International Centre for Diarrhoeal Disease Research, Bangladesh

Annual Report 1991

The INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH (ICDDR,B) is an autonomous, not profit organisation for research, education, training, and clinical service. It was established in December 1978 as the successor to the Cholera Research Laboratory, which began in 1959 in response to the cholera pandemic in Southeast Asia.

The mandate of the ICDDR,B is to undertake and promote research on diarrhoeal diseases and the related subjects of nutrition, fertility, and acute respiratory infections with the aim of preventing and controlling diarrhoeal diseases and improving health care. Globally, disseminating its findings, providing training in the areas of its expertise, and collaborating with other scientists and institutions are other objectives the institution is bound to uphold.

The Centre, as it is known, has its headquarters in Dhaka, the capital of Bangladesh, and operates a field station in Matlab Upazila of Chandpur District. It is organised into four scientific divisions: Clinical Sciences, Community Health, Laboratory Sciences, and Population Science and Extension. At the head of each Division is an Associate Director, the Associate Directors are responsible to the Director who in turn answers to an international Board of Trustees consisting of eminent scientists and physicians and representatives of the Government of Bangladesh.

The Centre is funded by organisations and nations which share its concern for the problems of developing countries. At present (May 1992), the major donors include the aid agencies of the governments of Australia, Bangladesh, Belgium, Canada, Denmark, France, Japan, The Netherlands, Norway, Saudi Arabia, Sweden, Switzerland, the United Kingdom, the United States, international organisations including the United Nations Development Programme, the United Nations Children's Fund, and the World Health Organization, and private foundations including the Ford Foundation and the Sasakawa Foundation. ■

Annual Report 1991

Asem Ansari

International Centre for Diarrhoeal
Disease Research, Bangladesh

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The ICDDR,B publishes a journal, a newsletter, scientific reports, monographs, annctated bibliographies, and many other items in the field of diarrhoeal diseases and on related subjects. Details of some of these publications may be found at the end of this report.

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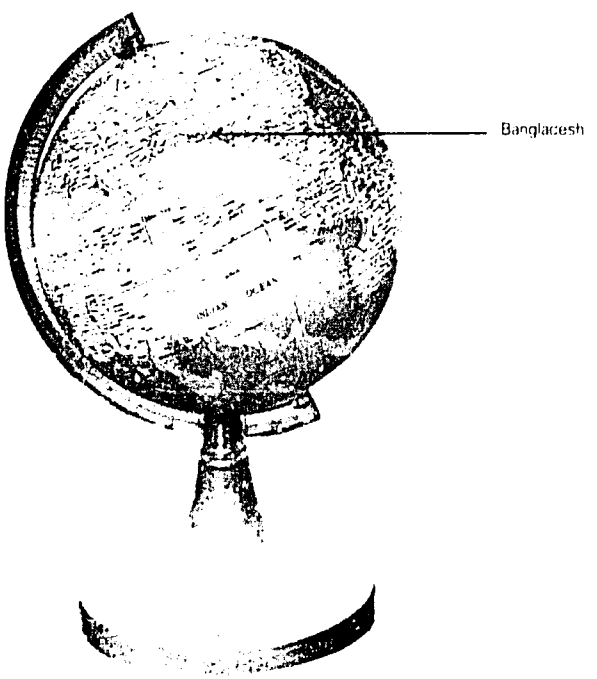
PREFACE

This is the thirteenth Annual Report of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B)

This report describes many aspects of the work of the ICDDR,B staff during 1991, including research, support for research, health services, training, dissemination, and administrative activities. The organisation of this report varies somewhat from the last few years; it is arranged by Division rather than topic. Instead of all watery diarrhoea studies being under one heading, for example, they will be found under Clinical, Community, or Laboratory, depending on their origin. They and all others can be found best by checking the index. Those studies that are done in collaboration with other Divisions are cross referenced. This format provides the reader with the opportunity to learn the operation of each Division and its staff.

Scientific papers, letters, abstracts, and editorials published by the Centre's current or former staff and by visiting scientists are also listed here. Many of these describe research actually done in previous years and reported in earlier reports.

If you have any comments on this report or would like more information about the ICDDR,B or the works described here, please write to the Director at the address given opposite.



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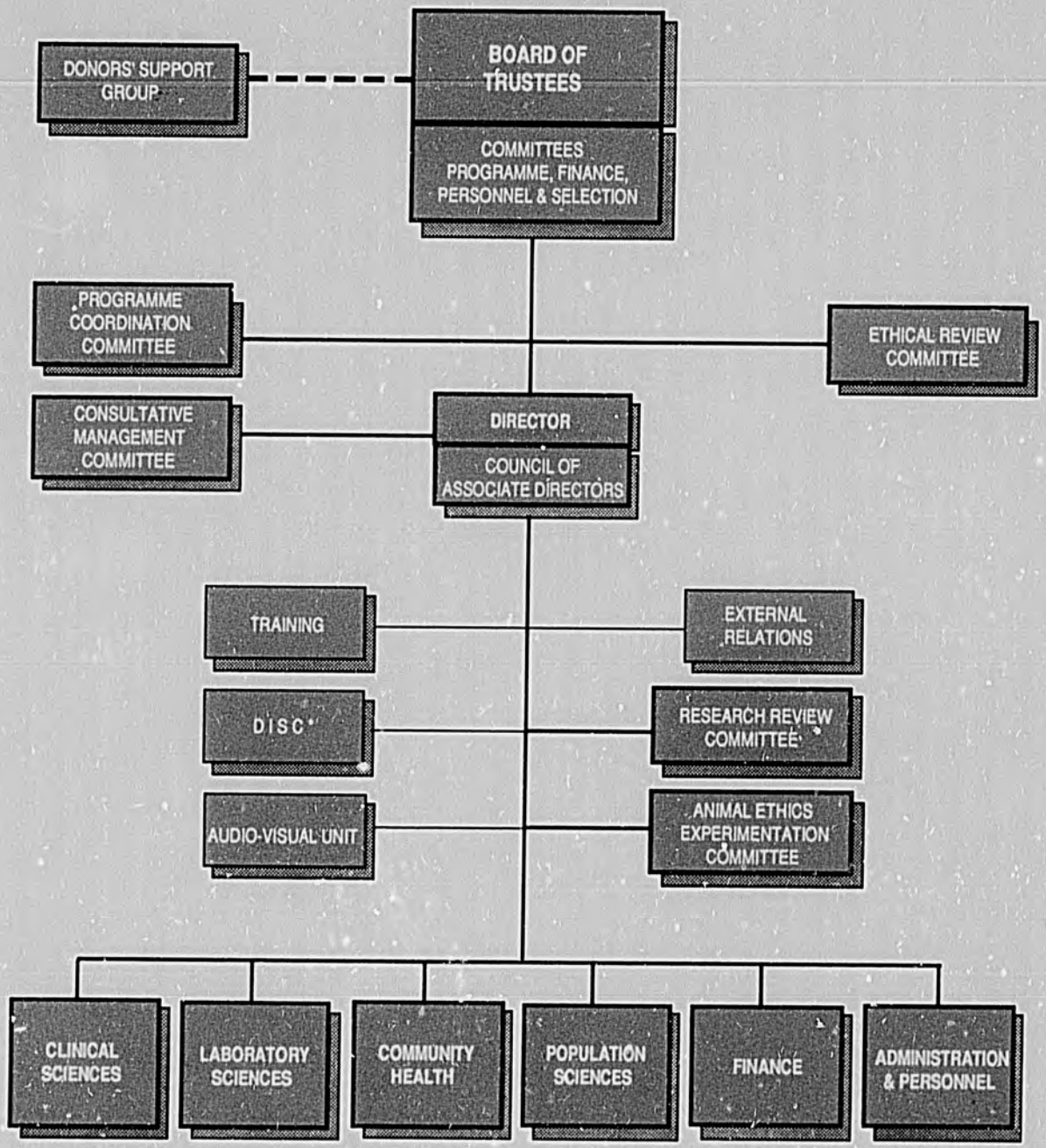
The director giving his welcoming address at the Centre's first Annual Scientific Conference.

ORGANOGRAM



* Diarrhoeal Diseases Information Services Centre

DIRECTOR'S REPORT

Major global and local events heralded the new year. The conflict in the Gulf saw thousands of Bangladeshis returning to safety and swelling the numbers of the unemployed. The popular uprising for a constitutionally elected government continued to occupy the time and minds of many. In March 1991 a major diarrhoea epidemic swept through the country and on 29 April 1991, one of the worst calamities ever to befall Bangladesh took place when a disastrous cyclone struck the south and south eastern part of the country claiming over 100,000 lives and wreaking havoc on property and crops. The Centre participated in contributing to national and international efforts to contain the diarrhoea epidemic, as well as addressing other health consequences of the cyclone. Understandably the time and resources needed had to be found, but while competing with the regular programmes, these activites further enriched the Centre's experience and gained it the respect and goodwill of the people of Bangladesh.

Requests for the Centre's expertise were not, however, limited to Bangladesh. The outbreak of cholera in South America for the first time in a century raised a call for the Centre, the foremost depository of cholera expertise in the world, to provide assistance. A team made up of an epidemiologist, a bacteriologist, and a clinician spent two weeks in Ecuador and assisted the Ministry of Health in the management of the outbreak. The Centre is likely to have an expanded role in South America as cholera is nearly certain to stay there for many more years. The Centre has also agreed to WHO's request to act as a reference laboratory for identification of *V cholerae*.

In a continuing effort to maintain and enhance its role as an international research institute, the Centre maintained communications and dialogue, as well as collaboration, with agencies and universities involved in child survival, population, and family planning and in diarrhoeal disease control. One end product was the September 1991 issue of the Journal of Diarrhoeal Disease Research published by the Centre which contained the research on diarrhoeal diseases in Africa, Asia, and Latin America. The studies were supported by the Applied Diarrhoeal Disease Research programme of the Harvard Institute for International Development which is funded by the United States Agency for International Development. The Centre also made fresh attempts to strengthen its capacity to communicate and disseminate research findings not only to the scientific and health community but also to programme planners, policy makers, and administrators. It did so by employing the services of an expert to assess strengths and weaknesses in this regard and assist in the development of an action plan for communications and dissemination.

In late November, the Centre organised an international workshop on water and sanitation with participants from several countries of the region.

The Centre held its first scientific conference in October 1991 to convey its research findings to the Bangaldeshi community, including health professionals, service providers, researchers, and policy and decision makers. The conference was warmly appreciated and the Centre is now committed to holding such a meeting on an annual basis.

Pursuing investigations on the research priorities identified by the Centre has occupied most of the Centre's scientific and support staff. These efforts are outlined in this report. To mention a few: In laboratory based research, new enteropathogens have been identified to add to the list of putative agents of diarrhoea, and a state of the art technology, namely the Polymerase Chain Reaction, has been introduced.

A novel treatment of rotavirus diarrhoea using hyper immune bovine colostrum seems to hold promise, zinc supplementation in undernourished children reduces diarrhoea morbidity, and the addition of amylase enriched cereal flour to weaning diets significantly increases energy and nutrient intake of sick children.

Analysis of measles surveillance data collected since 1982 in the Matlab treatment area and since 1989 in the comparison area continues to yield interesting information. While the total number of measles cases is drastically reduced at measles immunisation coverage rates of 65% or more, the proportion of cases of measles occurring below 9 months of age appears to increase (17% in low vs 30% in high coverage areas). This is a preliminary indication that measles transmission persists in young infants even when a high immunisation (90%) coverage rate is attained.

The data from the Demographic Surveillance System were successfully employed to validate an indirect methodological study to measure maternal mortality (the sisterhood method) and to examine the hypothesis that adult sons are a buffer against the adversity of old age in a rural developing society, thus justifying the desire to ensure an adequate number of surviving sons. Studies to identify factors that motivate couples to limit their family size and adopt birth control also continued.

Efforts have intensified to strengthen the research environment in order to improve productivity and quality. Emphasis on social sciences as an integral component of both clinical and community based research has led to the creation of a nucleus of social science expertise with recruitment of staff and allocation of resources. A weekly interdivisional forum has been launched at which research findings, research progress, or new ideas are presented to an audience of staff from all the divisions. This activity has fostered critical enquiry and scientific discipline amongst junior staff.

Major transformations have taken place in the Community Health Division with the various sections regrouped by research programmes. Following an end of project evaluation, the Urban Volunteer Programme has emerged as the Urban Health Extension Project (UHEP), with urban health research as its primary mandate. Similarly, a review by the Programme Committee of the Board of the Population Sciences and Extension Division is likely to be followed by a restructuring to enable the Division to respond better to both service and research challenges. One such challenge is the joint research project between ICDDR,B and the Bangladesh Rural Advancement Committee (BRAC) to examine the health impacts of nonhealth interventions in a community. It is due to start in 1992.

A meeting of the Scientific Advisory Council on Health was convened in early November to help the Centre identify directions for the future. The report made observations and recommendations on ICDDR,B's research agenda, its links with the international research community, and internal communications and staff development.

The Centre's training programme for national and international participants reflected the new emphasis on health research training, research methodology workshops, and aspects of diarrhoeal diseases not covered by training programmes elsewhere.

The year 1991 was one during which continuing support from our donors (including the Canadian International Development Agency) and a prudent austerity programme by management resulted in an excellent financial performance and the imminent possibility of the Centre's extinguishing the accumulated financial deficit. In addition, the Centre has been able to raise some of the funds required to start implementing the physical development plan with extension of the first floor of the hospital and library buildings. Nonetheless, the overall funding of ICDDR,B in 1991 fell to its 1986 level, and this despite cumulative inflation of well in excess of 100%. As an initial step in developing a fund raising strategy, a hospital endowment fund has been launched with the motto, Just $150 will cover the cost of treatment for one child every year FOREVER: it's that simple.

With vexing management and financial issues now held in abeyance, the year 1992 will see the Centre concentrating on further improving the quality of its research output and developing an institutional capacity to respond to calls and challenges from Bangladesh and the rest of the world.

Demissie Habte, M.D.
Director

ICDDR,B
HOSPITAL ENDOWMENT FUND

DONOR SUPPORT

Top: A few of the year's events given a comic twist by the Centre's artist, A. Ansari.

NINETEEN NINETY – ONE

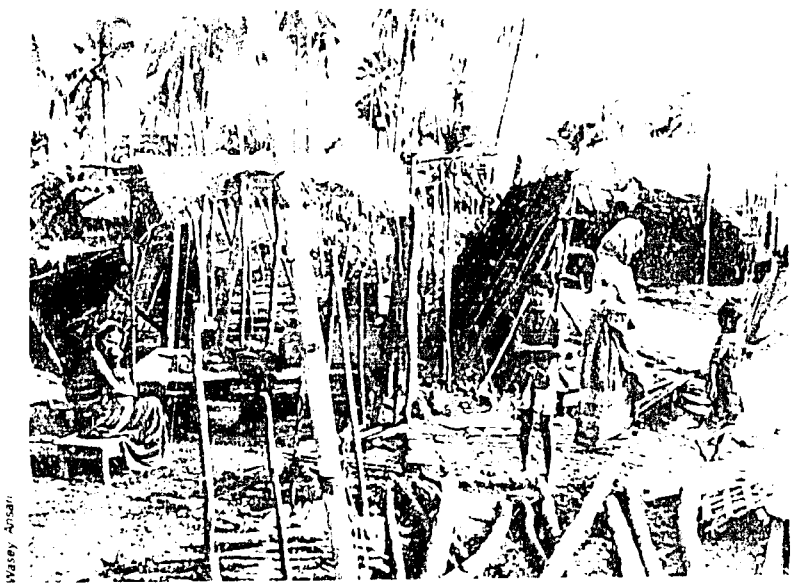
The Director's report highlighted the many events and innovations of outstanding importance in 1991. Below is an elaboration of several of those events that are not covered elsewhere in this report.

THE CYCLONE

On the night of April 29th, the coastal areas of Bangladesh experienced a cyclone of such overwhelming size and power that no one will ever truly know the total extent of the damage.

Bangladesh is a magnet to disaster. This is true, in part, because it is a developing country and, therefore, has developing country problems, i.e. poverty, overpopulation, political instability, and uncontrolled disease. But the country also holds a peculiar attraction because of its location and geography. It is a humid, tropical country with mountains to the north and a funnel shaped coastline on a bay to the south, making the area a target for natural calamaties, such as floods, cyclones, tornadoes, and thunderstorms. These physical and sociological conditions together translate into recurrent devastation for the people, expecially those who live on the coastline or on the islands in the Bay of Bengal. And there are many of them. The high density of population is the reason so many people are affected. The estimated population of the coastal area of Bangladesh is over 14.5 million, the density, approximately 520 people/sq km.

On April 30th, radios and televisions all over the world reported that Bangladesh was struck by yet another calamity – this time a cyclone with unprecedented proportions, with wind speeds of at least 225 km per hour (the measuring device blew away when it recorded this speed) and a tidal surge that reached a height of 7.5 metres. Only the cyclone of November 1970 claimed more lives, and that



Wasey Ansari

Villagers grieve the loss of their homes and families in the wake of the cyclone. Note the more solidly built building with tin roof still standing in the background.

was blamed on an inadequate warning system. This time the people were adequately warned, but many either didn't believe the warning, didn't want to abandon their property, or had no place to go.

