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THE RESEARCH ACTIVITY OF THE PAN AMERICAN CENTERS OF PAHO

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I. INTRODUCTION

The XXVIII Meeting of the Advisory Committee on Health Research of PAHO/WHO (ACHR), held in August 1991 in Montevideo, Uruguay, asked the Director of PAHO/WHO to have the Secretariat prepare a presentation for the XXIX Meeting on the research activities being carried out by the Pan American Centers. This request arose in response to the document "PAHO Technical Cooperation in Health Research: Initial Approaches to Evaluation," which highlighted the key role of research in the overall activities carried out by the Centers (1). The research activity of the Pan American Centers was also a subject of discussion at the XXXI Meeting of the Advisory Committee on Health Research of WHO, held in Geneva at the end of 1992. The discussion focused on a report addressing various aspects of the research conducted by the Pan American Centers and concluded that a Center's success depends on several factors, including a firm commitment to quality and high standards on the part of the governments and the Center's staff, the achievement of a critical mass, and financial stability (2).

This paper aims to describe and analyze research activity at seven of the nine Pan American Centers in terms of science and technology management, potential for scientific and technological production, and production of knowledge and technologies.

II. METHODOLOGY

Information was collected on the following Pan American Centers: ECO, CFNI, CAREC, PANAFTOSA, CLAP, CEPIS, and INCAP. Tables 1 and 2 present some basic data on these Centers. As can be observed, CFNI and INCAP concentrate on the nutritional and dietary status of the populations of their member countries. ECO and CEPIS have similar responsibilities as concerns the interaction between the environment and health. CAREC, CLAP, and PANAFTOSA each have different scientific and technical objectives. Center budgets range from US$1,595,000 (CFNI) to US$8,856,000 (PANAFTOSA).

With regard to science and technology management, the data collected on each Center focused on policies, objectives, strategies, priorities, and plans, as well as promotion, coordination, monitoring, and evaluation. Note was also taken of each Center's support for the development of science and technology in its member countries. As concerns the potential for scientific and technological production, information was obtained on the current and future availability of human resources, infrastructure, support systems, and sources of financing. In the area of production

of knowledge and technologies, information was compiled on current research activities, publications, and technologies produced by the Centers. Bibliographic searches were conducted on the SCISEARCH (3) and MEDLINE (4) data bases in order to identify which scientific publications produced by the Centers have been utilized by investigators in other countries as references for their own work.

Data were compiled through two-day visits to each Center between March and April 1993; whenever possible, the Directors and available investigators were interviewed. Similarly, relevant documents, e.g., reports, bulletins, and newsletters, were obtained on key areas, and this information was complemented by data on file at Headquarters and through fax transmissions with each of the Centers studied.

Each Center was approached as an independent case, and an attempt was made to identify the facilitating and limiting factors in three areas of study--management, potential, and production--at each of the seven Centers.

III. FINDINGS

A. Pan American Center for Human Ecology and Health (ECO)

Currently, ECO concentrates on epidemiological and toxicological aspects of the health impact of the main chemical contaminants of industrial and agricultural origin, as well as the promotion of training, exchange of information, and applied research programs in the area of human ecology and health (5).

Its policies, objectives, priorities, and strategies for research are not explicitly outlined in the Center's documentation, nor is there a working group that deals specifically with them. The promotion and coordination of scientific and technological activities are the responsibility of the Center's Director.

At the end of 1992, the Scientific Advisory Committee of ECO (SAC/ECO) felt that the Center's role in research should be catalytic, one of support and coordination, rather than the generation of primary data, with priority being assigned to projects identified by the countries and involving their participation (5).

ECO has no strategic plan from which it is possible to infer the main lines being followed, which would include research-related activities. In the SAC/ECO report, the following priority areas were identified (5):

a. Pesticides.
b. Heavy metals.
c. Atmospheric contaminants.
d. Hazardous waste.
e. Chemical emergencies.

The Center has pursued a strategy of setting up networks and currently operates three: one for epidemiology, one for toxicology, and the ecology and health projects (PROECOS). Through these networks, ECO has the potential to provide support for the development of science and technology in its member countries.

ECO has no research ethics committee.

The Center has five professionals working in research activities. Two of them hold a doctorate, including the only woman among the five; her work is funded under an extra-budgetary project. The research staff ranges in age from 39 to 43, with a median age of 43. They are regular staff members of PAHO and the United Nations system (PAHO/UN). PAHO Headquarters froze three professional positions in 1983. There are no young professionals receiving in-service training in research. The Center has three other professionals, who work in other technical services, and 21 support staff.

ECO does not have any laboratory facilities of its own. As a result, research that requires such support is conducted in collaboration with other research centers. This limits its potential for science and technology development, a situation that is further exacerbated owing to the Center's location (outside Mexico City), where it is relatively isolated from the research centers that can give it that support.

Scientific and technical data can be consulted at ECO through technical data sheets, ECOLINE, and at the Center's library, which receives 259 specialized journals, 48 of which are paid subscriptions (the rest are donated). ECO is able to access remote data bases via modem using the DIALOG system. The investigators felt that they had suitable access to up-to-date information for the development of science and technology.

