt, Permanent Secretary in the Ministry of Health, as my representative, on behalf of the Government of Trinidad and Tobago on the said Council.

Thank you.
### ANNEX 10

**Staff of CAREC**

#### Directors

- Diggory, Peter H (1982 – 1988)
- Campione-Piccardo, Jose (2008 - 2009)
- Irons, Beryl (2009 - 2012)

#### Administrators

- Succhi, Orlando (1974-1975)
- Scioville, Jean-Pierre (1984 - 1985)
- Cameo, Ava (1986 - 1995)
- Gayle, Carol (1997 - 1999)
- Bobb, Elton (2001)
- de Barros, Gilberto (2004 - 2009)
- Frixone, Anna Maria (2009 - 2012)

#### Technical, Administrative and Support Staff

- Abbott-Permell, Ingrid
- Abdool Aziz, Ahmed
- Abdool-Draakes, Gloria
- Abdul-Marie, Gail
- Abarisi, Pamela
- Abraham, V
- Agostini, Christiane
- Alighieri Sylvain
- Alexander, Norman
- Alexander-Cornwall, Christine
- Alexis, Charlene
- Ali, Aziz
- Ali, Carneille
- Ali, Salef
- Ali, Shaima
- Allen, Caroline
- Alphonse, Anthony
- Andall-Brereton, Glennis
- Asgarali, Aimran
- Andrews, Beverly
- Andrews, John
- Archer, Sharon
- Archibald, Jennifer
- Arthurly, Mervyn
- Arnt, Nilton
- Asgarali, Zinora
- Attong, Carollyn
- Baboolal, Shirematee
- Balbosa, Susan
- Banfield-Roach, Debra
- Baptiste, Eric
- Barclay, Joyce
- Barker, Andrea
- Barrow-Boisson, Lisa
- Bartlett, Christopher
- Batoo, Kathleen
- Baynes, Sharon
- Beckles, Gloria
- Berahazar, Ida
- Berkeley, Lynette
- Bethelmy, Rodney
- Bhagaloo, Naresh
- Bhagwandin, Leela
- Bhagwandin, Priya
- Bissessarsingh, Esther
- Blackman, Elizabeth
- Blache-Fraser, Ann
- Boisson, Eldonna
- Boisson, Joel
- Boisson, Mark
- Bocage, Christine
- Bombereau, Gaeille
- Boodhoo, Myrna
- Boodoo, Ruthven
- Boodram Laura-Lee
- Borse, Malcolm
- Bourne, Norma
- Bovell-Arthur, Nicole
- Bowen, Vanessa
- Boyd-Scobie, Carol
- Braden, B
- Bradshaw, Brader
- Bradshaw, Karen
- Braithwaite, Hilary
- Bravo-Khan, Carol
- Brewster, Ruth
- Briggs, Wele
- Brown-Joseph, Tamiko
- Brown, Clive
- Browne, Violet
- Buddha, Niles
- Burke, Eileen
- Burroughs, Gemma
- Butts-Mitchell, Simone
- Caffe, Sonia
- Camara, Bilali
- Cameron, Derek
- Campbell, Felicia
- Campbell, Jean
- Campbell, Tenisha
- Carr, Althea
- Casey, Eunice
- Cazai-Gamesley, Robert
- Chai Hong, Kenneth
- Chan, Gloria
- Chandler, Jocelyn
- Chang-Kit, Catherine
- Chanka, Soekraj
- Chan Pong, Gail
Charles, Ann Marie
Chaveco, Pedro
Chickooree, Geeta
Chiddick, Vanessa
Chiu Foon, Jocelyn
Cholmondeley, Colin
Chow, Hyacinth
Christian, Winston
Clarke, Denise
Clarke, Quintin
Cleghorn, Farley
Collimore, Simon
Copeland, Baden
Corbin, Edward
Cruickshank-Taylor, Victoria
Cox, Ross
Cudjoe, Dale
Cudjoe, Marilyn
Cupid, Claudette
Cupidore, Ann Marie
Cumberbatch, Alison
D’Abreau, Brenda
DaCosta-Carter, Cherry-Ann
Dalrymple, Binta
Daniel, Jocelyn
Darmanie, Arlene
David, Kenny