The official death toll reached nearly 150,000; however, that included only the immediate victims, most of whom were swept away or drowned by the tidal wave. Damage to property and crops, contamination of drinking water, and destruction of freshwater fish and livestock left survivors at an immediate high risk of death from starvation, disease, and exposure. Long term survival was another hurdle. Agricultural land was submerged in saline water adversely affecting crop cultivation; fruit trees were almost completely uprooted or broken; the ecology was so deranged by the loss of wild life and vegetation that it may take years to know the extent of the impact.

Members of the ICDDR,B staff worked along with many generous relief groups and the Bangladesh Army Medical Corps to dispatch aid to the victims as quickly as possible. Their progress hampered by continuing high winds and lack of proper equipment, they were grateful later to be joined by the U.S. Joint Task Force relief operation, code named Operation Sea Angels, who provided such things as hovercrafts, generators, and medical facilities, as well as large quantities of purified water and desalinisation units.

The most immediate need was for food and water, so the Centre's doctors helped pass out high calorie biscuits while tending the ill. Teams of scientists were also sent to test the water for both bacterial and saline content, assess the quality of the water purification tablets, and collect stool specimens for testing in the Centre's laboratories. Using ICDDR,B expertise to its fullest, training sessions were conducted on site on the treatment of diarrhoea and practical water treatment methods. In this area of the country, there is only one medical complex for every 200,000 people. In one of these hospitals in Chittagong, one of the ICDDR,B teams turned a 40-bed ward into a diarrhoea treatment centre by bringing cholera cots and other equipment from Dhaka.

At home, the Staff Cooperative Society worked day and night packaging over a million and a half packets of oral rehydration salts, barely keeping up with the demand. And a leaflet explaining post cyclone diarrhoea management and water testing and treatment was prepared and distributed among relief workers in the cyclone area.

Faced with the challenge of high risk weather patterns, government and non government agencies have been prodded by the storm to work harder toward finding solutions to, if not prevent disaster, at least reduce the devastation and death it brings. An ICDDR,B published paper of a study done after a 1985 cyclone which claimed an estimated 1,000 lives found that cyclone shelters were indeed effective in averting deaths. The problem is there are too few shelters and people are reluctant to leave their property to use them.

Education of the people is a primary concern, as are all the things ICDDR,B stands for: population control, sanitation, nutrition, and, of course, adequate management of diarrhoeal illnesses.

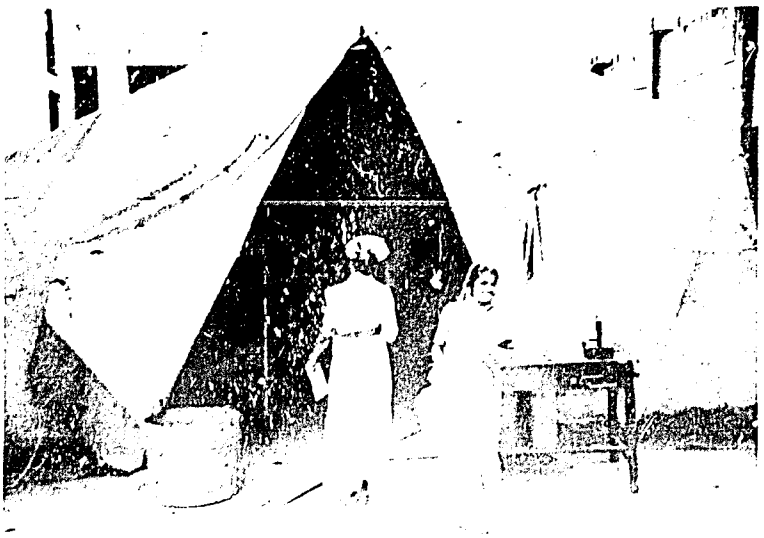
(Information for this report was obtained in part from CYCLONE '91 An Environmental and Perceptional Study, published by the Bangladesh Centre for Advanced Studies, Dhaka.)

EPIDEMICS

Twice during the year the tent went up on the parking lot to accommodate the overflow of patients at the Dhaka patient care facility. Attendance at the hospital was unusually high, the fourth highest in the history of the institution. These serious diarrhoea epidemics struck not just in Dhaka, but all over Bangladesh following the cyclone and other severe storms which caused flooding and disruption of everyday life. But diarrhoea epidemics are a part of everyday life too in developing countries, and many of the cases are cholera.

The 7th cholera pandemic, which inspired the establishment of this institution when it began in 1958, completed its spread to South America in 1991. And, in spite of the fact that cholera has been well researched — much of it done here at ICDDR,B — and that it is curable, it claimed thousands of lives.

There are several reasons for this: 1. The



Asem Ansari

This temporary facility for sheltering the overflow of patients during epidemics was set up twice during 1991.

organism survives well in areas of poor sanitation, where much of the world's population lives. 2. The average time from onset of symptoms to the occurrence of life threatening dehydration is approximately 12 hours, which is often not enough time for severely ill patients to reach medical care. 3. There has not been an adequate vaccine to provide immunity from the disease.

ICDDR,B has been trying to find ways to overcome these contraints. This report is filled with specific studies of those attempts, from improvement of water and sanitation facilities to the development of a vaccine. Much of this information and, in fact, the expertise of the scientists themselves, are being used worldwide to develop health measures which will prevent deaths and control the spread of this elusive disease.

(Information for this report was obtained from an editorial in the March 1992 edition of the JDDR).

HOSPITAL ENDOWMENT FUND

Because the care to all patients at both of the Centre's hospitals (Dhaka and Matlab) is free, covering the cost of this care is a perpetual concern. Hoping to minimise this worry, the ICDDR,B launched a campaign to raise money for an endowment fund. These funds, securely invested, from which only the interest can be drawn, will establish a permanent source of income to pay a large portion of patient care expenses.

The appeal went out in 1991. A colorful brochure was produced, letters were mailed to prospective donors, and about 15,500 U.S. dollars had come in by year's end. The committee formed to direct this endeavour has found that individuals are especially sympathetic and generous when they know that the money they give will not be funneled toward any administrative needs, and that every cent, taka contributes to the saving of lives.

A tear out page in the back of this report explains more and provides an opportunity for readers to contribute. Donations are tax exempt.

INTERDIVISIONAL SCIENTIFIC FORUMS

The weekly interdivisional scientific forums began in July. Lunch was catered and the Divisions rotated responsiblity for presentations. The following is a list of their subjects and speakers.

CLINICAL SCIENCES DIVISION

Short course Ciprofloxacin in the Treatment of Shigellosis ... M.A.Salam

Dr. Sultan Ahmed Chowdhury making a generous donation to the Hospital Endowment Fund. Prof. Habte is receiving and the hospital head, Dr. A. N. Alam, is looking on.

Comparative Efficacy of Oral Gentamicin with Nalidixic Acid in Acute Shigellosis ... M.R. Islam and A.N. Alam

Transport of Short Chain Fatty Acids (Butyrate) across Rat Distal Colonic Epithelium under Voltage Clamped Condition ... G.H. Rabbani

COMMUNITY HEALTH DIVISION

Life Experiences and Teen Fatherhood in Great Britain ... Kirk Dearden

An Evaluation of the Urban Volunteer Program Health Services Delivery System ... Abdullah Baqui and Charles Lerman

Cholera Epidemic in South America, Experience of ICDDR,B in Ecuador ... AKM Siddique

The History, Methodology, and Main Findings of the Matlab Project in Bangladesh ... KMA Aziz

LABORATORY SCIENCES DIVISION

Our Experience in Vaccine Development and Current Status of an Anti Shigella Vaccine ... Zia U. Ahmed

Aquatic Flora as a Reservoir of Cholera ... Md. Sirajul Islam

Pathogenises of *Providencia alcalifaciens* Diarrhoea ... M. John Albert

Polysaccharide Antigens of *Shigella dysenteriae* Type 1 ... Firdausi Qadri

Ribotyping of Diarrhoeagenic Bacteria: Potential Utility of the System for Molecular Epidemiology ... S.M. Faruque

POPULATION SCIENCE AND EXTENSION DIVISION

Mortality in Matlab, 1966 - 1989 ... Michael A. Strong

Effect of Family Planning on Fertility in a Rural Area of Bangladesh ... Abdur Razzaque

Maternal Mortality in the Extension Project Areas: Data from Verbal Autopsies ... Fazlur Rahman

Nutritional Status: A Determinant of Age Mis-statement of Young Children in Rural Bangladesh ... R. Bairagi

Strengths and Weaknesses of Longitudinal Surveillance System: Sex Differentials of Mortality in Matlab ... Abbas Bhuiya

Previous Birth Intervals, Prematurity and Childhood Mortality ... Khorshed A. Mourmder

CLINICAL SCIENCES DIVISION

Associate Director: D. Mahalanabis

The Clinical Sciences Division has the triple function of service, research, and training. It is responsible for providing health care to a large number of patients with diarrhoea coming to the treatment facility in Mohakhali, Dhaka. This large number allows easy and rapid access to patients in order to perform clinical research on pathogenesis/pathophysiology and health interventions (including drug and dietary trials) for the control and treatment of diarrhoea. The primary objective of the research is to develop optimum case management to reduce morbidity and mortality from diarrhoeal diseases. The Division also provides facilities for training in clinical disciplines and in research to various health professionals.

The Division has recently been depleted of its international expertise and is making efforts to recruit replacements through a programme of exchange with institutions abroad. The current number of staff members is 170, 20 fewer than in 1990. This number includes 13 research scientists, 5 of whom are on study leave, and 10 medical officers/investigators.

Members of the Division's staff participated fully in the Centre's first Annual Scientific Conference, presenting many papers. They also contributed to the Bangladesh Nutrition Conference in Dhaka in August and the Commonwealth Conference in New Delhi in November. Several physicians from the CSD responded to the need for assistance in the period following the catastrophic cyclone.

Collaborative research and exchange of ideas is carried on by the CSD with several local and international institutions. Those abroad are:

** The Institute of Child Health (UK)
** The All India Institute of Medical Sciences (New Delhi)
** The University of Basel (Switzerland)
** The University of Alabama (USA)
** The University of California, Davis (USA)
** Tufts University (USA)
** The National Medical Centre (Japan)
** Kothari Centre (Calcutta, India)
** INSERM (France)

HEALTH CARE

The Centre's hospital in Dhaka offers free care to all needing treatment for diarrhoeal diseases, related illnesses, or problems of children and their mothers, such as malnutrition and excess fertility. Most of the patients who attend are from the surrounding areas, but some come great distances by rickshaw. Here at the Clinical Research Centre (CRC), in addition to treatment and family planning, they are offered immunisations and health education.

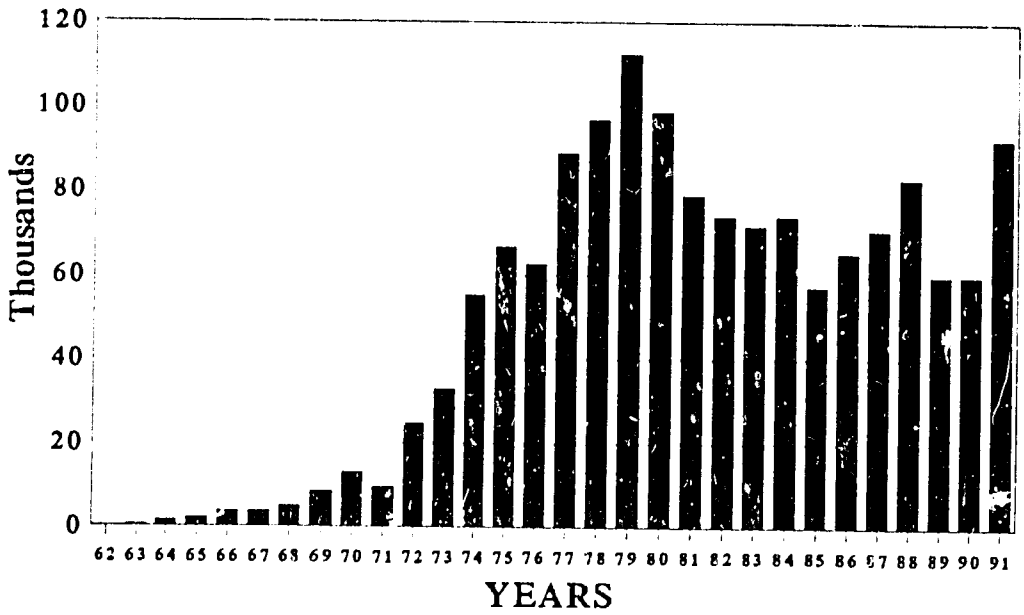
Clinical Research Centre, Dhaka

Officer in Charge: A.N. Alam
Funded by: Core Funds

During 1991, a total of 92,148 patients attended the CRC, 32,198 (53.7%) more than the previous year's figure of 59,950. This is the fourth highest number of patients treated at this Centre, and is about 10,000 more than the number of patients attending the CRC in 1988, the year of unprecedented floods (Figure). Based on a surveillance of a systematic 4% sample of all 92,148 patients, an estimated 11,625 had *Shigella spp.*, and an estimated 16,650 had *Vibrio cholerae*. Estimated case fatality rate for the various species of *Shigella* was 2.6%, but for *V. cholerae* it was not detectable with this sample size.

The total number of patients admitted to the inpatient facilities has increased by 341 from the previous year (5,557 in 1990 to 5,898 in 1991), representing an increase by 6.1%. Admissions as percent of total patient attendance have, however, decreased from 9.3% in 1990 to 6.4% in 1991. Of these admissions, 94.3% (5,561 patients) were admitted to the general wards and Intensive Care Unit (ICU).

Yearly patient visits at the Clinical Research Centre, Dhaka
(Formerly Cholera Hospital)



Average duration of hospital stay by patients in the General Ward and ICU was 5.9 days. The number of patients admitted to the Research Wards for different research protocols was 337. However, many more patients in the general wards and short stay areas were enrolled in various research protocols.

Of the patients requiring admission to the inpatient units because of associated complications, 479 died in spite of all possible efforts. Twenty nine patients died in the OPD and another 33 patients were dead on arrival bringing the total to 508, representing a death rate of 0.55%, which is 0.07% less than that of 1990.

Of the 5,898 admitted cases, 951 (16.1%) had *Shigella* isolated from their stool or rectal swab cultures, and 120 (12.6%) of them died. Corresponding figures for 1990 were 763 (13.7%) and 55 (7.2%) respectively. Typhoidal or non typhoidal *Salmonella* was isolated from 191 patients (3.2%). Of these, 8 died, resulting in a case fatality rate of 2.4%. Of all patients admitted, 451 (7.6%) had *V. cholerae* isolated from stool/rectal swab samples; 19 (4.2%) died. Non cholera vibrios were isolated from 39 (0.66%) of the admitted patients; 6 (15.4%) died. The highest number of deaths (326) occurred among the 4,351 patients who were either not sampled for faecal cultures, or had no bacterial enteric pathogens (ETEC is not routinely looked for) isolated from their faecal samples. The case fatality rate in this group was 7.5%.

A total of 70,868 litres of intravenous fluids were used, which is about 3 times more than were used in 1990. Use of IV fluids was 0.77 litre per patient (0.41 litre/patient in 1990). A total of 444,094 litres of ORS were used which is 130,119 litres more than in 1990. The ratio of intravenous fluids to ORS was 1:6.3; the ratio in 1990 was 1:12.7.

Radiological investigations were performed on 6,138 patients during the year, including 5,209 chest X - rays, 495 abdominal, and 435 others. In addition, some fluoroscopic examinations were performed for research protocols. Another 48 chest, 3 abdominal, and 18 other X - rays were performed for payment. During the year, 411 electrocardiographs were performed by this department, including 16 electrocardiographic examinations of private patients.

TRAVELLERS' CLINIC: Thirty patients visited

the clinic for consultation during the year. The clinic handled a total of 2,450 samples for different investigations that included 1,312 samples for clinical pathology, 696 samples for microbiological investigations, 402 samples for biochemical tests, and 40 samples for miscellaneous other tests.

Child Health Programme
Principal Investigator: M.A. Islam and
M. Mujibur Rahman
Funded by: DANIDA (Denmark)

Begun in 1987, the Child Health Programme (CHP) is an integrated health care service with both preventive and curative components. Its functions include:

** health education to all patients and attendants who visit the CRC,

** immunisation of children and women of child bearing age,

** nutritional rehabilitation of malnourished children,

** treatment of TB in both in patient and follow up settings,

** family planning activities that emphasize birth spacing and the use of contraceptives, and

** the provision of training to health personnel in preventive health care.

The programme continued its efforts in adjustment, improvement, and development of ongoing activities and conducted impact evaluations during the reporting period, further integrating its various activities with the routine activities of the CRC.

HEALTH EDUCATION is given both in groups and individually. Each group is comprised of 6 participants discussing a single topic for 15 to 20 minutes. The topics stressed are prevention and treatment of diarrhoea, nutrition, immunisation, child stimulation, and birth spacing/family planning. These aspects are covered further during individual interaction from bed to bed and further emphasised using practical demonstrations and film shows. During the year, 21,678 group sessions were conducted and about 130,000 attendants/ patients received health education messages.