ECO has both internal and external electronic communications capabilities. The Center has a local microcomputer network with internal electronic mail capabilities. The Information Center is currently installing a subsystem to give network users direct access to the BITNET, INTERNET, and

PAHONET data bases. BITNET and INTERNET provide access to universities and research centers around the world and are beginning to be used for scientific and technological development within the Center. However, ECO does not have any statistics packages for the processing and analysis of scientific data.

In 1992, ECO carried out only one extra-budgetary project that included activities related to the generation of knowledge and technologies (6, 7, 8).

Table 3 lists the publications produced by ECO between 1988 and 1992. As can be seen, the number of scientific publications showed a marked increase in 1992.

A search on the SCISEARCH and MEDLINE data bases for the period between 1985 and June 1993 showed a total of 49 articles that had been written by ECO staff.

B. Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS)

The mission of CEPIS is to contribute to solving problems related to the protection and improvement of the physical environment, mainly in those fields having a direct or indirect impact on health, such as water for human consumption, wastewater treatment and reuse, and management of household and hazardous waste, with special attention to disseminating, developing, promoting, and offering training in the application and use of economical, easy-to-use technologies (9).

At present, CEPIS does not have any explicit policies, objectives, strategies, or priorities for scientific and technological development. Nor does it have a strategic plan for the future outlining criteria for scientific and technological management. The Center has no External Scientific Advisory Committee to provide it guidance with regard to science and technology issues.

The areas in which CEPIS is conducting research are listed in the 1993 Annual Program Budget (10). They are:

a. Environmental risk factors.
b. Quality, losses, and efficient use of water for human consumption.
c. Wastewater treatment and reuse.

d. Solid waste.

The Center has no research ethics committee.

CEPIS has 11 professionals working in research activities, five of whom are women. Six of these professionals (including one of the women) hold a master of science degree. Five are under PAHO/UN contract, while the other six are local staff. The median age of the group is 46. Two of them are considered to be young professionals receiving in-service training in research. The Center has an internship program for young professionals from its member countries, and currently six professionals are participating in research projects under this format. CEPIS has six other professionals and 29 technical support staff.

The different contracting formats for staff performing similar work is a problem that came up in the interviews and one that requires attention.

CEPIS has chemistry and microbiology laboratories that provide support for the development of science and technology. The facilities were considered to be adequate by the users interviewed at the Center.

CEPIS does not have any qualified personnel to provide advisory support for the analysis of scientific data and there are no known computer programs for this type of analysis. However, the Center has microcomputers that would be capable of running such programs, as well as a computer technician who has installed and maintains the electronic mail and computer support services.

The holdings of the Center's library include scientific journals in its priority areas, as well as reference collections, files, and general information on sanitary engineering. Various data bases--REPIDISCA, AIDS, CCINFO, CITIS, ECO, ENSIC, IRC, LEYES, LILACS, MEDLINE, PAHO/INFO, POPLINE, SeCS, TOXLINE, Water Resources Abstracts, and Women, Water, and Sanitation-- are available on compact disk. The library is automated.

The Pan American Network for Information and Documentation in Sanitary Engineering and Environmental Sciences (REPIDISCA) is coordinated by CEPIS and has been available by electronic mail since September 1992. The technological progress achieved by the Center in making this information available through a public server represents a significant contribution to scientific and technological development.

In 1992, CEPIS carried out four extra-budgetary projects that included research-related activities (6, 7, 8).

The Center's publications have been mainly manuals, technical reports, and monographs, and the number of publications has shown a downward trend (see Table 4).

A search on MEDLINE for the period between 1985 and June 1993 showed a total of five articles that had been written by CEPIS staff.

C. Pan American Foot-and-Mouth Disease Center (PANAFTOSA)

PANAFTOSA was set up to provide technical cooperation to the countries of the Americas in all areas related to the prevention, control, and eradication of foot-and-mouth and other vesicular diseases (11).

It was not possible to identify any medium- and long-term policies, objectives, strategies, or priorities for science and technology at the Center. The Director is responsible for the promotion and coordination of the Center's research activities.

The 1993 COSALFA report (12) resolved that PANAFTOSA, working jointly with the countries, should carry out the necessary studies for eradicating foot-and-mouth disease.

The Center's priority areas, based on its 1991 Annual Report (13), are:

a. Molecular biology and genetic engineering.
b. Monoclonal antibodies.
c. Identification of foot-and-mouth disease antibodies in cattle using ELISA.
d. Correlation of vaccine control techniques.
e. Antigenic and/or immunogenic capacity of vaccine production strains vis-à-vis natural strains.
f. Key viral diseases in the control and prevention of foot-and-mouth disease.

PANAFTOSA has a network of national collaborating centers (13). In 1991, cooperation activities in research addressed vaccine control techniques in

the River Plate basin (12), although no documentation was obtained on the outcome of these collaborative efforts.

The Center has no research ethics committee.

PANAFTOSA has 15 professionals working in research activities, three of whom are women. Four professionals (including one of the women) hold a doctorate. The median age of the group is 51. Twelve of these professionals are under PAHO/UN contract, two are under local contract, and one is a short-term consultant.

The Center hires young professionals to receive in-service training in research. In addition, it recently instituted an internship program at its laboratories, enabling advanced students from technical schools to receive in-service training. This strategy is being utilized to help ensure the future availability of professionals for the Center.

The different contracting formats for staff performing similar work is a problem that came up in the interviews and one that requires attention.