Davis, Beverly
Davis, John
De Four, Michelle
De Freitas-Chin, Laura
De Gazon, Diane
De Gouvillle, Esther
De Goulard, Michel
De Lima, Thayne
De Roche-Benny, Hazel
Deosaran, Peter
De Souza, Mark
De Verteuil, Charmaine
Des Vignes, Franka
Dias, Celia
Doodnath, Lester
Dodo, Avita
Dolabaille, Michael
Dolan, Ena
Donald, Caswine
Douglas, Ken-Garfield
Dubroca, Christel
Duncan, Lydia
Dwarika, Linda
Dyer-Braveboy, Judith-Ann
Dyer-Regis, Bernice
Eastman, Catherine
Edghill, Lisa
Edmund, Thomas
Edwards, Charles
Edwards, Jeffery
Edwards, Velma
Edwards-Kaba, Winsome
Eselle, Nicole
Evans-Pouchet, Priscilla
Everard C R
Everingham, Lynne
Fabien, John
Faria, Anthony
Farley, John
Fevech, Oswald
Fitzpatrick, Leslie
Flanders, Euganne
Flemming, Colin
Flint, James
Floyd, Alana
Forbes, Leon
Forrest, Eunice
Fournier-Preston, Kathy
Francis, Claudette
Francis, Lorraine
Francis, Marlene
Frank, Donna
Frederickson, Christian
Gabriel, Wendy
Gajadarsingh, Leela
Garcia, Gabriel
Gaspard, Ella
Gatwood, Jill
George, Ann
George, Ian
George, Lucresha
Gibbings, Ronald
Goddard-Vidal, Cecile
Gosein, Radha
Grant, Keisha
Grant, Nigel
Grant, Stacey
Grell, Patrick
Guerra, Ambrose
Guevara, Lenny
Harrison, Philomen
Hart, Marcia
Haynes, Venice
Hector, Simone
Helmick, Charles
Hemmings, Merlene
Higgins, Dane
Higgins, Peter
Hingwan, Joseph
Holder, Yvette
Hosein, Abdul
Hoyle, Selwyn
Hull, Barbara
Hunte, Nicole
Hunte, Susan
Huson, Frederick
Hutchinson, Desiree
Hutson, Jennifer
Hylton, Howard
Indar, Lisa
Ivey, Marsha
Jack, Noreen
James, Fitzroy
Jagroop, Charmela
Johneire, Arthur
Job, Laurel
John, Sandra
Jones, Nigel
Jones, Marylyn
Jones, Sandra
Jordan, Carol
Joseph, Amanda
Joseph, Emmanuel
Joseph, Melina
Joseph, Nicole
Julien, Mervyn
Juleram, Deanna
Kaminjolo, J
Keenlysides, Richard
Khan, Jalaludin
Khan, Kamal
Khan, Saadia
Khan, Taimoon
King, Gary
Kitson-Piggott, Wendy
Kong, Patrick
Koplan, Jeff
Kowlessar, Gail
Kwang, Jenny
Labastide, Wayne
La Jeunesse, Kelly
Lalla, Narindra
Lambourne, Adrian
Lara, Iva
Lara-Augustine, Karen
Laporte, J
Latimer, Ken
Lawrence, Cletus
Lavine, Hazel
Lee, Robert
Lee-Wo, Rachel
Legall, George
Lewis, Ann-Michelle
Lewis, Merle
Lezama, Louis
Lutchman, Sandra
Leus, X
Madeira, Jones P
Mahabir, Suresh
Maharaj, Kamla
Malcolm, Margo
Mangal, Milton
Mann, Roger
Manzano, Cathy-Ann
Maraj, Nigel
Martinez, Raymond
Mayers, Damien
Maynard, June
Mc Clean, Roger
McDougall, Laura
Millan, Doris
Miller, Roger
Mitchell, Sylvia
Mohammed, Kassim  
Mohammed, Mansour  
Mohammed, Sadia  
Mohammed, Shayne  
Mohammed, Steve  
Monteil, Sherlyn  
Moore, Joanna  
Moosai, Robin  
Morais, Michael  
Morris-Glasgow, Victoria  
Moteeram, Larry  
Moyo, Nathifa  
Nanan, Debra  
Narine, Jai  
Narine, Rudy  
Nathan, Michael  
Nathaniel-Girdharrie, SueMin  
Nelson, Sheldon  
Nimblett, Alexi  