IMMUNISATION services, following the international Expanded Programme on Immunization (EPI) guidelines and policies are offered daily from 07.00 a.m. to 07.00 p.m. Mothers are motivated to immunise their children, themselves, and any accompanying females of childbearing age. During 1991, approximately 33,000 children under 2 years of age were treated in the CRC. The number of these children who needed immunisations was 10,241 (31%), and of these 7,642 (75%) received protection against diphtheria, whooping cough, and tetanus (DPT), measles, polio, and/or tuberculosis (BCG). In addition, 1,356 children, mostly siblings or relatives of patients or staff, were immunised, bringing the total number of children immunised by the CHP to 8,998. Sixty percent received the first injection of DPT and 3,145 children reported for follow up doses.

Efforts were made to increase the tetanus toxoid (TT) coverage of eligible women,

This child, like all others who visit the hospital, was instructed to receive protection against six preventable diseases

including all the visiting females of the patients as well as the mothers. The estimated number of unimmunised women was 16,300, and 10,943 (67%) received TT (70%, the 1st dose). The number of women reporting for follow up doses was 965. The mother's immunity to tetanus protects the newborn baby.

NUTRITION REHABILITATION services are offered by the CHP to inpatient and outpatient children; home visits are also made. In 1991, 289 patients were treated for severe malnutrition as inpatients in the Nutrition Rehabilitation Unit (NRU). Their attendants were given intensive training in low cost home based diets and practical demonstrations; 745 were followed up in the outpatient unit. Social counselling and income generating activities were also provided, and child stimulation and kitchen gardening were demonstrated to all attendants.

TUBERCULOSIS services are given to all diagnosed TB cases (patient, siblings and parents) free of cost either as out patients or at home visits, full course treatment is provided. During the year 109 patients (91 children and 18 adults) were treated.

BIRTH SPACING AND FAMILY PLANNING services were continued for mothers, and the services were further strengthened by offering education classes to fathers also. The programme focussed on increasing awareness and guiding the clients to choose the appropriate methods.

A total of 704 clients received a variety of methods for family planning, the injectable contraceptive being the most popular. A safe delivery kit was also distributed to pregnant mothers at or after 8 months of pregnancy. Forty two mothers received this kit which contains sterile cotton, gauze, string, and blade, plus soap, disinfectants, and plastic sheeting.

TRAINING is offered to ICDDR,B health workers, nurses, and other health personnel from government and non government institutions. During 1991, CHP trained 57 internal and 76 external health personnel.

CLINICAL RESEARCH

The research of the CSD is coordinated through the following task forces: watery diarrhoea, invasive diarrhoea, nutrition management, clinical epidemiology, and maternal and child health. Patient resources for research include, besides the CRC, two clinics. The Nandipara Clinic is in a peri urban village situated 10 km north east of Dhaka where there are 2,000 households with about 500 children under age 5; it is divided into 5 neighborhoods according to population clusters. The CSD physicians run this weekly clinic for a population made up of mostly landless peasants and day labourers. Narayanganj Clinic is centrally located in the project area to provide services to the study children. Rural children with common ailments not manageable at the door step are brought to this clinic and attended by physicians.

In the CRC, research facilities have been improved considerably, e.g. broadened data management and analysis, enhanced facilities for metabolic research, and created facilities to use the hospital wards for research. In the CRC, 337 patients were admitted to the 2 research wards under 9 different research protocols; the average stay in these wards was 6.3 days. Some patients were studied in the General Ward and Intensive Care Unit under two clinical research protocols. Additionally, more than 1,000 non admitted patients were studied in the outpatient areas under 2 research protocols. This is a new development in the CRC, initiated for optimal utilisation of patients for clinical studies.

The useful life of reusable syringes and needles for immunisation was evaluated under field conditions, and conditions for their optimum use were defined.

The number of patients being treated at the CRC is very large: about 200 300 patients every day, the yearly total being about 70,000. It is not feasible to study each patient in depth nor to collect clinical and microbiological data on each of these patients. Therefore, the Centre maintains and modifies a surveillance system in which data are collected from a 4% systematic sample of patients.

ICDDR,B Surveillance Programme, Dhaka
Principal Investigators: A.N. Alam and D. Mahalanabis
Funded by: UNDP/WHO from January 1987 to 1992

The purposes of this Programme are:

** To outline the causative organisms of diarrhoeal illness seen at ICDDR,B in relation to age, sex, and clinical aspects.

** To collect information on important socioeconomic factors relating to diarrhoeal diseases.

** To provide the background information to investigators of the Centre for developing new protocols.

** To provide a weekly report to the Government of Bangladesh on aetiological agents isolated from the stool/rectal swab samples collected from patients included in the protocols.

During 1991, 3,662 patients were enrolled in this Programme. The selected patients received the routine medical care and were interviewed by a member of the surveillance team. All these patients were given a thorough physical examination by a physician. Anthropometric measurements, such as height, weight, and arm circumference were taken, and a stool specimen/rectal swab was obtained for culture and microscopic examination. The table shows the aetiological agents isolated from these patients in 1991. ■

In research, increasing emphasis is being placed on dietary interventions as preventive, curative, and rehabilitative options in both acute and persistent diarrhoea. Several of these studies were completed in 1991. Two of them have given us a better understanding of optimum feeding during and after dysentery due to shigellosis in children.

Species of *Shigella* are major causes of diarrhoea and death in developing countries. Shigellosis leads to malnutrition, growth faltering, and recurrent infections, especially in children. The seriousness of the disease caused by these organisms demands a high priority among studies at ICDDR,B.

Aetiological agents isolated from the patients in the surveillance programme in 1991

Months	No. of patients	*V. cholerae* O1	*Shigella*	Other vibrios	Rotavirus	*Salmonella*
January	207	26	31	23	55	5
February	168	15	14	19	30	6
March	300	48	29	44	31	7
April	448	95	39	68	19	9
May	391	68	52	63	26	9
June	320	44	39	51	32	9
July	241	21	32	32	32	14
August	232	18	25	41	16	11
September	346	73	32	52	39	6
October	409	113	63	45	57	10
November	302	87	48	39	33	3
December	298	62	57	31	47	2
Total	3662	670	461	508	417	91
%		*18.3	12.5	13.9	11.4	2.5
Estimated total**	91,175	16,750	11,525	12,700	10,425	2,275

* Observed increase in *V. cholerae* isolation in 1991 was due to two epidemics experienced during the year.

** Extrapolated to the total number of patients attending the treatment facility.

High nutrient feeding during the acute stage of shigellosis
Principal Investigator: R.N. Majumder
Funded by: USAID from October 1988 to March 1992

The objective of this study was to determine if intensive high caloric feeding of undernourished children 1 4 years of age with shigellosis can improve their clinical and nutritional outcome (See 1990 Annual Report, p.12, for more details.)

In this controlled clinical trial, high energy feeding attained by frequent feedings of energy dense food was compared with the usual food intake in a group of children 1 4 years of age with severe shigellosis. Preliminary analysis of results indicated that sick children can take as high as 150 160 kcal/kg/day from day one of treatment. Even over a short period of 10 days significant nutritional weight gain was demonstrated. ■

Nutritional management of post shigellosis growth faltering
Principal Investigator: AKM Iqbal Kabir
Funded by: USAID from August 1988 to December 1991

The objective of this study was to evaluate the impact of feeding a high protein diet during convalescence from shigellosis. It has been hypothesised that the growth faltering seen in children with shigellosis is due to an extensive loss of serum protein in the stool and that a high protein diet during convalescence will lead to a rapid catch up growth. Children with shigellosis were randomly assigned to receive for 3 weeks either a high protein diet or a standard control diet. (See 1990 Annual Report for more details.)

The results show that children who ate the high protein/high energy diet were significantly taller than those who received a standard protein diet. This increase in height was maintained during follow up at 3 and 6 months. Children fed the high protein diet also experienced 22% less diarrhoeal attacks during the 3 months follow up.

The study has been completed and we concluded that growth faltering following infection with *Shigella* spp. can be prevented by feeding a high protein, high calorie diet. ■

Other studies completed during the year uncovered the availability of more antibiotics to treat shigellosis. This is important because currently used drugs are continuously becoming more and more resistant to the organisms. Pivmecillinam and ciprofloxacin were shown to be highly effective, whereas gentamicin in large doses, extensively promoted in China for the treatment of shigellosis, was found to be ineffective.

Pivmecillinam and gentamicin in the treatment of acute shigellosis.
Principal Investigators: M.R. Islam and A.N. Alam
Funded by: USAID from March 1989 to December 1991

The objective of this study was to evaluate oral gentamicin and pivmecillinam in the treatment of acute shigellosis and compare the efficacy with the currently used drug, nalidixic acid. The study was a double blind randomised clinical trial to evaluate the efficacy of these 3 drugs on children (See 1990 Annual Report, p.13, for more details)

The study is complete and the results suggest that oral pivmecillinam, a penicillanic acid derivative, is the same as nalidixic acid in the treatment of nalidixic acid sensitive cases of acute shigellosis. Gentamicin orally, however, was found to be ineffective. ■

Short course ciprofloxacin in the treatment of shigellosis.
Principal Investigators: M.A. Salam and M.L. Bennish
Funded by: Bayer and Core funds from August 1989 to August 1991

The objective of this randomized, double blind study was to compare the effectiveness of a conventional regimen of treatment for shigellosis using ciprofloxacin, a third generation quinoline derivative, given as 500 mg every 12 hours for 5 days with either a single dose of 1 g, or 2 doses of 1 g given 24 hours apart. Of the 118 adult males who were eligible for analysis, 40 received a single dose, 43 received two doses, and 35 received 10 doses of ciprofloxacin (1 dose every 12 hours). (See 1990 Annual Report, p. 13, for more details)

Treatment failed in 4 of the single dose group, 2 in the two dose group, and in none

of the 10 - dose group; these differences were not significant. When patients infected with *S. dysenteriae* type 1 were separately analysed, therapy failed in 4/10 (40%) patients in the single dose group, 2/15 (13.3%) patients in the two dose group, and 0/15 patients in the 10 - dose group; the difference between the 1 - dose and 10 - dose group was significant. However, eradication of *Shigella* organisms occurred faster with the single dose therapy than with the 10 dose therapy; the difference was significant on day 2 of the study.

We concluded that a single 1 g dose of ciprofloxacin is effective therapy for patients infected with species of *Shigella* other than *S dysenteriae* type 1, and is inferior to the ten dose therapy for treating patients infected with *S. dysenteriae* type 1. The efficacy of courses intermediate between 1 and 10 doses in the treatment of patients infected with *S dysenteriae* type 1 needs to be evaluated in larger trials. ■

Identifying patients at risk of developing serious complications to shigellosis is the aim of another long term study which is nearing completion. Both leukaemoid reaction, a condition which resembles leukaemia, and haemolytic uraemic syndrome, a serious blood disorder involving the kidneys, quite often complicate dysentery and are often fatal. Why some children develop these problems is still unknown.

Cytokines in the pathogenesis of shigellosis
Principal Investigators: M A Salam and M. Bennish
Funded by: USAID from December 1988 to December 1992

The objective of this study is to explore the relationship of the production and action of cytokines and severe and life threatening complications in shigellosis. The study specifically attempts: (a) to measure the production of the various cytokines, (b) to determine whether a correlation exists between these and the severity of the colitis, fever, leukocytosis, and weight loss, or the development of specific complications, and (c) to determine if patients recovering from *Shigella* related infection have a normal cytokine response to a defined stimulus, a DPT immunisation. If correlations are found, patients at risk may be more easily identified and provided with better treatment.

By the end of December 1991, 226 cases had been enrolled. Of these *S. dysenteriae* type 1 was isolated from 124, *S. dysenteriae* type 2 from 2, *S. flexneri* from 24, *S. boydii* from 3, and *S.sonnei* from another 3 patients. Twenty two of these cases had both leukaemoid reaction and haemolytic uraemic syndrome (HUS), and 36 patients had only leukaemoid reaction. It is estimated that another 8 patients with HUS will be required for the purpose of the study. Ninety - two patients have been enrolled as controls; 43 had *V. cholerae* isolated from their faecal samples and thus qualified.

So far, we have evaluated only the relationship between plasma endotoxin concentrations (EC) and HUS and leukaemoid reaction and have concluded that endotoxaemia in children with shigellosis is associated with the development of HUS but not with leukaemoid reaction. ■

The environmental risk factors of *Shigella* - associated dysentery is the subject of another protocal being carried out in collaboration with the Community Health Division (see CHD). ■

The preliminary results of another successful, nearly completed study offer a new approach in the treatment of rotavirus diarrhoea. These findings, i.e. that hyperimmune bovine colostrum reduces the diarrhoeal duration in infants with rotavirus may lead to better case management of rotavirus diarrhoea in infants. If this approach is also found useful in patients with shigellosis, it may open up the possibility of a new treatment for that disease too. ■

Hyperimmune bovine colostrum in the treatment of rotavirus diarrhoea and *Shigella* - associated disease
Principal Investigators: S. Tzipori and D. Mahalanabis
Funded by: AUSTRALIA from January 1990 to December 1991

The objective of this study is to discover the clinical efficacy of hyperimmune bovine colostrum (HBC) as an immunological approach to treating enteric infections with rotavirus and *Shigella* dysentery. HBC has been prepared by vaccinating pregnant cows with antigens from enteric pathogens including rotavirus and *S. dysenteriae* 1.

After enrollment, patients were randomly assigned to receive either hyperimmune bovine colostrum or colostrum from non immunised cows at a dose of 100 ml 3 times a day for 3 days in a double blind treatment schedule. Clinical outcome is measured by a set criteria (see 1990 Annual Report, p 11 for more details)

Patient recruitment has been completed. The preliminary results show beneficial effects of HBC in patients with rotavirus diarrhoea. The data analysis of patients with *Shigella* is in progress.

Since oral rehydration solution (ORS) is a simple, life saving measure that can be given by care givers at home, finding the most effective, most efficient, and most acceptable ORS is a high priority. This mixture of salts and sugar in water is used to replace and correct the fluid lost during diarrhoea and thus prevents death from dehydration. Prepackaged, ready to use instant rice ORS has been developed and extensively tested in a large number of patients in the hospital and at home; these packets are now being introduced for routine use at the treatment centre replacing the daily need for cooking rice ORS.

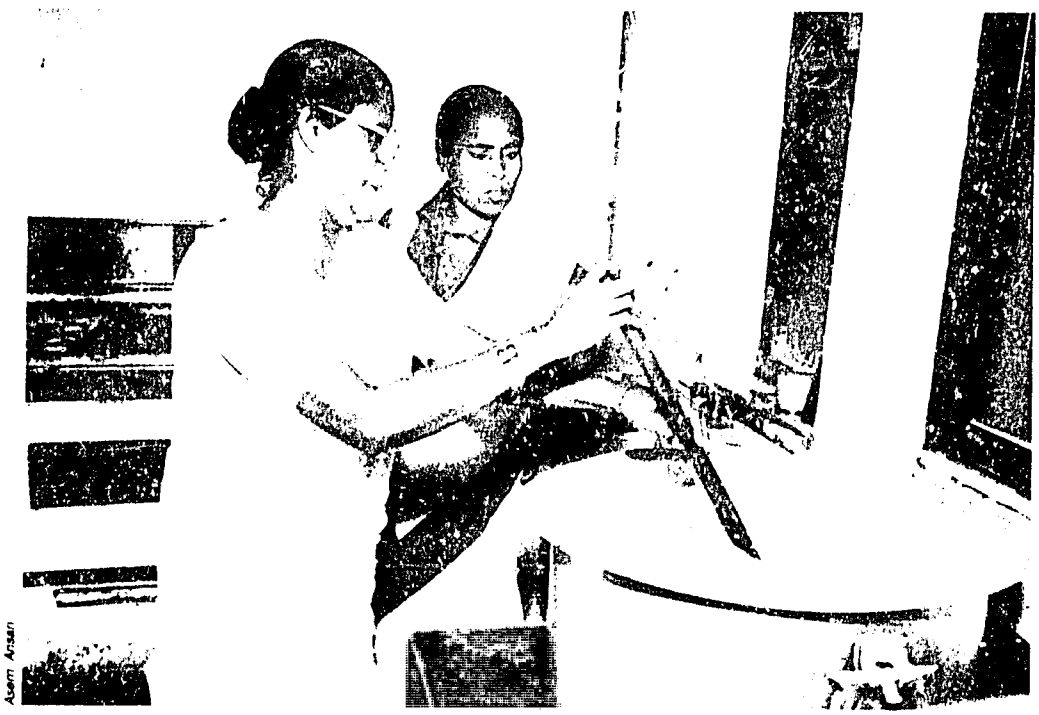
Precooked ready to use rice ORS in children with mild diarrhoea

Principal Investigators: D. Mahalanabis and A.S.G. Faruque

Funded by: WHO from September 1990 to May 1992

This randomised, controlled study aims to determine if the use of precooked rice ORS, compared with glucose ORS, leads to a reduction in the duration of illness in infants and young children with mild diarrhoea, and better nutritional weight gain over a short period of follow up. The findings of the study may help in designing a future action programme for control of diarrhoeal diseases.