PANAFTOSA has diagnostic and reference laboratories for molecular biology, the production, development, and control of vaccines (pilot plant), the production and shipment of reference reagents, and an animal colony. The molecular biology laboratory has the potential to provide support for similar laboratories in the Center's other member countries and at other Pan American Centers. However, it is anticipated that this laboratory will have more routine work in the near future and, as a result, will need more personnel. The conditions of the animal colony were described as unsuitable.

A statistician provides advisory support for the processing and analysis of scientific data.

The Center's library receives scientific journals in relevant subject areas and has reference collections, files, and general information on veterinary medicine. The LILACS data base is available on compact disk, but the library has no on-line access to international data bases. The users interviewed felt that the library was adequate.

PANAFTOSA does not have any external electronic communications capabilities that would give it access to academic institutions around the world or to public servers with scientific and technological data bases via such

networks as BITNET or INTERNET. One investigator at the Center has a personal BITNET address that is available.

The Center's location was mentioned as a major limitation for science and technology development activities, including such considerations as: the lack of telephone lines, the infeasibility of working outside normal office hours (safety factor), and problems related to biosafety (open installations).

In 1992, PANAFTOSA carried out several extra-budgetary technical cooperation projects (6, 7, 8). However, there were no new extra-budgetary projects involving research-related activities. The research activities that were carried out were financed with the Center's own funds. Historically, PANAFTOSA has not produced proposals or sought donor agencies to provide support for the development of science and technology at the Center. Recently, the Center's management has indicated as part of its policy framework that the Center will begin working in this area.

The Center's main activity is the production and quality control of vaccines, but it also conducts research and development activities in this area. Its technological contribution is significant.

Table 5 gives a summary of the publications produced at PANAFTOSA, based on information from the Center's Catalog of Publications 1952-1992 (14). As can be seen, the number of scientific publications has fallen significantly, dropping two thirds in the space of five years.

D. Caribbean Epidemiology Center (CAREC)

The mission of CAREC is to improve the health of the Caribbean population by enhancing the capacity of its member countries in epidemiology, laboratory technology, and disciplines related to public health through technical cooperation, services, training, research, and well-qualified and motivated personnel (15).

Some of the Center's research policies and objectives appear in its Strategic Plan 1993-1997 (15). Special emphasis within the program objectives is placed on the Center's research orientation and on enhancing its ability to carry out operations research. However, no medium- or long-term objectives or strategies for the development of science and technology could be identified.

The Center's priority areas are outlined in the report of the 18th Meeting of the Scientific Advisory Committee of CAREC (SAC/CAREC, 1992) (16) and are summarized below:

a. Surveillance of disease, with emphasis on chronic diseases.
b. Health situation analysis and evaluation of social and economic impact.
c. Control of AIDS/HIV and associated sexually transmitted diseases (STD).
d. Diseases preventable by vaccine and vector control.

The Center's 1993-1997 plan for scientific and technological development is embodied in the plan of two Divisions--Epidemiology and Laboratories--and two Programs--Sexually Transmitted Diseases and the Expanded Program on Immunization. Each of these units has a strategic plan for 1993-1997.

It was not possible to identify any collaborative studies being carried out with the member countries or any multicenter studies. Networks have not yet been set up between the research centers of the subregion.

Since 1989, CAREC has had a Research Ethics Committee, equipped with formal procedures for reviewing proposals. All proposals that require such approval are reviewed by the Committee (17).

The Center has 19 professionals working in research activities, seven of whom are women. Five of these professionals (all men) hold a doctorate. The median age of the group is 37. Eight of the 19 professionals are under PAHO/UN contract, nine are under local contract, and two hold honorary positions. Four of the 19 professionals are considered to be young professionals receiving in-service training in research. CAREC has 11 other professionals and 80 technical support staff.

The different contracting formats for staff performing similar work is a problem that came up in the interviews and one that requires attention.

CAREC encourages the participation of associated investigators, interns, master's students, and medical students from other institutions within and outside the Caribbean subregion to serve internships under CAREC projects. In 1992, a total of six people participated in this arrangement.

The Center has four laboratories that it uses to fulfill its mission; in the opinion of the investigators interviewed, the laboratories possess the necessary requirements for the development of science and technology. The laboratories specialize in bacteriology, parasitology and medical entomology, virology, and immunology. Work has begun on developing capacity in molecular biology and on upgrading the virology laboratory.

The SAS, SPSS, BMDP, and EpiInfo statistics packages are available for the processing and analysis of scientific data. Two statisticians provide advisory support to the professionals working in data analysis.

The CAREC library receives 175 scientific journals in its priority areas and has reference collections, files, and general information on biomedicine. The MEDLINE, POPLINE, LILACS, and Macmillan CD/AIDS data bases are available on compact disk. The library is partially automated, although there is no on-line access to international data bases. The few users interviewed expressed diverging opinions that ranged from the library being adequate for their needs to it being outdated.

The Center will soon have external electronic communications capabilities that will give it access to academic institutions around the world, as well as to public servers with scientific and technological data bases via BITNET.

In 1992, CAREC carried out 11 extra-budgetary projects that included research activities. Eight of the eleven projects were related to AIDS (6, 7, 8).

As yet not much emphasis has been placed on research relating to chronic diseases and health situation analysis.