Nimrod, Marisa  
Noriega, Michele  
Normoyle-Elke, Holly  
Noya, P H  
Nurse, Janice  
Nurse, Michele  
Ogunnaite-Cooke, Susanne  
Olivierre, Ronald  
O’Brien, Gaetille  
O’Brien, Kinosh  
O’Brien, Michael  
O’Neill, Cheryl  
O’Neill, Russell  
Olugbemi, Olufemi  
Osterud, C  
Pantin, Valerie  
Paraphile, Marcel  
Parris, Jairzinho  
Pascall, Kevin  
Pearl, Rhona  
Persad, Dave  
Persad, Terry  
Philip-Frederick, Christine  
Phills, Emile  
Picherry, Daphne  
Pierre, Anthony  
Pierre, Wendy  
Pile, Jacqueline  
Polia, Sadie  
Polson, Karen  
Poucet, Emile  
Prabhakar, Parimi  
Prescott, Latisha  
Quava, Avion  
Quesnel, Sarah  
Race, Malcolm  
Ragbir, Nirmala  
Ramdin, Veda  
Ramdhany, David  
Ramgoolie, Cindy  
Ragoonaanansingh, Rhea  
Ramlochan, Sally-Ann  
Ramkissoon, Dinesh  
Ramoutarsingh, Kenneth  
Raphael, Karen  
Rattan, Ashok  
Rawlins, Kay  
Rawlins, Samuel  
Raymond, Chevonne  
Razack-Mohammed, Nadira  
Redhead, Charles  
Reid, Avril  
Reid, Hugo  
Reid, Philip  
Remy, Peter  
Renaud, Diane  
Ribas-Antunez, Maria  
Richards, Leah-Marie  
Richardson, Patricia  
Riley, Glenroy  
Roach, Veronica  
Roberts-White, Yvonne  
Romano, Darryl  
Roses, Mirta  
Russell-Brown, Pauline  
Sallandy, Lisa  
Salas, Rosalba  
Samiel, Sheila  
Sammy, Daisie  
Sammy, Althea  
Samuel, Clayton  
Scott, Lawrence  
Sebro, Cecile  
Sedaranne, Frank  
Seeteram, Sunatee  
Seon, Marion  
Seunarine, Anthony  
Sheppard, Kenneth  
Shiroishi, Yukohiro  
Sims, Julie  
Sinanan, Carlton  
Singh, B  
Singh, Risha  
Singh-Ramlogan, Sharmaine  
Sirjoop, Faria  
Sixto, Leah-Madge  
Skeete, Gladstone  
Smith, Carol  
Smith, Henry  
Smith, Michael  
Smith, Shirley  
Smith, Michael  
Sookhai-Mahadeo, Sharon  
Soveraas, Yvan  
Spinks, Michael  
Squires, Catrina  
Sylvester, Owen  
Sylvester, Pauline  
Tardieu, Vincent  
Taylor, Nicola  
Teller-Baptiste, Mercedes  
Theodore, Nicolette  
Theodore-Gandi, Bernadette  
Thomas, Agnes  
Thomas, Andrea  
Thomas, Lisa-Clair  
Thomas, Lisa-Marie  
Thomas, Lorna  
Thompson, Althea  
Thompson, Edwin  
Thompson-Nicholls, Diana  
Tikasingh, Elisha  
Tom, Curtis  
Trotman, Carol  
Turner, Elizabeth  
Valadere, Anne-Marie  
Vance, Jenna  
Vaughan, Helen  
Vialva, Lloyd  
Vidale, Curtis  
Vire, Faron  
Virgil-Richard, Patricia  
Wallace Sankarsingh, Sacha  
Weaver, Robin  
White, Camille  
Wagner, Hans-Ulrich  
West, Michael  
West, Renee  
Wight, Keion  
Williams, Desley  
Williams, Emelda  
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Williams, Marion  
William, Mile  
Williams, Rachel  
Williams-King, Deborah  
Williams-Mitchell, Carol  
Wilson, Janet  
Wilson, Valerie  
Wilson-Drakes, Cheryl-Ann  
Wiltshire, Joanne  
Wiltshire, Simon  
Wright, Arlette  
Wright, Leslie  
Wylie, Michael  
Young, Kyle