Children 3 to 35 months of age with watery



Asem Ansari

Before the pre cooked rice ORS was introduced into the routine of the CRC, it was necessary to prepare the daily requirement by cooking the ingredients in this large kettle. It was then cooled and ladled into pitchers and administered by cup or spoon.

diarrhoea receive either pre-cooked rice-ORS or glucose-ORS. A physical examination is performed and a clinical evaluation is made every 8 hours for the first 24 hours. Patients are given ORS to be used at home until diarrhoea stops and are home visited after 24 hours of discharge. Children then visit the hospital after 48 hours and again on day 16 for another examination and measurements.

More than 350 children have been enrolled. The study continues. ■

The impact of ready to use packaged rice ORS on morbidity and nutrition
Principal Investigators: A.S.G. Faruque and D. Mahalanabis
Funded by: SDC (Switzerland) from February 1991 to February 1993

This study aims to evaluate the role of ready to-use packaged rice ORS in reducing the number and duration of diarrhoeal episodes, and in improving nutrition in infants and young children with mild diarrhoea in rural communities. The response of the mothers is also being monitored. A randomised controlled design will be used so that at the design stage no severe imbalance in composition of groups exists. Comparable communities will be randomly allocated to intervention and control. About 1,200 children will be studied in 24 communities. The study is in progress.

The results of the study will help to formulate a future health policy in diarrhoeal disease control and management and will have far reaching implications for child survival efforts. ■

Comparison of L-alanine glucose based ORS with the standard formula
Principal Investigator: F.C. Patra
Funded by: WHO from 1988 to 1991

The objective of this randomized, double-blind study is to evaluate the efficacy of two oral rehydration solutions based on glucose and an amino acid L-alanine in reducing the magnitude and duration of diarrhoea in adults and older children with acute watery diarrhoea. The two solutions are compared with citrate-based glucose-ORS in a controlled clinical trial.

In a recently reported study from ICDDR,B, an oral rehydration solution containing 90 mmols/l of L-alanine plus 90 mmol/l of glucose as substrates was found to be more highly absorption efficient (reduced total stool output by 51%) than the standard glucose ORS. Since L-alanine is expensive, this study is evaluating an ORS containing a reduced amount of L-alanine (50 mmol/l) and 100 mmol/litre of glucose as substrates in an ORS. Enrollment has now reached 236 patients and data are being analysed. This study is part of our ongoing effort to improve the absorption efficiency of ORS which has obvious public health importance. ■

Absorption promoting ORS in animal models.
Principal Investigators: S. Islam, D. Mahalanabis, A.K. Chowdhury, M.A. Wahed, and A.H. Rahman
Funded by: PCC from 1990 to 1991

This study was carried out in collaboration with the Department of Pharmacy, University of Dhaka, using the substrate, L-glutamine to improve the absorption efficiency of ORS. L-glutamine, a neutral amino acid, was used as an organic molecule in an electrolyte solution to promote the absorption of ORS in the ligated small intestinal loops of rabbits. Polythylene glycol (molecular weight 4,000) was used as a non-absorbable marker.

Our results showed that in the jejunum the absorption of water, Na^+, and K^+ from an ORS containing glutamine was slightly improved but these differences were not significant. Glutamine stimulated the absorption of Cl^- significantly ($P < .002$) in the jejunum, as opposed to Cl^- absorption from glucose ORS. However, in the ileum, ORS containing glutamine enhanced significantly better absorption of water and electrolytes (Na^+, K^+, and Cl^-) than did the glucose ORS ($P < .006$, .051, .001 & .021 respectively). ■

Management of acute diarrhoea in diabetics
Principal Investigator: R. Haider
Funded by: USAID from July 1988 to June 1992

In collaboration with the Bangladesh Institute for Research and Rehabilitation in Diabetes, Endocrine, and Metabolic Disorders (BIRDEM) this study was undertaken to determine which oral rehydration solutions containing glucose, rice, or glycine can be used safely in the treatment of diabetics with acute diarrhoea.

The number of diabetic patients is increasing in developing countries where diarrhoea is already a common problem. Hence the rationale for the study. In this randomised study, fluctuation of blood glucose levels after administration of WHO ORS, rice ORS, and glycine ORS is being assessed in uncomplicated diabetics with acute diarrhoea.

Patient recruitment has been completed and the data are being analysed. ■

Other studies also involved the management of acute watery diarrhoea. One is a completed study which disputes the use of *Sacolene* in the treatment of cholera, and another is also a completed study identifying the risk factors associated with severe dehydration.

Sacolene in cholera
Principal Investigator: F.C. Patra
Funded by: Searle, France from January 1988 to June 1991

The objective of this study was to evaluate the anti secretory effect of *Sacolene* in adult patients suffering from cholera, using a double blind randomised controlled clinical trial. *Sacolene* contains methylated casein and sucrose. It is empirically used and commercially distributed as an oral anti diarrhoeal medication in Europe. Data collection has been completed and some preliminary analyses have been carried out.

Seventy eight adult patients with cholera and severe dehydration were studied; 39 were given *Sacolene* (60 gms per day) and 39 received a placebo. Otherwise, they all received the standard treatment, except that no antibiotics were administered. History and admission characteristics were similar; *V. cholerae* of the classical biotype was predominant. Stool output during the first 24 hours and the first 48 hours and total output (ml/kg of admission weight) were similar, indicating no effect on purging rate. As expected, ORS intake was also similar, but the control group needed more unscheduled IV rehydration (54% versus 31%). The total fluid intake, however, was similar in the 2 groups, as was the diarrhoea duration.

In conclusion, *Sacolene* was found to have no beneficial effect in patients with severe cholera. ■

The risk factors for dehydration in children with diarrhoea
Principal Investigator: ASG Faruque
Funded by: WHO from 1988 to December 1990

The aim of this case control study was to identify the risk factors associated with severe dehydration in children with watery diarrhoea. For better control of diarrhoea, it is important to understand the factors that place a child at risk of severe dehydration.

This completed study shows that, among etiologic agents, *V. cholerae 01* is associated with a higher risk of severe dehydration. Cessation of breastfeeding, though uncommon, was also associated, and a lack of mothers' education and poor socioeconomic status were useful prognostic indicators. Other factors found to be significantly associated were protein energy malnutrition as indicated by reduced arm circumference, young age, high stool frequency, poor appetite during diarrhoea and a history of vomiting. ■

Energy dense weaning food recipes based on amylase rich, germinated cereal (ARGC) flour suitable for use in infants and young children have been developed and evaluated. Four studies have been initiated to test the suitability of this approach in feeding infants and young children with dysentery, acute watery diarrhoea, persistent diarrhoea, and with severe malnutrition. The significance rests on the fact that a thick porridge made from cereal staples with sufficient energy density is often too sticky for infants and young children to eat adequate amounts. A simple way to prepare an energy dense weaning food that is thin in consistency is to add a small amount of ARGC flour to a thick porridge. The ingredients are locally available and inexpensive.

Development and evaluation of ARGC flour
Principal Investigator: D. Mahalanabis, and M.A. Wahed
Funded by: SDC from 1990 to 1992

In a controlled trial, 25 infants with diarrhoea were fed an energy dense rice porridge liquified with ARGC flour in a 30 minute meal and were compared with 25 controls who were offered the usual thick porridge. The study infants ate 40% more porridge (7.7 g vs 5.5 g per Kg of body weight).

Asem Ansari

A female physician accompanied by a health assistant supervising a mother feeding ARGC flour thinned porridge to her baby who is being treated for acute persistent diarrhoea

The evaluation of its effect on viscosity and its use in weaning food formulation has been completed. We concluded that the use of ARGC flour is feasible and may be a possible solution to formulating energy dense food. It does not favour bacterial multiplication, but it does induce *in vitro* increase in osmolality. More studies are needed to evaluate the overall impact.

ARGC flour in the treatment of dysentery
Principal Investigator: R.N. Majumder and D. Mahalanabis
Funded by: SDC from 1991 to 1993

This randomised trial will evaluate the role of liquified, energy dense porridge preparations in increasing the calorie and nutrient intake in infants and young children from 6 to 36 months of age with acute dysentery (particularly shigellosis). The study is in progress.

In addition to the introduction of a suitable energy dense food during a dysenteric illness, this formula could also help to educate mothers in appropriate weaning practices. Adverse nutritional consequences of severe dysentery in children are important public health problems; anorexia and increased faecal loss of nutrients are serious causes of malnutrition due to shigellosis. It is postulated that a liquid meal is better taken than a semi solid or solid meal by infants and children with shigellosis. Therefore, this approach of liquifying a thick, sticky porridge and retaining its energy density may be helpful in improving the nutrient intake by these children. ■

ARGC flour for children with acute watery diarrhoea.
Principal Investigator: Amal K. Mitra and Mujibur Rahman
Funded by: SDC from July 1991 to 1993

The aim of this controlled study is to evaluate the role of a porridge liquefied by the addition of ARGC flour in increasing the calorie and nutrient intake in infants and young children with acute diarrhoea. Patients attending the CRC are randomly chosen to receive either of 3 diets. (a) the experimental diet of rice or

rice plus lentil plus ARGC flour, (b) a control diet of rice or rice plus lentils of the same energy density, or (c) a control diet of rice or rice plus lentils, liquefied by adding water to the same viscosity as the experimental diet. A total of 99 patients of either sex, 33 in each group, will be studied over a period of 2 years. Besides standard case management, 4 meals of the assigned porridge will be offered every day until discharge. The major response variables will be quantity of food intake, quantity of breast milk intake, diarrhoeal duration, and diarrhoeal stool output. Net absorption of total energy, protein, and lipids of 100 male patients will be measured using an intake and output balance over a period of three days.

So far, we have recruited 85 children. The study is in progress. ■

ARGC flour based weaning food for undernourished children.
Principal Investigators: Mujibur Rahman and M. Aminul Islam
Funded by: SDC from April 1991 to June 1992

The objective of this study is to evaluate the role of a liquified energy dense diet in increasing the energy and nutrient intake of severely undernourished children 5 to 18 months of age after recovery from diarrhoeal diseases. Inpatients of the NRU are selected to receive either of 3 diets: (a) the study diet of an energy dense porridge of rice and pulse, liquified by adding ARGC flour, (b) a control diet of the same porridge liquified by adding additional water but not adding ARGC flour, or (c) a control diet of a thick energy dense porridge alone. We also evaluate whether intake of ARGC flour causes diarrhoea or adversely affects breastfeeding. The results may encourage researchers to conduct further studies on the bioavailability of nutrients in such weaning foods, their community acceptance, and methods of promotion.

Of the 102 children needed, we had enrolled 58 children into this ongoing study by the end of the year. ■

ARGC flour and yoghurt in persistent diarrhoea.
Principal Investigator: D. Mahalanabis
Funded by: SDC from July 1991 to December 1993

This study is planned to evaluate the role of yoghurt and starch that has been partially hydrolysed by adding ARGC flour in an effort to improve the diet of patients with persistent diarrhoea. A total of 180 patients will be selected randomly and, using a factorial design, divided into four groups: one group will receive cooked rice powder plus milk; the second group, partially cooked rice powder partially hydrolysed by adding ARGC flour plus milk; the third, a diet based on cooked rice powder plus yoghurt; and the fourth will receive the partially hydrolysed cooked rice powder plus yoghurt. The intake of these specialised diets, breast milk intake, stool output, weight gain, and duration of diarrhoea will be the measured results.

The study is in progress. The findings may lead to improved dietary management of persistent diarrhoea. ■

Diarrhoea is identified as "persistent" if it continues for 14 days or longer. Especially common among infants and young children, it often leads to severe malnutrition and death. In the following studies, attempts are being made to find ways to prevent diarrhoea from becoming persistent, to manage cases which have defied the usual treatments, and to improve the nutritional status of children with chronic diarrhoea and thus guard against malnutrition.

Prognostic and risk factors for prolongation of acute diarrhoea
Principal Investigators: D. Mahalanabis and A.S.G. Faruque
Funded by: SDC from December 1989 to April 1992

This randomised, controlled study aims to identify the factors that determine the progression of an acute diarrhoeal episode to persistent. It also seeks to use these factors as indicators of the need for early and appropriate treatment. Children with acute watery diarrhoea are given either rice ORS or glucose ORS and are evaluated before, during, and after treatment at regular intervals.

The risk factors that influence the duration of diarrhoeal episodes or determine nutritional impact from persistent diarrhoea are of particular interest. The results may help in designing future intervention strategies against

The Nutrition Rehabilitation Unit of the CRC has the appearance of a classroom with its uniforms and regular instruction in dietary care. Here the mothers learn to grow, cook, and feed nutritious food by taking an active role.

persistent diarrhoea.

The research is in progress; more than 600 children 3 to 35 months of age have been enrolled. ■

Smallbowel microbial ecology of severe persistent diarrhoea
Principal Investigators: D. Mahalanabis and J. Albert
Funded by: USAID from February 1990 to December 1992

This is a descriptive study on pathogenesis and pathophysiology of persistent diarrhoea. The aim of this study is to evaluate the role of diarrhoeagenic *E. coli* in the small bowel, particularly enteroadherent *E. coli* of the type with localised adherence and autoaggregative adherence in severe persistent diarrhoea of infants and small children; in addition the role of bacterial overgrowth of the small bowel with fecal flora will also be evaluated.

Patients with severe clinical disease due to persistent diarrhoea will be compared with those with acute watery diarrhoea of short duration. Quantity of faecal coliforms in the small bowel and isolation rates of 3 types of enteroadherent *E. coli* will be compared. About half of the target number of patients have been recruited; laboratory work is also in progress. ■

Trimethoprim sulphamethoxazole in the treatment of persistent diarrhoea
Principal Investigators: P.K. Bardhan, N.H. Alam and R. Haider
Funded by: USAID from July 1989 to December 1992

The objective of this study is to evaluate the efficacy of an absorbable antimicrobial agent, trimethoprim sulphamethoxazole (TMP - SMX), in the management of children with persistent diarrhoea. Overgrowth of bacteria in the small intestine is one of the postulated mechanisms

in the pathophysiology of persistent diarrhoea and the effect of reducing this overgrowth by drugs is being investigated.

In this double blind study, patients 3 - 24 months of age with persistent diarrhoea, are being studied in 2 groups (one receiving TMP - SMX and the other a placebo) for the presence, quantification, and type of microbial organisms in the upper small intestine. Both groups are given a modified diet and a vitamin mineral mixture. The clinical responses of the 2 groups are also being compared.

The study is in progress. By the end of 1991, 50 patients had been enrolled in the study and no adverse effects noted. ■

Coconut oil - based comminuted chicken meat diet in persistent diarrhoea
Principal Investigator: P.K. Bardhan
Funded by: WHO from June 1989 to March 1992

In this metabolic balance study, a diet based on coconut oil, which is a rich source of medium chain triglycerides, is being compared with a diet of equal calorie content based on soyabean oil. Eighty four children 3 - 12 months of age suffering from diarrhoea for more than 2 weeks are randomly assigned into the 2 dietary groups. Clinical response and coefficients of nutrient absorption are recorded, related to the functional derangements as identified by various laboratory investigations, and then compared between the 2 dietary groups. Subjects are followed for 2 months to monitor prognosis and also to ensure appropriate dietary management at home. Seventy - four patients have so far been studied. ■

Various studies are discovering the usefulness of vitamin and mineral supplements in the prevention and treatment of diarrhoea and diarrhoea - related illnesses. Previous studies done here and elsewhere have shown, for example, that children deficient in vitamin A have a higher risk of dying, that zinc supplementation increases the linear growth and improves the health of malnourished children, and that iron deficiency is associated with increased susceptibility to infection in experimental animals. Adequate dietary intake of essential micronutrients may be one important cost - effective means of improving child survival in less developed countries.

Micronutrients in the treatment of acute diarrhoea and ARI
Principal Investigators: D. Mahalanabis and A.S.G. Faruque
Funded by: SDC from August 1991 to April 1993

This randomised community intervention trial aims to evaluate the role of certain micronutrients in reducing the number of acute respiratory infections (ARI) and diarrhoeal episodes, average duration of ARI and diarrhoeal episodes, and total number of days the patient suffers from ARI and diarrhoea. Also, the study will appraise their use in improving nutrition in infants and young children in rural communities.

Comparable communities will be randomly allocated to different intervention groups of the target children in 24 communities. Children in 6 communities will get a micronutrient mixture comprised of zinc, selenium, iron, copper, and folate; those in another 6 will get a mixture of iron, copper, and folate; another group from 6 communities will receive only zinc and selenium, and the remaining group will receive a multivitamin preparation. The multivitamins will also be present in the mixtures of the other 3 groups. About 1,200 infants and young children will be studied.

The study is in its preparatory phase. ■

Evaluation of zinc and iron on growth and morbidity.
Principal Investigators: S.M. Akramuzzaman and Amal K Mitra
Funded by: UNICEF from August 1989 to 1992

The aim of this community - based study is to evaluate the role of zinc and iron supplementation in reducing morbidity and improving the growth of children in a poor community. The study is being carried out in Nandipara, where about 450 eligible children from more than 2,000 households were randomly placed either into an intervention group receiving vitamins plus minerals, or a control group receiving only vitamins, both daily for one complete year in a double - blind schedule. Daily morbidity and compliance are being recorded by the locally recruited volunteers and rechecked by the health assistants. Anthropometric measure -

ments are being taken on a fortnightly basis. The investigators monitor the records, and give treatment for illnesses on their weekly visits.