Since 1988 the number of scientific publications has doubled, averaging around 28 publications a year up through 1992 (see Table 6). The Center is publishing more periodicals, and work has begun on a series of monographs and manuals. Conference papers have shown a cyclic pattern of ups and downs over the last five years.

A search on MEDLINE for the period between 1985 and June 1993 showed a total of 67 articles that had been written by CAREC staff.

E. Latin American Center for Perinatology and Human Development (CLAP)

CLAP was set up to contribute toward improving maternal and child health by working with the countries to identify and solve the main perinatal, obstetric, neonatal, and pediatric problems in the Region. The strategies utilized in pursuing this mission are: research, dissemination of information, training of human resources, development of policies and standards, organization of perinatal services, and technical cooperation with the countries of the Region (18).

Some of the Center's policy lines have been clearly defined and indicate that research focuses on the study, development, and evaluation of appropriate technologies and on the design of innovative biomedical, epidemiological, and operations research in perinatal and pediatric health services and the community, in keeping with the general policies of WHO and PAHO (18). However, there was no document available that defined short- or medium-term policies, objectives, strategies, or priorities for scientific development at the Center.

The priority areas are all related to perinatal health:

a. High-risk pregnancy.
b. Antenatal risk.
c. Fetal health.
d. Perinatal health.
e. Adolescence and reproduction.

These policies, objectives, and priorities are used by the Director in promoting and coordinating research activities. CLAP has a Scientific Committee that evaluates research proposals, but it is not clear what role this Committee plays in the management of science and technology at the Center.

CLAP also has a network of perinatology institutions located throughout the Region which it uses to carry out collaborative and multicenter projects for technological research and development.

The Center has an ethics committee that reviews proposals involving human subjects; the committee is made up of two external members and three CLAP staff members. Once reviewed, all proposals are sent to the Ethics Committee at PAHO Headquarters.

CLAP has 17 professionals working in research activities, five of whom are women. Twelve are physicians. The median age of the group is 48. Four of the 17 professionals are under PAHO/UN contract, five are under contract with CLAP, and eight are under temporary contract. Two of these professionals are considered as possible future staff members. The Center has nine other professionals working in other technical services and 26 support staff.

The different contracting formats for staff performing similar work is a problem that came up in the interviews and one that requires attention.

CLAP encourages the participation of medical students and collaborators in special projects (18 professionals participated in 1992). Eight professionals from different countries in the Region were CLAP fellows in 1992.

CLAP has a biological chemistry laboratory with the necessary infrastructure for supporting the Center's research. It has a sonography laboratory that needs to be upgraded with modern equipment in order to make it competitive in this area and a bio-engineering laboratory that provides support for the development of perinatal technologies. The Center's electronic maternal-fetal monitors date from the 1970s. In addition, it has access to the various laboratories of the clinical hospital.

The SPSS and EpiInfo statistics packages are available for the processing and analysis of scientific data. A statistical physician provides advisory support to the professionals working in data analysis.

The CLAP library receives 36 scientific journals in its priority areas and has reference collections, files, and general information on biomedicine. The LILACS, PAHO, REPIDISCA, ECO, MEDLINE, and CURRENT CONTENTS data bases are available on compact disk. The library is partially automated, although there is no on-line access to international data bases.

The Center does not have any external electronic communications capabilities that would give it access to academic institutions around the world or to public servers with scientific and technological data bases via BITNET and INTERNET.

In 1992, CLAP carried out three extra-budgetary projects that included research-related activities (6, 7, 8).

The number of publications produced by the Center (19) is indicated in Table 7, which shows that scientific publications have dropped off since 1990. In 1992, there was an increase in the number of periodicals and conference papers. The preparation of manuals shows a cyclic pattern of ups and downs.

It is important to emphasize that CLAP has produced and continues to produce technologies in the area of perinatal health, some of which are documented in scientific publications but others, such as equipment, are not.

A search on MEDLINE for the period between 1985 and June 1993 showed a total of 40 articles that had been written by CLAP staff.

F. Caribbean Food and Nutrition Institute (CFNI)

The mission of CFNI is to collaborate with its member governments in their efforts to achieve an adequate level of nutritional well-being and food security through the identification, adaptation, development, implementation, and evaluation of programs aimed at promoting, establishing, and maintaining optimum nutritional status for the entire population, in keeping with the primary health care strategy (20).

Some of the Institute's research policies and objectives are outlined in the document on the future work of CFNI up to the year 2000 (21). The focus is on applied research--and within that area, on operations research--as well as the participation of its member countries and regional and international agencies in conducting such research. The promotion and coordination of research activities are the responsibility of the Institute's Director.

The Institute's priority areas are identified in the report of the 19th Meeting of the Policy Advisory Committee of CFNI (PAC/CFNI, 1991) (22) and are summarized below:

a. Non-communicable chronic diseases (NCDs).
b. Risk factors for NCDs.
c. Primary prevention of NCDs and fostering of healthy lifestyles in schoolchildren.
d. Caribbean lifestyles linked to specific dietary behaviors.
e. Reduction of anemia.
f. Nutritional value of the food consumed in the West Indies.

Although policies, objectives, and priorities have been outlined, they have not been fully implemented. Accordingly, the latest report (1993) of the Scientific Advisory Committee of CFNI (SAC/CFNI) asked CFNI to review the recommendations on research made by PAC/CFNI in 1991 with an eye to their implementation (23).

It was not possible to identify any scientific and technological development plan for 1993-1997, nor the strategies being pursued in support of the development of science and technology in the Institute's member countries.

There were no collaborative studies under way with member countries, no multicenter studies, and no training aimed at strengthening science and technology in food and nutrition.

CFNI has four professionals working in research activities, one of whom is a woman. Two of the professionals hold a doctorate. The median age of the group is 57. All four professionals are under PAHO/UN contract.

Considering that the Director is about to retire and that the nutritionist and the advisor in nutrition have only three years left until their retirement, and that no new internal talent has been identified that could assume these positions, the human resource potential at CFNI is at a critical low for the development of science and technology and fulfillment of its mission.

A student from the University of the West Indies is working at CFNI on her doctoral dissertation in nutrition. She could be considered as a candidate to replace the nutritionist in the immediate future, although CFNI has not indicated this possibility to her. There are no young professionals receiving in-service training in research at the Institute. CFNI has five other professionals working in other technical services and 20 support staff, two of whom are located in Trinidad.

CFNI has a hematology laboratory equipped with the latest technology available in this field, which provides support for research on anemia. The laboratory is managed by the public health nutritionist and the doctoral candidate; both have been trained in the most up-to-date analytical methods in the field of anemia. This laboratory is one of the Institute's strong points.

CFNI possesses the physical infrastructure for a food analysis laboratory that has not yet been set up. It was planned to support the priority area of

"nutritional value of food consumed in the Caribbean" (see the priority areas listed above).

The SAS, SPSS, and EpiInfo statistics packages are available for the processing and analysis of scientific data. A statistician provides advisory support under a part-time contract to the professionals working in scientific data analysis.

The library at CFNI has a comprehensive collection on food and nutrition. However, some of the bibliographic references required for research on anemia have been obtained from the United States through telephone communications with the group of investigators that collaborates with CFNI in this area.

The Center does not have any external electronic communications capabilities that would give it access to academic institutions around the world or to public servers of existing scientific and technological data bases. The University of the West Indies, however, does have a BITNET connection.

In 1992, CFNI carried out three extra-budgetary projects that included research activities, two of them on iron deficiency (6, 7, 8).

The number of publications produced at CFNI is indicated in Table 8, which shows a decline in the publication of scientific articles over the last five years.

A search on MEDLINE for the period between 1985 and June 1993 showed a total of 30 articles that had been written by CFNI staff.

G. Institute of Nutrition of Central America and Panama (INCAP)

INCAP was set up to identify, generate, transfer, and apply--in an effective, efficient, and equitable fashion--knowledge, technologies, and resources that will contribute to solving the food and nutrition problems of its member countries as part of the broader goal of promoting human development (24).

INCAP was originally conceived as a research institute and, as a result, the generation of science and technology occupies a very important place in its activity. There has always been a mechanism for coordinating research in the

form of groups, committees, or organizational units. Between 1986 and 1989, INCAP undertook to define its research policies, objectives, and strategies, which were officially approved in 1990 by its Directing Council (see Annex 1).

These tools are currently used to coordinate and promote scientific and technological development in nutrition, food, and health at the Institute. The Scientific Committee is responsible for the implementation of policies, achievement of objectives, and application of institutional strategies.

Between 1988 and 1990, INCAP drew up its Strategic Plan 1991-2000 (24), which is currently being implemented and identifies science and technology as one of three basic processes. As part of the plan, the Institute defined the following priority areas in 1992:

a. Human nutrition.
b. Micronutrients.
c. Food protection.
d. Infectious diseases.
e. Dietary socioeconomics.
f. Integrated systems of agriculture, food, nutrition, and health.

Each of these programs has a five-year plan that includes the generation of science and technology.

In 1988, INCAP began conducting collaborative and multicenter studies with research centers in its member countries. Since 1992, it has been coordinating a multicenter-type study with the Regional Operative Network of Food and Nutrition Institutions (RORIAN) with centers located in: Venezuela, Ecuador, Colombia, Brazil, Peru, Mexico, Chile, Jamaica, Puerto Rico, Cuba, and Argentina.

INCAP has a project monitoring unit that has been registering and processing all its research projects since 1973. Ad hoc committees made up of two scientists and a statistician are empaneled to review each proposal. There is a Research Ethics Committee--which includes members from outside the Institute--to review proposals that involve human subjects. An ad hoc committee was also once convened to review animal rights in research.

The Institute has 30 professionals working in research activities, ten of whom are women. Ten of the 30 (including one of the women) hold a doctorate. The median age of the group is 41. One professional is under

PAHO/UN contract, while the other 29 are under contract with INCAP. The Institute has 31 other professionals and 221 technical support staff.

INCAP has an internship program under which young professionals receive in-service training in research (11 professionals are currently participating in this program). These interns are not included in the group of professionals mentioned above. The idea behind the program is to promote future professional potential for the Institute. INCAP also has undergraduate, master's, and doctoral students from Central American and other universities working on theses and dissertations under a variety of research projects.

The Institute encourages the participation of associate investigators and investigators on sabbatical from research centers around the world. In 1992, six investigators participated under this format.