After the initial census and household mapping the procedure of supplementation was carried out and was completed in December. The common illnesses among these children are acute respiratory infections, otitis media, and skin infections. The morbidity and anthropometric data are being entered regularly into the computer. The study is in progress. ■

Enteric Protein Loss in Childhood Shigellosis
Principal Investigator: A.N. Alam
Funded by: USAID/UNDP from April 1987 to 1991

In this study, faecal clearance of alpha 1 antitrypsin was measured to assess the enteric protein loss in children with acute shigellosis. Intestinal permeability was also measured from the excretion ratio of two carbohydrate markers (lactulose and mannitol) offered to patients as drinks. Attempts were made to determine the nitrogen losses in urine and faeces and to assess the effects of chemotherapy and zinc supplementation on such loss and alteration in gut permeability.

Thirty two patients between 1 12 years of age with acute shigellosis were enrolled in the study. Children who received zinc supplementation showed significant improvement of the lactulose/mannitol excretion ratio, suggesting that zinc may help repair the intestinal mucosal damage in shigellosis. Faecal clearance of alpha 1 antitrypsin and nitrogen absorption were not affected by zinc supplementation.

The role of zinc in improving small bowel mucosal function adds to the argument that zinc supplementation should be evaluated in all diarrhoea management schemes. ■

A study on the association of *Helicobacter pylori* with gastroduodenal diseases has been completed and shows a strong relationship.

***H. pylori*: its association with human gastroduodenal diseases.**
Principal Investigator: P.K. Bardhan
Funded by: Sandoz and SDC from March 1990 to December 1991

The objectives of this study were to investigate the occurrence of *H pylori* in gastric biopsies from patients and evaluate the connection between its presence and gastritis and peptic ulcer. The significance rests upon the fact that gastric acidity is an important host defence barrier against enteric pathogens and is dependent, in part, upon the integrity of gastric mucosa. Recent reports suggest a strong association between the presence of *H.pylori* and gastritis. The study is attempting to detect its presence (if any) in gastroduodenal biopsies obtained from patients of the CRC who were referred for routine upper GI examinations and to correlate the clinical, endoscopic, and histological findings.

A total of 100 patients have been included. The biopsies are being examined to check for specific antibodies against *H. pylori* by the enzyme linked immunosorbent assay (ELISA) technique.

The study has recently been concluded and the results will soon be available. Preliminary analyses show the presence of *H pylori* in more than 90% of the patients. ■

Albendazole is an effective treatment for a wide range of intestinal worms. Recent laboratory research has also shown that it is toxic to the intestinal protozoan *Giardia intestinalis* when it is grown in culture.

Albendazole as a treatment for *G. intestinali* infections
Principal Investigators: Andrew Hall and Quamrun Nahar
Funded by: SmithKline Beecham from June 1990 to August 1991

The aim of this study was to see if albendazole is an effective treatment for infections with *Giardia* in children, and to see if it is as effective as metronidazole, the drug usually given. The study has been completed.

Urban poor children between 5 and 10 years of age infected with *Giardia* were randomly assigned to be treated with different doses of albendazole or with metronidazole. Three stools were collected over a period of 10 days after treatment to check whether the drugs had worked. Albendazole was found to be effective against *Giardia*: a single dose of 600 mg succeeded in treating 62% of infections; a

single dose of 800 mg, 75%; 400 mg given daily for 3 days, about 81%: and 400 mg given daily for 5 days, 95% of all infections. In both phases metronidazole treated 97% of infections. Albendazole at the largest dosage used was not significantly less effective than metronidazole and therefore could be used as an alternative drug. ■

Breastfeeding is encouraged in developing countries not only because it is the quintessential source of nutrition for the infant, but because it passes the mother's immunity to certain diseases to the baby and provides a safe alternative to bottle feeding, which often employs contaminated utensils and water. Other reasons are continually being discovered. Finding a satisfactory way to measure breast milk intake in the field to help in research studies was the aim of one study untaken by the CSD.

A technique for measurement of breast milk intake

Principal Investigators: D. Mahalanabis and Ken Brown

Funded by: PDF USAID from September 1990 to August 1991

This study, which was carried out in collaboration with Davis University (USA), aimed to develop accurate, acceptable methods to measure breast milk consumption. The study attempted to assess the possibility of using the doubly labelled water technique to measure breast milk intake by Bangladeshi infants in rural communities. This technique relies on a single oral dose of 2 stable isotopes. The changing abundance of these 2 naturally occurring isotopes in excreted urine can be used to calculate the amount of breast milk consumption as well as the energy content of breast milk.

The feasibility of the deuterium dilution technique as a method of measuring breast milk intake in a field situation is of critical importance. The experience may provide the researchers with the opportunity to modify the techniques as necessary to suit local conditions.

The study has been completed. Though the method was found safe, the procedure was not found reliable. Therefore, further improvement is needed. ■

Finally, in research, a study was done to determine the prognostic indicators and risk factors for noncompliance with the follow up dose of DPT immunisation. It was determined that mothers who had no education and were of low socioeconomic status were the ones most likely to neglect returning for the second dose.

TRAINING

The third function of the CRC, training, is in part performed in cooperation with the Training Branch of ICDDR,B (See Training). The CRC, recognising the need for training of the medical doctors who want to specialise in medicine or paediatrics, initiated a new programme for training in 1991. Under this programme, five medical doctors who have post graduate training in medicine or paediatrics for at least one year after their completion of internship, have been offered a fellowship for one year.

COMMUNITY HEALTH DIVISION

Associate Director: R. Bradley Sack

The Community Health Division is comprised of investigators whose primary interest is in the study of infectious diseases at the community level, especially diarrhoeal and related illnesses in children and their mothers; further attention is also given to family planning, nutritional rehabilitation, and maternity care. More specifically, these interests include: epidemiologic patterns of illness, transmission of infectious agents, delivery of health care, and prevention of illness through education and behavior modification as well as through vaccines. The research and service work of the Division takes place in both rural and urban areas, mostly with persons of low socioeconomic status. The rural area is in Matlab, and the major program there is called the Maternal and Child Health and Family Planning Project. The urban area is in Dhaka, and the major program there is called the Urban Volunteer Program. Prof. Sack took over his duties as the new Associate Director in February.

The major achievements of 1991 are reported below in brief. More details are given by the various units of the CHD

** A number of persons in the CHD were involved in relief activities that followed the cyclone. Teams of physicians were sent to the affected areas, a temporary treatment center was established in the Chittagong region, and two training sessions, both with courses on diarrhoea management and environmental health (water and sanitation), were conducted.

** In response to requests by the Government of Bangladesh (GoB), teams of physicians and epidemiologists visited the areas of the country where major diarrhoea epidemics were occurring. Most of the patients in the epidemics were confirmed as having cholera.

** An ICDDR,B team of cholera experts, including Dr. AKM Siddique from CHD, was sent to Ecuador, South America, to assist the government there in the management of a cholera epidemic.

** The Environmental Health interest group organised and held a regional workshop in Comilla in November to set priorities in applied research needs in water supply and sanitation and to develop regional collaboration. There were participants from 11 countries of the region and 3 experts from North America. The workshop was funded by SDC. It was agreed that ICDDR,B would initiate a forum for regional communications, and prepare a written report of the proceedings for dissemination, to be ready in early 1992.

** Construction began on the first floor above the library, in which centralised office space for the CHD will be located.

** A large number of presentations by CHD members were given at the First Annual ICCDR,B Conference in Dhaka, and at the Commonwealth Conference on Diarrhoea and Malnutrition in New Delhi.

** A new 3 year grant from USAID was awarded to continue the work in the urban slum areas of Dhaka. The new project, which is called the Urban Health Extension Project, will replace the Urban Volunteer Project which is finishing at the end of March 1992.

** A large grant from the Ford Foundation was received for studies in maternal care in Matlab.

The Division has 5 scientific interest groups, each with a coordinator, each meets monthly to discuss areas of common work and study. These groups are: MCH/intervention, Matlab Diarrhoea Treatment Center, Epidemiology, Social Sciences, and Environmental Health. The Division also has a Coordinating

Committee, made up of several persons from each of the interest groups; that committee meets weekly. In addition, all members of the Division meet together monthly.

The activities of the interest groups follow:

The MCH/intervention group is involved with activities that serve the medical needs in the community, both rural (Matlab) and urban (Dhaka slums). There are a large number of individual projects that involve diarrhoeal diseases, respiratory illnesses, measles immunisations, nutrition, and maternity care.

RURAL ACTIVITIES

The rural activities of the CHD are conducted primarily in Matlab (50km SE of Dhaka), where the Centre maintains a health complex called the Matlab Health and Research Centre. It is also often referred to as the hospital. This modern 2 storied building, completed in 1990, covers an area of 35,000 sq ft. It is located in Matlab Upazilla, Chandpur District, where since 1963 the ICDDR,B has been operating its main field research station, now covering a population of about 200,000. The overall activities of this field station include: a 70 bed Diarrhoea Hospital in the Health Centre, 3 Community Operated Treatment Centres (COTCs) in the field, a prospective Demographic Surveillance System (See DSS), a comprehensive Maternal and Child Health and Family Planning Project, field research in diarrhoeal diseases and nutrition, and field training of national and international participants. In addition to the wards for diarrhoea patients, the Centre also includes an MCH FP clinic (maternity ward, Nutritional Rehabilitation Unit, 10 bed pneumonia ward, 10 bed MCH ward, theatre for voluntary surgical contraception), a laboratory, and a staff clinic.

Matlab MCH FP Project
Principal Investigators: Andres de Francisco and J. Chakraborty
Funded by: NORAD (Norway) and CIDA/WUSC (Canada) from 1977 to 1991

The Matlab Maternal and Child health and Family Planning (MCH FP) Project is set up to design, implement, and monitor primary health care services to about 13,000 women and their children and maintains a record keeping system in Matlab. This comprehensive programme has the challenging objective of reducing fertility and subsequently improving child survival. Health care activities at the household level are delivered by 80 Community Health Workers (CHWs) who are residents of the villages and make regular fortnightly visits. They provide counselling and distribution of family planning methods, conduct mother and child survival activities, and collect demographic data for a population of 100,000 (one half the DSS area). (For a brief history of MCH FP see 1990 Annual Report, p 33)

The Project operates and maintains 4 sub centers, one in each of 4 treatment blocks within the treatment areas. These are mainly to attend mothers and children, and each one covers approximately 25,000 people. MCH FP paramedics work there, receiving patients referred to them by the CHWs. One of the COTCs mentioned above is in one of the sub centres. Each sub centre also has a day care centre for nutrition activity.

FAMILY PLANNING ACTIVITIES. At the end of 1991 the MCH FP Project achieved a contraceptive users prevalence (CUP) of 60.3%, the highest ever reported in rural Bangladesh. This was achieved through the efforts of the CHWs who offered different types of contraceptives and information about advantages and disadvantages of each type to eligible couples for them to choose the method they prefer. At the end of the year, 10,563 women were contraceptive users, 5,208 (49%) were using injectable contraceptives (DMPA) and 2,681 (25%), oral contraceptives. Surgical sterilisation was another popular choice. A second female physician began performing surgical sterilisations at the hospital and a total of 70 tubectomies were done during the year. Although this is not an impressive number, the high quality of the surgery and post operative care of the patients is considered very important.

Since a high proportion of women receive injectable contraceptives, we have given high priority to the analysis of data collected on side effects and discontinuation rates. An analysis of menstrual cycle disturbances and discontinuation of DMPA in Matlab was presented during this period. A sample of 221 married women of reproductive age who

accepted DMPA for the first time in July - August 1988 were interviewed. The major reason given for discontinuation was the change in menstrual status it caused. Side effects, management of the side effects, motivation for use, and the husband's opinion also affected the duration of its use. This is remarkable in the light that over 90% of women reporting choose DMPA because of the negative aspects of other methods.

Due to a shift by the GoB to recommending lower dose oral contraceptives and to the higher possibility of contraceptive failure if one oral dose is missed, we started an evaluation of oral contraceptive efficacy. Failure rates of low dose vs the high dose of oestrogens in oral contraceptives are being compared. The results of this study will provide important feedback that will help improve the contraceptive activities of the Project.

MOTHER AND CHILD SURVIVAL ACTIVITIES. Besides providing treatment for diarrhoeal diseases and maternity care, the Project offers the following services to mothers and children below 5 years of age:

** A comprehensive Expanded Programme of Immunisation (EPI) in the four service blocks of the MCH-FP area

** Intervention services to decrease mortality and morbidity of acute respiratory infections

** Regular monitoring of mid upper arm circumference (MUAC) every 3 months

** A Nutrition Rehabilitation Unit (NRU) in the Matlab Health and Research Centre for prevention and treatment of malnutrition

Service statistics indicate that during 1991, 1,953 pregnant women received antenatal care and 633 received post natal care. On 444 occasions mothers called the programme's nurse midwives to attend their deliveries, they managed to deliver 245.

One hundred and fifty three mothers were admitted to the hospital for deliveries by our staff and 118 females were admitted for other reasons. The out patient department saw 6,028 women of reproductive age during the year and 20,323 contacts were made for follow up of various contraceptive methods.

A total of 1,045 children below 5 years of age were admitted to the hospital during 1991; 708 (68%) were suffering from acute lower respiratory infections. Similarly, the out-patient department and the 4 sub-centres attended 6,483 infants and 15,425 children 1 to 4 years of age. There was a marked seasonality in attendance, peaking during the rainy months.

There were 388 children below 5 years of age treated for [illegible]tery at the sub-centres and 263 children admitted to the hospital with this condition.

Immunisation data for the year showed that 93.8% of infants have been immunised with BCG (tuberculosis), 81.3% with DPTP III (diphtheria, pertussis, tetanus, and polio); 93.6% of children 9 to 23 months of age were immunised against measles, and 96.7% of women of reproductive age, with two doses of tetanus toxoid. Over 30,000 capsules of vitamin A were distributed during the year in the appropriate dosage every six months.

Similarly, during the year 204,450 locally made ORS packets were distributed and 3,247 safe delivery kits were produced and distributed to pregnant women.

RECORD KEEPING SYSTEM: During 1990 the Project achieved a computerised record-keeping system which provides feedback to the field workers within one month of data collection. The computerised system continues giving feedback to the CHWs and supervisors on health service delivery. During this period a great deal of effort was given to increasing the effectiveness of this information, translating to a better organisation of CHWs activities. Because the visits to the households are targeted and thus time is more efficiently organised, the quality of care is improved.

An approach to the management of ARI
Principal Investigators: Andrés de Francisco, J. Chakraborty, and Kate Stewart
Funded by: The Netherlands

Reporting in the 1990 Annual Report, we gave an account of the importance of acute respiratory infections (ARI) as a cause of death of children below the age of 5 years in rural Bangladesh and the efforts of ARI Project begun in 1988. The Project concentrated this year on the delivery system of treatment for

Table 1

Incidence, attack, admission, and case fatality rates of pneumonia in children under five by age and sex, Matlab MCH/FP programme area

Rates	0 - 59 m	Age groups 0 - 11 m	12 - 23 m	24 - 59 m	Sex Males	Females
Incidence rates per 1000 children*	56 5	142.1	71.8	24.9	65.5	47.3
Attack rates per 1000 children+	87.9	180.9	139.5	42.1	101.2	74.2
Treatment rate per 1000 children§	62.0	128.3	99.1	29.2	72.5	51.2
Admission rate per 1000 children℗	18.2	47.7	26.0	6.4	23.2	13.0
Case fatality rate per 100 children with ALRI**. ++	2.9	4.8	0 9	1.2	2.8	2.9

* Numerator includes all children diagnosed by a project health worker and/or fatal ALRI cases.

\+ Numerator includes all episodes diagnosed by a project health worker and/or fatal ALRI episodes.

§ Numerator includes the number of ALRI episodes managed by project health workers.

℗ Numerator includes all ALRI episodes admitted to the Matlab ALRI Ward.

** Denominator includes all children diagnosed by a project health worker and/or fatal ALRI cases.

++ Excluding neonates (see text).

pneumonia and on improving the ability of the motners to recognise and to call for treatment in the case of an early pneumonia.

In 1991, we reported the effect of the programme on mortality and morbidity of pneumonia after linking all the computer files which have information on treatment and referral patterns. Attack and treatment rates for 1989 were calculated as well; the CHWs and the sub-centres and hospital registered 3,346 episodes of pneumonia during that year through active and passive surveillance. The incidence of pneumonia and the attack rates were higher in infants than in children. Case fatality rates varied with age and were close to 3/100 in children below 5 years of age (Table 1).

A comparison of the effect of home treatment for pneumonia and referral of cases to the sub-centres was carried out in order to evaluate the adequacy of health service provision for ARI. It revealed no differences in severe pneumonia between the two types of treatment.

During 1991, 2,025 episodes of pneumonia have been reported by the CHWs; 1,515 cases (75%) were treated at home and the rest were referred to the sub-centres or to the hospital.

Even though the Project has managed to avert some pneumonia deaths mainly by prompt treatment of cases by the CHWs, data disclosed the difficulty the Project staff have in reaching infants and children who experience an episode of pneumonia, particularly early in the disease.