INCAP has 16 laboratories that cover the entire range of fields related to food and nutrition: chemistry, biochemistry, biotechnology, microbiology, physiology, food analysis, sensory analysis, as well as an animal colony and a pilot plant for the development and preparation of new food products. A recent external evaluation (25) concluded that--despite its limitations--INCAP has a unique analytical capacity in Central America.

The SAS, BMDP, StatXact, EpiInfo, and PCarp statistics packages are available and there are four statisticians at the doctoral level who provide advisory support to the investigators in data processing and analysis.

The Institute's library receives 929 scientific journals in its priority areas and has reference collections, files, and general information on biomedicine. The MEDLINE and LILACS data bases are available on compact disk. The library is partially automated and has on-line access to international data bases via DIALOG.

INCAP joined the BITNET network in May 1991 and at present 20 of the 30 professionals have received addresses and use the network. Arrangements are currently being made to hook up to INTERNET.

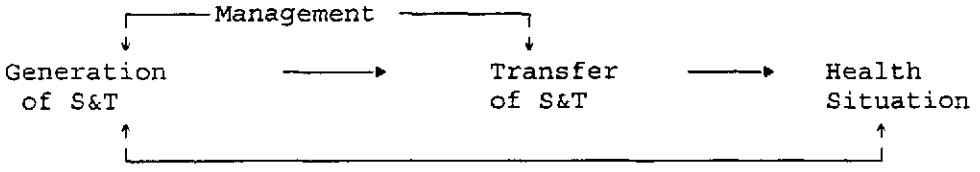
In 1992, the Institute carried out 26 extra-budgetary projects that included research-related activities. Seventeen of these projects dealt exclusively with research (6, 7, 8).

The number of publications per professional increased in 1992 (see Table 9). The Institute's scientific production rose from 0.7 publications per professional in 1991 to 1.2 in 1992 (25).

A search on MEDLINE for the period between 1985 and June 1993 showed a total of 188 articles that had been written by INCAP staff.

IV. DISCUSSION

Over the last decade, the Pan American Centers have made a considerable effort to transfer the knowledge and technologies that they generate to the countries they serve. This process of transfer, however, is only one part of the following cycle:



In the pursuit of the ultimate goal of health for all, the health situation will present a continuing challenge to the Centers' creativity, calling on them to generate new options geared to improving the health situation, and the way to achieve this is through the development of science and technology (S&T).

Accordingly, the Centers should be generating S&T and doing so in an oriented and coordinated fashion. Herein lies the importance of having S&T policies, objectives, strategies, and priorities that are explicitly defined and approved by the respective governing bodies of the Centers, since they are the basic tools for the management of S&T. At present only one Center has them. However, it is not enough for these tools to exist, there must be an institutional unit to ensure that they are used. Otherwise, if this is left to each Director, the development of science and technology at the Center may be very unstable.

Two of the seven Centers have a strategic plan for the next four to ten years, prepared by in-house staff with external technical assistance. These Centers are already implementing their strategic plans, which explicitly identify the development of S&T as an important element in their own future development. At the Centers where such a process is not under way, it is unclear what the future of S&T will be.

Education must go hand in hand with research in order to maximize its effect. While all the Centers provide training for human resources, there was no correlation between training and research at the Centers studied.

The strategy of using networks of universities, institutes, and collaborating centers is being utilized by five of the Centers. In the case of research, this means conducting collaborative and multicenter studies, that is, concrete activities in science and technology that are carried out jointly.

External Scientific Advisory Committees (ESACs) can be a useful tool and should be viewed as an international support group for the Centers. It is important to have an academically qualified and objective outside view of the Centers' work in science and technology. Three of the Centers met with ESACs in 1992 and early 1993. This made information available that was necessary for the present study. Without these reports, data collection would have required visits of at least a week to each Center rather than just two days, given that the formats of the Center's annual reports vary considerably and it is very difficult to glean from them what information pertains to the development of science and technology. Three other Centers have no arrangements for ESACs, and the last one only meets sporadically with its ESAC, since it is the object of frequent external evaluation missions because of the extra-budgetary funding it receives.

Three of the seven Centers have research ethics committees, each with a different makeup and different procedures. The other four Centers rely on the Ethics Committee of PAHO.

The monitoring of research projects and the monitoring of extra-budgetary projects in general is weak at the Centers: only one Center has an office responsible for such monitoring. DRC is developing an information system for research-project management that could prove to be a very useful tool in the management of S&T at the Centers.

It is very difficult to obtain information from the Centers on the percentage of resources devoted to the generation of knowledge and technologies. The 1990 study on PAHO technical cooperation in health research (1) found that the Centers invested 26.3% of their resources in research. Applying this percentage to Table 2, the Centers will invest an estimated US$8,059,109 in S&T in 1993. This figure is quite significant compared to the amounts invested by Latin American and Caribbean universities in health research.

Generally speaking, the Centers lack a policy for human resources development. With regard to science and technology, there are no official programs for ongoing training of investigators and technical staff at the Centers. Two of the seven Centers offer their professionals the possibility of taking short training courses and one of them offers the opportunity to continue with master's or doctoral studies at centers of academic excellence outside the Center's host country. The five Centers that do not offer such possibilities rely on PAHO/UN contracts to obtain qualified personnel.

At the four Centers that have different contracting formats for similar work, this situation was mentioned as a serious problem affecting job stability and the possibility of pursuing a professional career at the Center.