Behaviour modification through an intervention: the ARI Project

Principal Investigators: Andrés de Francisco, Sushila Zeitlyn, and J. Chakraborty

Funded by: The Netherlands

The investigators of this study conducted a quantitative analysis of community perceptions and practices related to ARI to evaluate ways of increasing the reporting of early disease and stimulate practices that prevent progression to severe disease. Therefore, focus discussion groups with case scenarios were carried out with mothers of children living in the area. A workshop was held to summarise the findings. The main findings of these activities were that mothers are able to recognise severe pneumonia but do not know how to recognise early disease and that they suspend breastfeeding during sickness of the child. Some insights on practices of handling the newborn were detected which could be modified because they are risk factors for pneumonia. Programme managers and supervisors highlighted ideas which could be used to improve the understanding of ARI and proposed methods to promote early recognition and early referral of symptoms.

The Project was extended to implement strategies that would encourage mothers to recognise symptoms early. A series of messages have been developed and transmitted to mothers during the CHW fortnightly visits. To evaluate the effectiveness of this approach, two comparable groups of villages were selected in blocks B and C, each having a population of 10,000. A series of focus discussion group sessions were held to determine baseline knowledge and practices related to pneumonia at the household level. Both blocks continue having the same access to treatment for pneumonia. A programme transmitting messages for improving the recognition of early signs of pneumonia was introduced in block C towards the end of the year, using person to person communications and group discussions. (see photograph) Outcome variables to be analysed during 1992 include active or passive detection, referral patterns, timing of detection of pneumonia by the mothers, and timing of calling of CHWs. A second cross sectional focus discussion group session will be held in both areas to compare changes with the first session of group discussions.

Intervention to reduce deaths from dysentery

Principal Investigators: Jacques Myaux, Eradul H. Khan, Md Yunus, and Andrés de Francisco
Funded by: NORAD, WUSC/CIDA from 1989 to 1991

A. de Francisco

This child suffering from pneumonia served as an example for other mothers of the ban to recognise early signs of the disease. The Community Health Worker organised the meeting spontaneously when she found the child in a home she was visiting.

The aim of this completed intervention study was to assess the feasibility and impact of antibiotic treatment given in the home to children under 5 years of age with dysentery due to *Shigella* spp. CHWs of two study blocks were supplied with nalidixic acid and asked to treat children 3 59 months old with dysentery. CHWs of the other 2 blocks were asked to refer children with dysentery to the sub centres for treatment.

At the same time a random sample of the population was selected for weekly surveillance to detect cases of dysentery and to collect rectal swabs for culture. In 1991, 199 rectal swabs were collected and 27.6% grew species of *Shigella*. Analysis of collected data for the year 1991 showed an isolation rate of *Shigella* species of 28.9% in patients with dysentery attending the sub centre and 28.5% in patients at the Matlab Hospital.

Of 392 *Shigella* isolates from the community, 65% were *S flexneri* and 9% were *S dysenteriae*. Resistance to ampicillin and co trimoxazole was high among the *Shigella* strains; resistance to nalidixic acid was low. The latter was increased significantly in the nalidixic acid intervention community when compared with an adjacent area.

In conclusion, from a public health perspective, a systematic strategy based on antibiotics is not advisable due to the low isolation rate of *Shigella* spp., cost, side effects, and possible resistance induced by drugs. Because of strong interdependence between malnutrition and persistent diarrhoea, emphasis should be given to investigations and interventions of preventive care by education programmes on effective and well targeted risk factors and the development of an effective vaccine.

An approach to improving maternity care. The Maternity Care Project

Principal Investigators: Andres de Francisco, Anne Marie Vanneste, Shameem Akhter Khan, and J. Chakraborty

Funded by: Ford Foundation from 1987 continuing

The Matlab Maternity Care Project was designed with the objective of reducing maternal mortality and morbidity. Activities aimed at this objective include operations research and the provision of maternal health services. The Project was implemented in the context of the pre existing MCH FP Project, and although the activities are concentrated in its treatment area population of 100,000, demographic information is available on a larger population of 200,000 through the DSS.

The Project has 4 professionally trained mid wives (government trained with 3 years of nursing and one year of midwifery) posted in half of the intervention area. Each team of 2 midwives is posted to serve a population of approximately 25,000, similar in size to that constituting a union. The midwives provide antenatal and postnatal care, attend as many deliveries as possible, and give practical train ing to the Traditional Birth Attendents (TBAs). Following governmental advice, Lady Family Planning Visitors (LFPVs), who are equivalent to the Family Welfare Visitors with 2 years training, are now also posted. A chain of referral was established, including the Matlab hospital where female medical officers are available to manage non surgical obstetric complications, and the Government District Hospital in Chandpur (one hour from Matlab) for cases requiring caesarean section or blood transfusion.

Maternal mortality is an indicator of the health of women of reproductive age and a measure of the quality of the health services provided to a community. During 1991, the Maternity Care Project had very interesting results to report. A reduction of the maternal mortality ratio (a measure of death occurring once pregnant) was achieved in the intervention areas when compared with the non intervention areas. This encouraging data prompted us to evaluate more deeply all the information collected by the Programme since its conception to ascertain reproducible strategies. Meanwhile, the programme contin ued to address the maternal mortality issue and to provide health care at all levels.

A study was carried out on the client's perspective of maternity care services by interviewing 124 women of reproductive age. The relevance of antenatal care and the paramedics roles were stressed. The study shed some light on obstetric decision making at the family level.

The process by which the Project has shown a reduction of the maternal mortality ratio must

be looked into carefully. For this matter, a comprehensive analysis of data collected to date has been carried out. The success of this analysis depended on a system of record keeping which included the use of recording cards.

A recording card is filled with data of the pregnancy or delivery of any woman who comes into contact with the Project at any point during her pregnancy. Mothers who have not had any antenatal care but deliver with staff of the Project or who contact the Project during the postpartum period also have recording cards filled out.

Analysis of data from the recording cards has enabled us to evaluate the Project activities between March 87 and November 90. During this period, 3,030 women had a card, which is equivalent to 58% of the 5,274 deliveries occurring in the 2 intervention blocks. Furthermore, 324 deliveries from the non intervention block travelled into the intervention area for nursing care, corresponding to 5% of all the deliveries from the latter area.

Women who delivered during this period and had a recording card have been compared with women who delivered during the same period but did not contact us and so did not have a card. This was done to estimate how representative our analysis is of the total population of women who delivered in the area. The data on the recording cards was found to be fairly representative of the total population of women who delivered during that period with or without having had any contact with our Project. The following are some features revealed by the analysis and its interpretation.

THE WOMEN

** The Project is selecting women in their first pregnancies, who are at higher risk.

** The Project is selecting women of higher socioeconomic status. The poor and less educated are not being reached.

** Almost 6 out of 10 women who delivered in the intervention area had contact with the Project.

** Mothers who die are contacting the Project before death.

ANTENATAL, POSTNATAL, AND DELIVERY ATTENDANCE:

** There is low coverage of antenatal care by midwives (only 44% had one visit or more) posing difficulties for detection of high risk mothers who deliver prematurely or have complications.

** The first antenatal care visit occurs too late (mean 6.8 months of pregnancy).

** There is a low call for delivery (15% of pregnancies), probably due to preference for TBAs.

** Very few deliveries are performed by midwives (9%). Few of these are for high risk mothers.

** There are few postpartum visits within the high risk period of 2 days after the delivery (10%)

** Only 25% had postpartum visits between 2 and 4 days after delivery.

** Midwives are a valuable resource for the training of LFPVs.

** The midwives' schedules are overloaded. They cannot perform antenatal and postnatal care, and deliveries for all women, as expected. One antenatal visit should not take less than twenty minutes; longer time is required if proper health education is ensured. Trying to test the feasibility of using less skilled staff, i.e. CHWs to do antenatal care, we trained a group of them and are currently evaluating the outcome. Even though the visit is done at home, preliminary reports indicate that some mothers have complained about the time they have to invest every month. Monthly antenatal care also poses a high burden on CHWs time. A more targeted and less intensive strategy would be desirable.

MORBIDITY AND MORTALITY:

Eclampsia is a life threatening disease which occurs during pregnancy exposing the mother and the fetus to great risk. Eclampsia, as a cause of maternal death in this community, has been determined as contributing to 16% of maternal deaths from 1976 to 1985. Since the

start of the Project, 5 women have died of eclampsia out of the 11 maternal deaths. Two of them called a doctor less than 11 hours before the delivery and three delivered with a TBA or a relative. One blood pressur measurement detected 45% of eclampsia morbidity.

Anaemia is another serious cause of morbidity and mortality during pregnancy. Clinical examination reveals that the vast majority of pregnant women have some degree of anaemia. There were three deaths attributable to anaemia during the study period; none of them delivered with professional help. Two women died of post partum haemorrhage from which one called the midwife 2 hours before delivery and the other one delivered with a TBA.

Causes of perinatal mortality (death of the infant from the 28th week of gestation to the first week of age) have been reported for this population. Data from the recording cards show that of 44 stillbirths, 16 (36%) occurred due to malpresentations which could have been detected in the antenatal period and 13 (30%) to premature deliveries. Other causes were 9 cases due to eclampsia (20%), prolonged labour, anaemia, and cord prolapse. Causes of early neonatal mortality (first week of age) have been related to similar causes.

The recommendation for the Maternity Care component of the MCH-FP Project is to institute antenatal care to be given by less skilled staff, mainly the CHWs. The integration of TBAs into this system is desirable. The training of CHWs on antenatal care by the nurse trainer supported by the Programme has been carried out on schedule. A thorough evaluation of these changes will be done in collaboration with her to evaluate the impact of the inclusion of CHWs in high risk screening and referral, thereby possibly averting maternal mortality.

Nutritional surveillance system and rehabilitation units
Principal Investigator: A. de Francisco and J. Chakraborty
Funded by: Helen Keller International/France

Activities on nutritional aspects during 1991 have centred on the evaluation of the Nutrition Rehabilitation Unit (NRU) in the hospital, the screening of malnourished children in the treatment area, as well as their referral to the NRU or the day care centres in the sub-centres, and the contribution to the country-wide screening for malnutrition in disaster-prone areas carried out by Helen Keller International.

Children in the MCH-FP area undergo a MUAC measurement every 3 months. All patients who are found to have a MUAC below 120 mm are evaluated monthly and referred to the day care centre for rehabilitation. If the MUAC is below 110, the child and the mother are referred to the NRU in Matlab where the child is rehabilitated and the mother is involved actively in the preparation of foods and taught how best to prepare the available food.

The effectiveness of the NRU has still to be documented. It is not known if survival of children who leave the NRU after treatment is better than that of children who do not go there. This poses difficult epidemiological problems for the evaluation of the effectiveness of the NRU. Nevertheless, current evaluation of data collected since the beginning of this project should explain its effectiveness.

A nurse trainer has been involved in gardening activities at Matlab and at the sub-centres to stress the fact that locally grown vegetables are useful and nutritious. She is also training the staff in charge of this Unit.

During 1991, 77 children below 5 years of age were admitted to the NRU; 45 (58%) were females. At Nayergaon, the largest sub-centre, 118 patients were seen in the day care centre. There were 935 visits, giving a mean number of 7.9 visits/patient. At the same time, the mothers have shown an attendance in line with the children's attendance which strengthens the view that they are interested and involved in the process of rehabilitating their children. Because mothers are in charge of other children which cannot be left alone at home, they tend to bring one sibling (0.76 children in average) with the malnourished child. Sessions of community health education on nutritional issues are given at the day care centre and to mothers at the routine out-patient department of the sub-centre.

Measles surveillance system
Principal Investigators: Andrés de Francisco, Mike Strong, Md. Yunus, and Hafiz Chowdhury
Funded by: UNICEF 1989 continuing

Measles is the single most important vaccine preventable disease. Among the developing countries, scientists have described thoroughly the pattern of measles in Africa, but in Asia basic epidemiological concepts of measles transmission have not been sufficiently addressed to date.

In 1989, a measles surveillance system was placed in the area to monitor the incidence of measles. The measles immunisation coverage has been estimated to be 33% of children between 9 and 23 months of age. This system also intended to estimate the proportion of cases in infants below 9 months of age. For this matter, the CHWs of the comparison area were taught to recognise measles cases by the clinical sequence of signs and symptoms. A system to transfer the reported information to the central office in Matlab immediately was set up with messengers and boatmen. To validate the accuracy of the diagnosis, a medical officer or a trained medical assistant visited a sub sample of the cases, particularly those reported in young infants and the index cases in a given household. Medics responsible for visiting the patients were given drugs and guidelines to treat or refer severely ill patients.

Age specific incidence data from the first 2 years of the surveillance show that confirmed measles cases in the first year of age account for 25% of all cases. About 17% of all confirmed cases occurred below 9 months, the age at which immunisation is currently given.

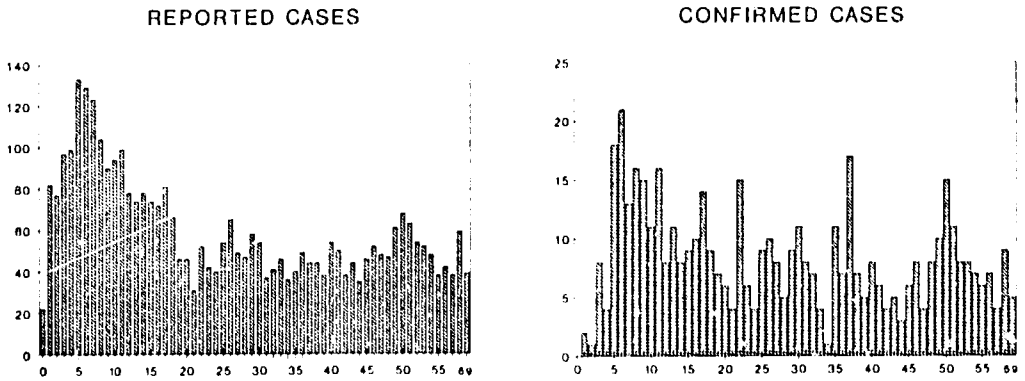
Of the 4,673 cases reported, 18% were visited by medics within a mean of 7.1 days of the appearance of the rash, most of them at home. Eighty two percent of the visited cases were confirmed, evidence that the CHWs' diagnoses are quite accurate.

The figure on age distribution of measles shows the date of onset by age of cases reported by the CHW (Figure 1). Cases tended to cluster below the age of 60 months and a high proportion were reported in the first 9 months of age. These data suggest that measles below 9 months of age is a problem in rural Bangladesh.

Data from the treatment area show that a coverage of around 69% of children 9 - 23 months of age reduces markedly measles incidence above one year of age. At this coverage level, evidence of measles in infants below 9 months remains constant.

Cost effectiveness study of MCH/FP interventions
Principal Investigators: Vincent Fauveau, J. Chakraborty, and Andres de Francisco
Consultant: Nimal Attanayake (University of Colombo, Sri Lanka)
Funded by: NORAD and WUSC/CIDA

Figure 1 Measles surveillance system: cases reported and confirmed by age at onset December 1989 November 1991



A thorough analysis of the cost-effectiveness of the Matlab MCH-FP Project was carried out by an economist who, after 3 visits, produced a preliminary report on cost effectiveness of the Project between 1986 and 1989. The MCH-FP programme as a whole was catalogued as a cost effective way of delivering primary health care.

The introduction of several new MCH interventions since 1986 increased the cost of the structure of the Project. These interventions were analysed in terms of their costs. The report points out that it is quite difficult to split research and health services costs, the report is confined to the internal explicit costs of the Project which means that the social cost, depreciation, and rental values are not taken into account.

The activities were analysed in 9 categories: family planning, immunisations, oral rehydration therapy, acute respiratory infections, maternity care, nutritional rehabilitation activities, vitamin A distribution, curative services, and control of dysentery.

The highest share of the expenditure was on the family planning activities. All activities have had positive growth except for the NRU, which has remained constant due to appropriate interventions in the field.

The most effective intervention in terms of cost effectiveness indicators of cost per death averted was EPI. ARI activities had the second lowest, particularly in the neonatal group, followed by dysentery and maternity care. Cost per birth averted was also calculated and shows a relatively high cost effectiveness of the family planning programme. Average cost per case treated/performed/attended demonstrated an upward trend throughout the period and is also included in the report.

Community Health Education Program in Matlab: a pilot experiment
Principal Investigators: J. Myaux, R. B. Sack, A. de Francisco, M. Yunus, J. Chakraborty, K. Aziz, A.M. Vanneste, and E. Khan
Funded by: BADC (Belgium) from July 1991 to July 1992

Community based studies reveal the important need to educate rural mothers regarding maternity care, children's health, and simple hygiene. Some common practices, e.g. reducing food intake or breastfeeding interruption during diarrhoeal episodes, incorrect use of ORT, and unequal intra family food distribution have negative effects on children's health. Information and education activities have been introduced in Matlab, mostly through the Community Health Workers (CHWs), but these activities have been neither systematic nor supervised.

For this reason, it was decided that a global, integrated programme of education and information was needed. To start, a preparatory stage was set up in 1991, which will permit us to identify the educational priorities, the target groups, and the potential patterns of communications. This pilot experiment involves 6 intervention groups: water & sanitation, diarrhoea, maternity care, acute respiratory infections, weaning foods, and immunisations. Three of them were started in 1991.