The lack of a policy for human resources development, coupled with concern about job stability and different contracting formats, all have an impact on the Center's ability to maintain critical mass.

Five Centers encourage the participation of undergraduate, master's, and doctoral students in research or technological development projects or work on theses or dissertations under projects at the Center. This is very important in that it expands the potential of these Centers for the production of science and technology.

Digital telecommunications are changing the way work is done in science and technology. There are now several, broad-based public servers that provide information around the clock and are accessible by electronic mail. The traditional concept of the library is changing rapidly. Over 3,000 universities and research centers are linked to the BITNET network, which means that informal communication between investigators can be almost instantaneous, tearing down geographical barriers and the concept of distance and time. Macrocomputers at major academic centers can be accessed from virtually anywhere in the world via INTERNET, making it possible to run interactive analyses from any home or office. As a result, access to BITNET and INTERNET is a basic necessity for the development of S&T. Three of the Centers already subscribe and are using one or both of the networks; one Center is currently making arrangements for hook-up; the other three have not yet begun work in this direction.

The Centers have launched a more active search for extra-budgetary funds for both specific projects and institutional strengthening. This requires staff skilled at writing attractive proposals, and--in the case of institutional strengthening--a strategic plan to provide guidance and direction for the Center in the medium and long terms. Agencies such as USAID, GTZ, and ODA are providing financial support for institutional strengthening at three of the Centers.

Three of the Centers offer their services on a remunerated basis and have set up revolving funds that support the development of science and technology. This trend is commendable and represents yet another way of drawing in financial resources for the Centers. It goes without saying that these actions should always be conducted within the framework of each Center's mission.

The Centers have different strengths with regard to S&T and could enhance their potential by sharing available resources.

The Centers have produced and continue to produce a sizeable volume of publications and technology. Tables 3 through 9 show that in the last five years the Centers have produced 653 scientific publications, and between 1985 and June 1993, 335 articles from the Centers were registered on the MEDLINE data base.

Unlike the situation of publications, however, there is no general inventory of technologies produced by the Centers. One Center has published a book on its technologies. Another has begun drawing up an inventory of the technologies it has developed, which it plans to make available through a data base to be accessible by electronic mail. Recently, the Centers have begun to produce useful software in different fields; for example, three Centers are developing applications for using internal and external electronic mail to access data bases. Some Centers are producing their own scientific and technical data bases and in some cases are working to put them on public servers via BITNET or INTERNET.

In sum, the Centers most active in research are the ones that obtain the most extra-budgetary resources to continue their research and to provide for human resources training, communication and information, and technical assistance. These Centers have broadened their international ties, which in turn has brought in more financial resources and offers the possibility for tapping highly qualified human resources in the short and medium terms. Also, these Centers have young professionals in training under different formats--graduate students, individuals who are in the process of writing thesis/dissertation, in-service trainees, interns, and associate investigators--who can provide future potential for professionals at the Centers. At the same time, these Centers have more human resources working in S&T, and their critical mass in S&T enables them to maintain and expand their research activities.

V. RECOMMENDATIONS

1. The Centers should formulate policies, objectives, strategies, and priorities for the development of science and technology and submit them to their authorities for approval. At the same time, a system should be set up for implementing and monitoring the use of these management tools.

2. It is suggested that the five Centers that do not yet have a strategic plan for the medium and long terms consider the possibility of preparing one. This will serve to chart a general course not only for scientific and technological development but also for the overall development of the Center.

3. ESACs are a useful tool for the development of science and technology. It is recommended that the Centers that do not already have them consider setting them up, bearing in mind that the makeup of the committee should be carefully studied and directed by the Center. An effort should be made to protect against external evaluation missions that arrive with the preset idea of terminating research activities and whose members often are not scientists. The ESACs should be totally independent of any institutional policy councils or committees.

4. It would be desirable to have a standardized format for the Centers' annual reports so that information could be obtained rapidly for describing and analyzing research activity, without having to resort to cross-sectional studies, as is the case at present, and which--as is well known--has its limitations.

5. Every research project should be based on a research protocol that has been subjected to scientific, technical, and--if applicable--ethical review. Activities carried out with external financing at the Centers should have such protocols. Activities not financed with external funds do not seem to have these protocols (for example, some of those mentioned in the APBs)--this situation needs to be standardized in order to ensure that research is of good quality and follows the scientific method. These protocols should be placed on file with an office at the Center, where they can be accessed easily by anyone at any time.

6. Information on project monitoring should be used in the preparation of financial projections for the following two to four years, as a component of strategic planning for Center budgets.

7. Given the freeze in PAHO/UN positions for the Centers and considering the limited number of positions available for the future, a review should be

undertaken of the medium- and long-term strategy for maintaining and improving the critical mass of human resources at the Centers for the development of S&T. An equitable and definitive solution to the problem of different contracting formats should be sought for the immediate future. All these actions should be envisaged as part of a policy for human resources development at the Centers.

8. Support should be given for preparing proposals for institutional development and for seeking extra-budgetary financing to ensure implementation of the strategic plans, which should include the strengthening of S&T as a fundamental component.

9. It is recommended that support be provided for the preparation of proposals for technological research and development in priority areas in order to attract extra-budgetary funding. Support should also be given for the marketing of technologies with an eye to bringing in extra-budgetary financing that would contribute to the development of S&T.

10. A systematic effort should be made to better document and emphasize what the Centers have to offer, both in terms of knowledge--through publications--and in technologies. This information should be circulated among the Centers.

11. The Centers should take the lead in writing proposals for collaborative and multicenter studies, coordinating them and sponsoring meetings to review progress in the different countries where they are under way. This is one means of maintaining and self-financing the communication needed to keep the networks operating, for example through joint workshops on specific subjects. In addition, the Centers should provide leadership in the promotion and use of computerized networks in order to strengthen the links between the nodes of the various networks with which they work, as this will facilitate the conduct of collaborative research projects. With the availability of communication via BITNET and INTERNET, this does not need to entail any major cost.

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TABLES

Table 1
Basic Data on the Pan American Centers

Acronym	Full Title and Location	Area	Year Founded
ECO	Pan American Center for Human Ecology and Health. Mexico City, Mexico	Health impact of the main chemical contaminants of industrial and agricultural origin.	1975
CEPIS	Pan American Center for Sanitary Engineering and Environmental Sciences. Lima, Peru	Protection and improvement of the physical environment: water, treatment and reuse of wastewater, management of household and hazardous waste.	1968
PANAFTOSA	Pan American Foot-and-Mouth Disease Center. Rio de Janeiro, Brazil	Prevention, control, and eradication of foot-and-mouth and other vesicular diseases.	1951
CAREC	Caribbean Epidemiology Center. Port of Spain, Trinidad and Tobago	Improvement of the health of the Caribbean population through epidemiology, laboratory technology, and disciplines related to public health.	1975
CLAP	Latin American Center for Perinatology and Human Development. Montevideo, Uruguay	Improvement of maternal and child health: identification and solution of perinatal and pediatric problems.	1970
CFNI	Caribbean Food and Nutrition Institute. Kingston, Jamaica	Nutritional status and food security of the countries of the Caribbean (excluding Cuba, Haiti, and the Dominican Republic).	1967
INCAP	Institute of Nutrition of Central America and Panama. Guatemala City, Guatemala	Solution of food and nutrition problems of its member countries as part of the broader goal of promoting human development.	1949

Table 2
Operating Budgets of the Centers, 1993
(in US$ millions)

Center	Regular funds	Country Funds	Other funding	Total
ECO	1,043,000		1,527,000	2,570,000
CEPIS	2,909,000		1,340,000	4,249,000
PANAFTOSA	7,449,000		1,407,000	8,856,000
CAREC	1,371,000	1,679,000	1,257,000	4,307,000
CLAP	1,062,000		1,063,000	2,125,000
CFNI	1,028,000	306,000	261,000	1,595,000
INCAP	1,546,000	750,000	4,645,000	6,941,000

Table 3
ECO Publications, 1988-1992

Type of Publication	1988	1989	1990	1991	1992
Scientific publications	21	12	8	2	22
Journals	11	8	16	10	13
Serial publications	6	2	1	2	1
Monographs	0	0	0	0	0
Theses & dissertations	0	0	0	0	0
Conference papers	62	74	67	77	71
Teaching materials	18	15	8	19	12

Table 4
CEPIS Publications, 1988-1992

Type of Publication	1988	1989	1990	1991	1992
Scientific publications	-	-	-	-	-
Journals	1	1	2	4	10
Serial publications	-	-	-	-	-
Monographs	28	10	19	15	10
Theses & dissertations	-	-	-	-	-
Conference papers	2	2	5	7	-
Teaching materials	5	2	3	2	-

Table 5
PANAFTOSA Publications, 1988-1992

Type of Publication	1988	1989	1990	1991	1992
Scientific publications	13	11	9	6	4
Journals	1	1	2	1	3
Serial publications	5	10	0	0	0
Monographs	0	0	0	0	0
Theses & dissertations	0	1	0	0	1
Conference papers	12	5	1	16	12
Teaching materials	0	0	0	0	0

Table 6
CAREC Publications, 1988-1992

Type of Publication	1988	1989	1990	1991	1992
Scientific publications	22	26	40	41	39
Journals	1	3	3	5	5
Serial publications	0	0	0	1	0
Monographs	0	0	6	10	2
Theses & dissertations	0	0	1	1	0
Conference papers	9	4	9	1	5
Teaching materials	n.a.*	n.a.	n.a.	n.a.	n.a.

* Not applicable.

Table 7
CLAP Publications, 1988-1992

Type of Publication	1988	1989	1990	1991	1992
Scientific publications	33	18	43	13	13
Journals	2	-	1	1	10
Serial publications	1	1	1	1	1
Monographs	8	-	8	2	9
Theses & dissertations	1	-	1	1	1
Conference papers	2	2	2	4	5
Teaching materials	1	-	2	-	1

Table 8
CFNI Publications, 1988-1992

Type of Publication	1988	1989	1990	1991	1992
Scientific publications					
Journals					
Serial publications					
Monographs					
Theses & dissertations					
Conference papers					
Teaching materials					

Table 9
INCAP Publications, 1988-1992

Type of Publication	1988	1989	1990	1991	1992
Scientific publications	57	29	92	50	29
Journals	1	1	1	1	1
Serial publications	-	-	-	1	1
Monographs	16	0	4	4	23
Theses & dissertations	23	13	22	10	10
Conference papers	-	-	-	-	18
Teaching materials	-	-	-	-	27