I. **Maternity care: perception of males**
Principal Investigator: A.M. Vanneste

The aim of this study was to gather information from males about their ideas about maternity care. In Matlab, although men are the decision makers in the family, they have usually been excluded from the health services provided by ICDDR,B. Focus group discussions were organised to provide baseline information for further health education on the subject. Sixty four men were selected on the basis of educational level, occupation, age, and religion. The overall result was that men had a very good perception of what is going on in maternity care, and that most men supported the programme and would like to see it upgraded to include more midwives or better training for the CHW's who have participated in antenatal screening since the end of 1990. Males were also aware that pregnant women's workload should be reduced, but poverty seems to interfere with the application of this knowledge. The restriction of certain foods for pregnant women based on cultural and religious customs is still widely respected, but there is a general awareness that pregnant women should eat sufficient and healthy foods since the mother's food is also the child's.

II. **Weaning foods: practices and perceptions of mothers**

Principal Investigators: Churamonie Jagdeo, J. Myaux, and J. Chakraborty

A descriptive study is exploring the practices and perceptions of mothers about weaning food. From the comparison and intervention areas of 11 villages, 240 children between 5 and 24 months of age were enrolled. A questionaire was used by interviewers to collect basic information. Analysis of the data is in progress, and a 6 month strategy of group education has been proposed.

III. **Water and sanitation: promotion of good practices through schools and women's clubs**
Principal Investigators: Bilqis Amin Hoque, J. Myaux, J. Chakraborty, and R.B.Sack

The potentials of involving primary schools and women's clubs in the promotion of safe water and sanitation is a very popular subject in this decade. But this approach has not been properly tested in this country. We, therefore, are studying the possibility of involving primary schools and women in delivering specific water and sanitation messages in rural Bangladesh and plan to formulate recommendations for a large, education intervention program in health and sanitation. The groups for this small scale feasibility study will be limited to teachers and children in 4 selected primary schools and 4 women's clusters in the selected community. These selected teachers and leaders from the women's clusters will be trained to promote specific safe water and sanitation messages in their target populations. The changes in practices and acquired knowledge related to the messages in the population will be compared between the baseline survey and a survey conducted 3 months after the training.

The baseline survey has been completed in the schools. We are developing training materials for the teachers and women leaders.

URBAN ACTIVITIES

According to the United Nations, over three billion people, or 44% of the world's entire population, will live in urban areas of developing countries by the year 2000. The magnitude of this urban growth is unprece dented and the problems accompanying it are bound to tax existing social and political structures and economic resources. The phenomenal growth in cities is associated with an equally phenomenal growth in the number of urban residents who live under abysmal conditions. Current figures indicate that typically over 50%, and some- times as high as 80%, of a developing country's urban populations live in extreme poverty. If present trends continue, it is estimated that by the year 2000 over one billion people will be counted among the urban poor. This situation is especially ominous for women and children, many of whom struggle for basic survival.

Approximately half of the estimated 7 million people living in Dhaka, the largest metropolis of Bangladesh, reside in urban slums. Almost 90% of slum dwellers lack private latrine facilities and regular garbage disposal services. Only about 6% of slum and squatter settlements have primary education facilities and only 3% have primary health care facilities.

The leading ca ises of childhood death are diarrhoeal diseases, acute respiratory infections, and tetanus. With affordable and sustainable health care programs, the prevalence of these diseases can be dramatically reduced.

Urban Volunteer Program (1986 - 1991)
Project Director: Ngudup Paljor
Funded by: USAID from 1986 to 1991

The Urban Volunteer Program (UVP) is an operations research and service delivery project to test the feasibility and impact of using women from slum communities to furnish preventive health care and referral information to slum residents.

In 1981, the ICDDR,B began training women volunteers in urban Dhaka in the use of ORS packets for diarrhoeal disease, on the assumption that community women could play an important role in teaching others about the home treatment of diarrhoea with ORS. Recruitment and training of the volunteers at this point was done in an ad hoc manner, without clear selection criteria and no effort to define service catchment areas. What is known as the Urban Volunteers Program began in late 1986. Although the volunteer activity at this point was scattered, varied and unquantified, anecdotal observation suggested that there was considerable potential in the

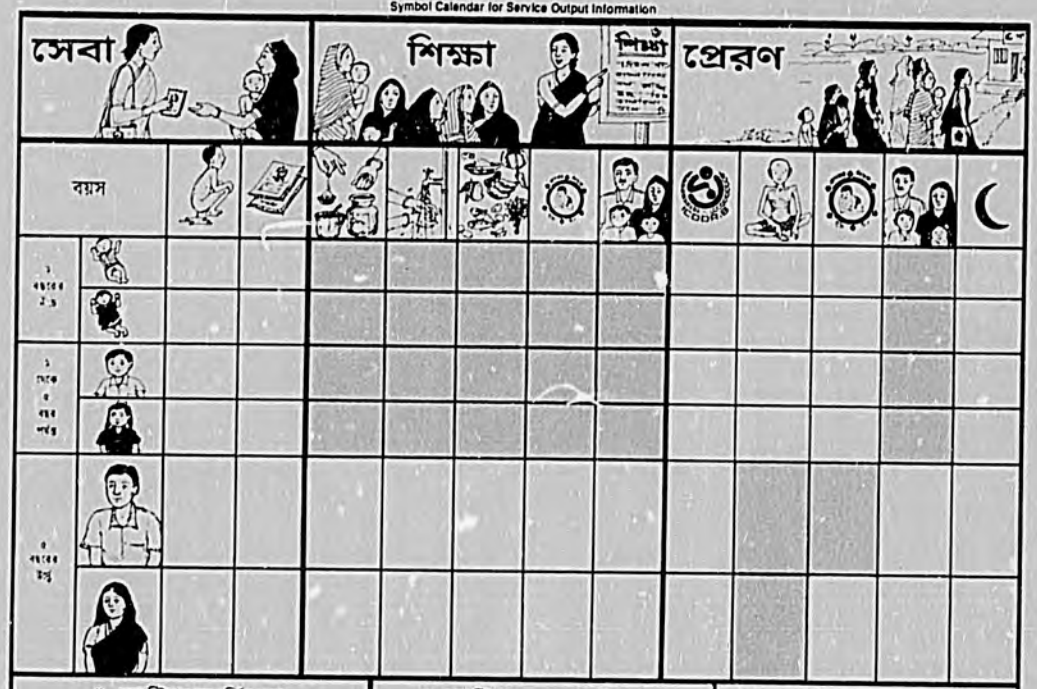
use of women volunteers as primary health care providers in the urban slums. From the onset, the UVP has struggled to reconcile service delivery with a research mandate, a task complicated by the fact that the project inherited a much larger cadre of volunteers and geographical spread of service delivery than necessary for research purposes. The Program has also struggled over the years to transform an informal network of volunteers into a cogent service delivery model.

Despite the above-mentioned difficulties in implementing research to test the effectiveness of the volunteer model, there has been a general consensus based on field experience that the volunteers are able to deliver basic MCH-FP services, given appropriate training and supervision.

The year 1991 was a transition period for the Program in concluding the UVP pilot phase and laying the groundwork for the Centre's initiative in urban health research and service delivery efforts. The pilot phase of the UVP was deemed successful by a three member external evaluation team commissioned by the USAID. The evaluation team recommended that a follow-on project be funded and the operations research should be the main research focus.

The five-year UVP pilot effort has identified several constraints on service delivery in the urban slum environment. These include lack of reliable data about population characteristics and temporal changes in these characteristics, lack of stable community leadership, disruption in breastfeeding and child care due to

Symbol Calendar for Service Output Information



Urban volunteers, most of them unschooled local women, are trained to use especially designed symbol calendars to collect information from slum residents.

changes in family composition and employment of mothers outside the home, erratic supplies of nutritious food, poor sanitation and hygiene, pollution, and violence. These constraints are unusually severe in Bangladesh because of the country's extreme poverty and rapid population growth. Between 1981 and 1990, its urban population grew from 13.5 to almost 23 million people, of which 11.5 million were estimated to live below the poverty line. Nevertheless, these problems are by no means unique to Bangladesh. Throughout the developing world, there is a pressing need to deliver essential preventive health services to rapidly growing slum populations, but little is known internationally about how this can be done. The UVP pilot project has brought experience and insight into the effective delivery of preventive health care to women and children in urban slums and has identified key areas for future research.

SERVICES PROVIDED: Through a network of over 450 volunteers who reside in the slums, the Program has provided extensive services in diarrhoea prevention and treatment, nutrition promotion, immunisation coverage and promotion of family planning methods. Service delivery is done through health education, distribution of health commodities such as ORS, Neem soap, and referral services to static health facilities. The project has maintained two Nutrition Rehabilitation Centers. The service statistics are collected by

Table 2

Urban Volunteer Program, ICDDR,B
Summary of service statistics, January - December 1991

	Health Commodities Distributed		Health Education					Referral to Health Facilities				
Month	ORS	Neem soap	ORS prep.	Nutrition educ	Hygiene educ.	Immun	Family plan	ICDDR	Nutriton centr	Immun centr	Family plan	Others
JAN	15059	0	5608	2486	5254	1450	719	45	62	287	106	0
FEB	18201	0	7046	3116	6634	1589	886	53	91	394	208	0
MAR	23943	0	8308	3921	8270	1720	1049	40	57	301	166	0
APR	25794	0	10040	4233	9211	1952	1400	115	58	292	158	113
MAY	31905	426	10797	5171	9568	2131	1453	153	57	290	191	68
JUN	35036	2357	10957	4834	14566	2049	1758	76	32	236	154	52
JUL	27513	3441	9152	5265	8999	2540	1661	71	44	356	185	138
AUG	24552	2276	8799	5542	8623	2591	1803	50	45	437	191	101
SEP	25698	2784	8843	6013	8748	2552	1887	106	31	297	173	82
OCT	29413	3170	10893	8130	10567	3344	2252	76	45	306	152	108
NOV	26004	4020	10063	7204	9882	3014	2122	53	35	322	151	82
DEC	22259	5361	7543	5317	7418	2510	1437	33	25	411	179	96
TOTAL	305377	23835	108049	61232	107740	27442	18627	871	582	3929	2014	840

volunteers by using a symbol calendar. The volunteer's activities, including service data collection, are monitored and supervised by field supervisors and community health coordinators. Over 450 volunteers were trained in basic health promotion and disease prevention strategies in diarrhoea, nutrition, immunisation, and family planning. Additionally, the volunteers were also trained in rudimentary service data collection methods. Each volunteer receives refresher training every four months.

Services provided by UVP in 1991 are illustrated in Table 2.

Urban Health & Extension Project
Project Director: Ngudup Paljor
Funded by: USAID from 1991 to 1994

The successful conclusion of the UVP pilot phase led to the birth of the Urban Health & Extension Project (UHEP) which is conceived as a follow on activity to capitalise on the achievements of the UVP's pilot effort. One of its principal agenda is to develop a sustainable and replicable MCH FP service delivery system for the urban poor in partnership with the Government of Bangladesh (GoB) and the NGOs.

Although there is a structured health and family planning services delivery system for the rural population, no comparable system exists for the urban poor. International and local NGOs are the primary service providers for this population, but their services are often selective and less than optimum, and their coverage incomplete. These limitations are largely caused by a lack of coordination among NGOs and between them and government agencies. They are compounded by a lack of reliable data about urban poor populations. The strategies thus far devised have largely focused on rural Bangladesh. There is an urgent need to identify sustainable, affordable preventive health and family planning service delivery strategies which take into account the unique constraints of the urban slum environment.

The GoB has signaled interest in improving its primary health care program and integrating health and family planning services in its Fourth Five Year Plan. Evidence of this comes from its five year goals of reducing the maternal mortality rate from 5.7 to 4.5, reducing the infant mortality rate from 110 to 80 per 1000 live births, and reducing its neonatal mortality rate from 80 to 60 per 1,000 live births. A key strategy in this Plan is to target destitute people for preventive and curative services. In addition, the new Plan for the first time includes the development of comprehensive urban primary health care. The World Bank Donor Consortium has expressed enthusiastic support for the GoB's initiative and commitment and accordingly recommended funding for urban health initiatives. The Fourth Five Year Plan focuses particular attention on decentralised administration and the mobilisation of local people to improve health care and family planning services.

UHEP shares the GoB's long term goal of reducing infant, child, and maternal mortality. It will contribute to this goal through activities which will strengthen the currently weak and spotty MCH FP service provision system in urban poor communities.

At some point the Government is expected to assume responsibility in the provision of basic MCH FP services to the urban poor. The development of a health service delivery system now, in full partnership with the GoB, could be the impetus they need to assume that eventual responsibility and to enable the concerned government entity to step directly into the system when the necessary capacity to assume this responsibility has been built.

The Project's principal research activities will focus on three areas:

1) collecting valid information on current socioeconomic, demographic, and epidemiologic characteristics of Dhaka slums and charting the changes in these characteristics through routine longitudinal statistics and special surveys,

2) testing the efficacy and cost effectiveness of specific interventions in family planning and directly related maternal and child health issues, and

3) conducting operations research studies to improve family planning and health service delivery to urban poor communities.

The Project will begin in 1992 to formulate

research agenda. Though not yet finalised, following are some of the broad research themes the Project will pursue in the next several years:

** Develop and evaluate a sustainable and replicable health service delivery system to improve coverage and quality of care to urban poor communities

** Identify the major causes and determinants of infant, childhood, and maternal morbidity and mortality, the determinants of contraceptive use, patterns of health care utilisation, and chan demographic trends

** Investigate factors impacting upon maternal health, both obstetric and non obstetric

** Develop and test innovative child survival interventions

** Identify and investigate social intervention modalities, especially women's reproductive health and empowerment issues and family health

Aside from the successful conclusion of the UVP pilot phase, the Project conducted a set of research protocols. They follow

Urban Surveillance System
Principal Investigators: Abdullah Baqui, Kanta Alvi, N.M. Jahangir, Sufia Nurani, K.L.B. Banu, R.A. Jahan, et al.
Funded by: USAID

The Urban Surveillance System is a comprehensive health and demographic surveillance system developed in a representative sample of the urban slum population of Dhaka by the UVP and continued by the UHEP. It was designed to address the lack of reliable slum-specific data and to evaluate the effectiveness of its service delivery system in a representative sample of the urban slum population of Dhaka city. The estimated total target population of the USS is about 376,000 people residing in the slums of 5 thanas of Dhaka city: Mohammadpur, Lalbag, Kotwali, Sutrapur, and Demra.

The USS sample was drawn based on a multi-stage probability areal sampling method, the ultimate sampling units are clusters, each cluster being approximately 30 households (HH). Since January 1991, we have had 161 clusters under surveillance; total number of HHs under surveillance was 4,558. During the year, we remapped our target areas and updated and expanded the USS sample size to 254 clusters and about 8,400 HHs.

We conducted household registration and baseline surveys in all the sampled households. Baseline information included demographic and socioeconomic characteristics of the population, and KAP and selected health status indicator information in the area of diarrhoea, nutrition, immunisation, and family planning for the population.

The USS contains three ongoing data collection mechanisms: longitudinal demographic surveillance to track areal demographic events; verbal autopsy to ascertain cause of death; and health service indicator surveillance to track diarrhoea rates, ORT use, immunisation and vitamin A coverage, contraceptive use, and volunteer activity information from the recipients. All information is collected on a 90 day cycle.

Our current plan is to update some of the baseline information (SES, water & sanitation status) annually and to conduct special surveys to identify the effect of specific interventions and/or to explore new issues.

The data update and capture system consists of interactive programs using DMBS files called 'tables' to record and validate captured data. The system has been implemented using 'Rbase for DOS' in PC AT clone computers. Incoming records are edited intra record, inter record (within household) and within the cluster.

Most of the baseline data have been analysed. The Project plans to publish quarterly and annual reports and make them available to agencies engaged in health activities in urban areas.

An evaluation of the urban volunteers
Principal Investigators: Abdullah Baqui, Charles Lerman, Nqudup Paljor, et al.
Funded by: USAID and BADC

The purpose of this study was to evaluate the effectiveness of the urban volunteers in delivering services in the areas of diarrhoea,

nutrition, immunisation, and family planning. A prospective evaluation of the volunteer health services delivery system is being done in the USS research clusters. Half of the clusters have been assigned to intervention and the other half to comparison areas. Volunteers have been recruited and trained, and quarterly surveys to track evaluative indicators have been conducted.

However, because the USS did not become fully operational until February 1991, it was not possible to use USS data to evaluate the effectiveness of the volunteer health services delivery system prior to the expiration of the pilot phase of the UVP in late 1991. Instead, a cross sectional survey was developed to provide quantitative indicators of the system's effectiveness in time for utilisation in project planning.

A second aspect of this study is to evaluate the entire volunteer service delivery system; a 4 cell survey was undertaken. The survey was designed to compare infant and childhood feeding practices, knowledge of diarrhoea prevention and treatment, childhood immunisation, nutrition, and family planning. We also compared selected health status indicators and health practices such as diarrhoea prevalence rate, ORT utilisation rate, and contraceptive use prevalence in the following 4 population areas: UVP activity only, NGO outreach activity only, joint UVP and NGO activity, and no activity area. All the NGOs used paid professional health workers to deliver their services; the UVP services were exclusively volunteer driven. The USS baseline survey information was used; however, because of the inadequacy of the sample size, it was supplemented by collecting the same information from a sample of general volunteer clusters.

When mothers' knowledge was compared with other service providers, we observed that the UVP areas were as good as NGO areas. However, when mothers' actual health practices such as ORT use, immunisation status, and contraceptive use were compared, the UVP areas were still better than comparison areas but not NGO areas. The joint areas were, in fact, the best areas. The data indicated that urban volunteers effectively influenced mothers knowledge. This finding has relevance to the GoB and NGO policy makers and program managers who may want to use volunteers in their programmes.

We conclude that volunteers can play an important role in a structured health service delivery system. However, a system based on volunteers alone is unlikely to be adequate. We should envisage volunteers' roles as 'exemplary mothers' who may be able to generate demand for services, as social and cultural liaisons between professional health workers and slum residents in overcoming 'invisible barriers' that inhibit service utilisation. They may also be able to serve as depot mothers for ORS and contraceptives.

The effectiveness of TOPV in children with gastroenteritis

Principal Investigators: J. Myaux, A. Uzma, L. Unicomb, M. Santosham, R. Besser, and D. Silimperi
Funded by: BADC and UNICEF from November 1990 to August 1992

The purpose of this study is to evaluate the effectiveness of trivalent polio vaccine (TOPV) when administered to children during an episode of diarrhoea. Given the high frequency of diarrhoea in children in developing countries, it is important to determine whether the TOPV vaccine given at the time of diarrhoea will provide adequate protection. Although the International Expanded Program of Immunization (EPI) standards recommend that the vaccine should be given even during an acute diarrhoeal episode, many children are refused immunisation because of their illness. They also state that when given during diarrhoea, an extra dose of TOPV should be given later. Unfortunately this is rarely done.

The study population is comprised of infants residing in communities that are included in the UVP research clusters. A cohort study design is being used, selecting one infant aged 6 to 16 weeks with acute diarrhoea for every two healthy infants from the same environment, and then comparing their antibody levels with the 3 polio virus serotypes after the administration of TOPV. The cohorts are followed up for 4 months with 3 blood and 2 stool samples.

Seventy five sets of 3 infants (one with diarrhoea and two controls) were enrolled in 1991. Stool examinations for rotavirus were done on a routine basis and 85 children had

been tested for sero-conversion by the end of the year. A preliminary report indicated that about 39% (32/83) of the children were not protected against at least one polio serotype, and 18% failed to convert on 2 sero-types. The vaccine used for the study was tested for potency, and was found effective.

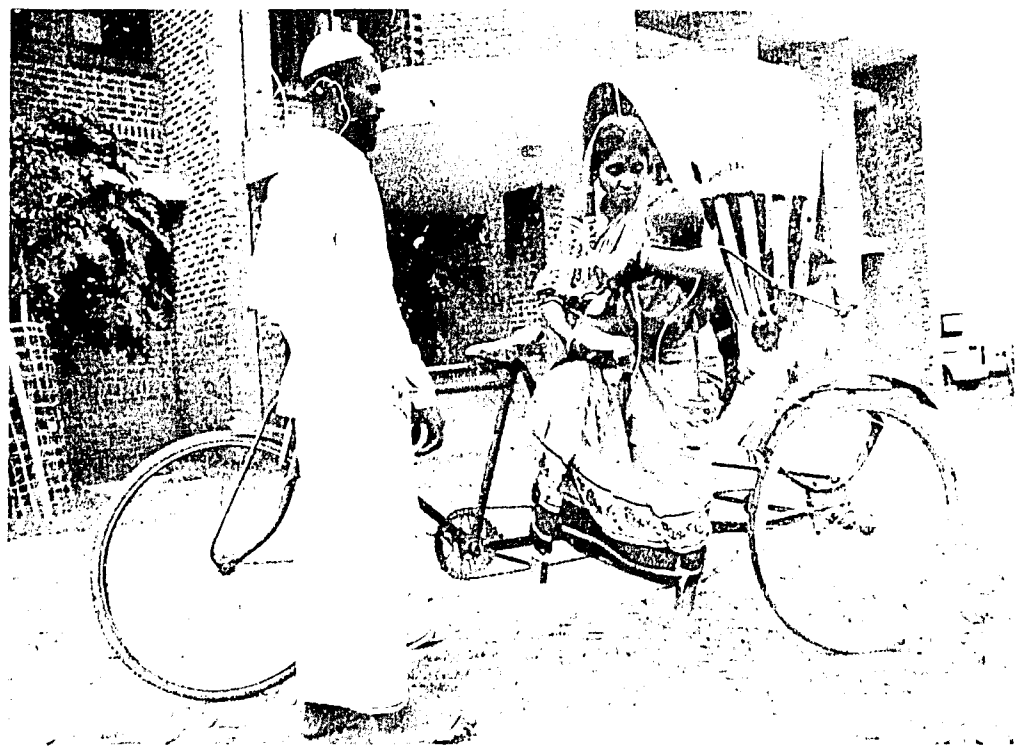
A comparative study of the correct use of packet rice-ORS vs glucose-ORS
Principal Investigators: S.M. Siddiqui and Abdullah H. Baqui
Funded by: USAID and BADC

The purpose of this study is to compare the acceptability and usage of prepackaged rice-ORS with that of the standard glucose-ORS in an urban slum population. The field work has been completed and the data are being analysed.

The impact of enhancement of life choices among slum women
Principal Investigators: Naeema Chaudhury and Shahnaz Ahmed
Funded by: Ford Foundation

This study is complete and reports have been submitted to the Ford Foundation. (See 1990 Annual Report for more information.)

The Matlab Diarrhoea Treatment Center interest group includes those whose primary involvement is in this rural field hospital and research centre. The Treatment Centre provides diarrhoeal treatment to Matlab and surrounding areas, thus providing support to many of the ongoing community based protocols. A laboratory provides microbiological support for the hospital. The United Nations Capital Development Fund (UNCDF) continued in 1991 to provide financial assistance for completion of construction of the physical plant inaugurated in 1990.



Asem Ansari

A mother brings her baby to the Matlab Treatment Centre over land by rickshaw. Since Matlab is a delta intersected by canals and river branches, many patients also come by boat.

Matlab Diarrhoea Treatment Centre
Head: Md. Yunus
Funded by: WUSC, CIDA

The Diarrhoea Treatment Centre (DTC) in the Matlab Health and Research Centre and the 3 Community Operated Treament Centres (COTCs) located at Nayergaon, Kalirbazar, and Shataki provide free treatment services to diarrhoeal patients of Matlab and neighbouring upazilas. During 1991, 10,400 patients were treated at the DTC. Of these, 28% came from within the Demographic Surveillance System (DSS) area and 72% from outside. The case fatality rate was 0.65%. Another 3,303 patients with diarrhoeal illness received treatment at the 3 COTCs run by Voluntary Health Workers trained and supported by the DTC. Only 6 patients died in these Centres, a case fatality rate of only 0.18%.

Stool specimens from 2,942 patients who were residents of the DSS area were cultured and yielded two main pathogens: *Shigella* spp. (11%) and *Vibrio cholerae* 01 (8%). Non-cholera vibrios and *Salmonella* were each isolated from only 2% of patients. Figure 2 presents the isolation rate of these organisms for the last seven years. The isolation of *V. cholerae* 01 rose during the year from that of previous years, that of non-cholera vibrios dropped sharply. Isolation of *shigella* spp. declined during both 1990 and 1991, the most common species was *S. flexneri* (65%), followed by *S. dysenteriae* (21%). This was similar to the previous year.

Figure 3 presents the resistance pattern of *Shigella* isolates to common antibiotics over the last 5 years. As in previous years almost all isolates of *S. dysenteriae* type 1 were resistant to ampicillin and trimethoprim-sulfamethoxasole. 94% of these were also resistant to nalidixic acid. Resistance to nalidixic acid rose from 3% in 1987 to 94% in 1991. *S. flexneri* and other species of *Shigella* were still sensitive to nalidixic acid, although 4% of them were resistant to mecillinam.

Microscopic examination of 2,462 stool samples was performed and the main ova and parasites detected were: *Ascaris lumbricoides* (33%), *Trichuris trichiura* (13%), hookworms (6%), and *Giardia lamblia* (3%). *Entamoeba histolytica* was detected in only 1% of the samples.

The Matlab Centre hosted 234 visitors during 1991 from home and abroad, including representatives of donor agencies, visiting scientists, and foreign diplomats. (See Visitors)

Matlab Staff Clinic
Head: Md. Yunus
Funded by: Core Funds

The Matlab Staff Clinic which provides health care services to staff members and their entitled dependents is primarily managed by a female Health Assistant. There is no specific physician or nurse assigned to the Clinic; the physicians of the DTC run it on rotation. During 1991, 5,235 patients were treated as out patients by the Clinic and another 71 were provided with hospitalised care. In addition, vaccinations against diphtheria, whooping cough, tetanus, poliomyelitis, measles, and tuberculosis were provided.

The Epidemiology interest group is involved with diarrhoeal outbreaks throughout the country, including those that follow natural disasters, such as floods and cyclones. A sentinel diarrheal surveillance system is being established that will involve several different geographical areas of the country.

Epidemic Control Preparedness Programme
Principal Investigator: A.K. Siddique
Funded by: Australia, BADC, CIDA, SDC, ICHF, American Express Int'l, USAID

CYCLONE: The April 1991 cyclone in Bangladesh was responsible for an estimated 120,000 deaths in the coastal areas and in a number of islands in the south eastern part of the country. (See Cyclone in Introduction) Soon after the disaster, there were widespread outbreaks of diarrhoea in most of the affected areas. The Epidemic Control Preparedness Programme (ECPP) carried out investigations of an intervention in these outbreaks. The ECPP physicians spent 335 man days in the affected areas treating patients, demonstrating management methods of acute diarrhoea cases to other relief workers, and distributing ORS and other medical supplies, 1,250,000 packets of ORS were provided.

Our physicians operated a temporary diarrhoea treatment centre in the Chittagong region for two months in collaboration with the Health Services of the GoB. They also collaborated

Figure 2 - Isolation of vibrios and *Shigella* species
Matlab Treatment Centre for last seven years

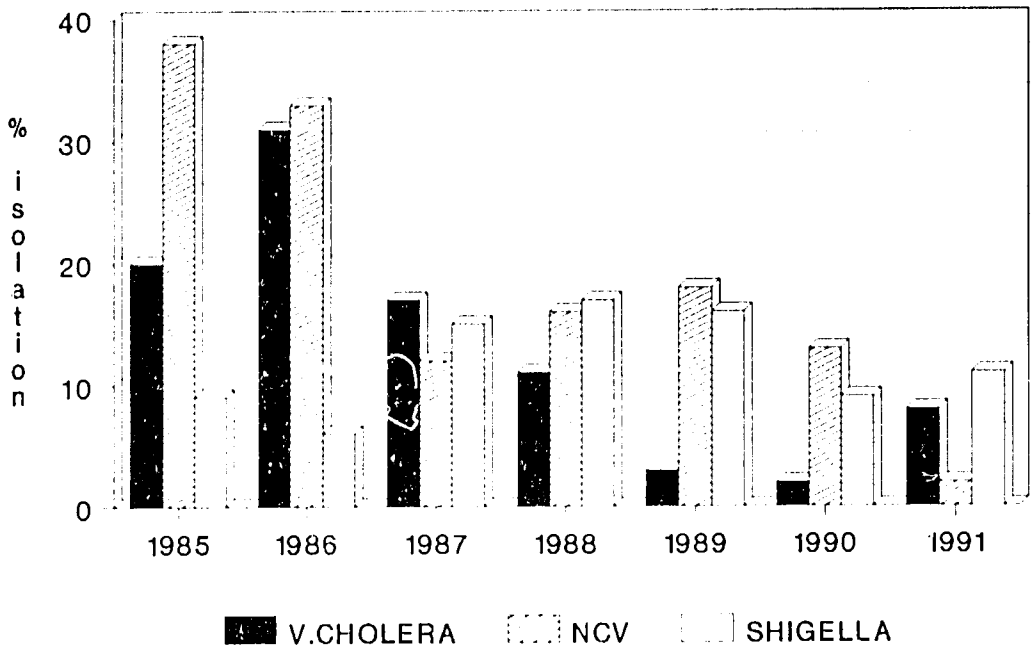
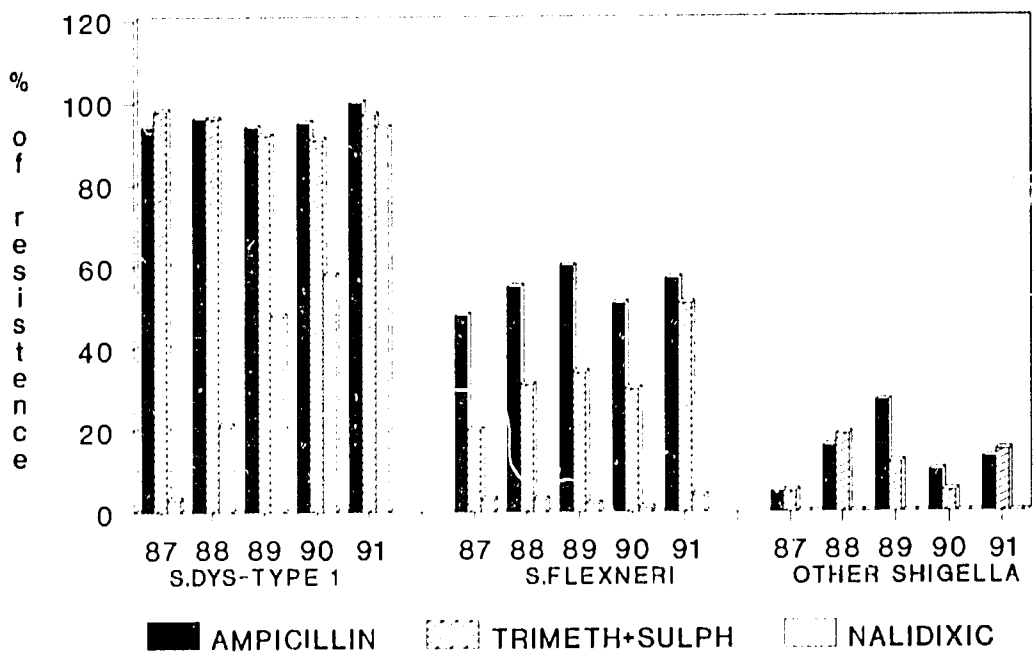


Figure 3 - Resistance pattern of *Shigella* species
Matlab Treatment Centre for last five years



ciosely with the members of the US task force (Operation Sea Angels) during their relief operations. During the post-disaster period, they treated 6,885 persons acutely and severely ill with diarrhoea in the affected areas.

EPIDEMIC: In August, an epidemic outbreak of diarrhoea that started in the north-western part of the country spread through the 30 northern districts of the country. (See Epidemic in Introduction). The government epidemic surveillance reported 214,856 cases and 2,620 deaths between September and November. ECPP, responding to a call for assistance, conducted epidemiological investigations in 17 districts and provided treatment to 4,018 diarrhoea patients. A total of 829 patient's specimens were collected for laboratory identification of the aetiological agents; 59% of these were positive for *V. cholerae* 01 on culture. Besides investigation and intervention, our physicians also collaborated with the local government staff to set up 78 temporary treatment centres and provided field training to government and non-government health workers.

The impact of rotavirus infection at birth on subsequent infections
Principal Investigators: Nigar S. Shahid, J. Albert, N. Nahar Banu, S.M. Faruque, and Leanne Unicomb
At Dhaka Shishu Hospital: Khaleda Banu
At Holy Family Hospital: B. Elahi
Funded by: SDC from July 1991 to June 1993

The objective of this study is to determine whether exposure after birth with rotavirus (RV) strains influences the outcome of a subsequent infection with community strains. Studies conducted elsewhere have shown that infection of neonates with unique "nursery" strains confer protection against severe diarrhoea upon subsequent infections. A pilot study conducted by us in 1990 has shown that a high percentage of babies housed in nurseries in two hospitals in Dhaka shed RV asymptomatically. (See 1990 Annual Report, p.7) Preliminary evidence based on serotyping and electropherotyping suggest that these RVs differ from community strains. If we find that infection with RVs in the neaonatal period (whether unique nursery strains or those found in the community) confer protection against clinically significant RV diarrhoea, such a result could have an impact on future RV vaccination programmes.

Neonates are enrolled from two hospitals: Holy Family Hospital (HFH) and Dhaka Shishu Hospital (DSH). They are followed daily for the first 7 days and then weekly for the first year of life, with stool samples collected on each visit and each diarrhoeal episode. Antigen detection for RV is carried out daily. Each diarrhoeal stool is matched with a non-diarrhoeal control stool and subjected to analysis for RV, parasites, diarrhoeagenic *E. coli*, vibrios, *Campylobacter*, and *Shigellae*. Colostrum and monthly breast milk samples are collected for estimation of serotype-specific RV antibodies. Blood samples (cord blood and quarterly samples) are collected for anti RV IgA and IgG estimation to detect mild or asymptomatic infections. Monthly anthropometry (ht, wt, and MUAC) is conducted.

By the end of the year, 104 (51 from HFH; 53 from DSH) neonates had been enrolled. Of those enrolled from HFH, 41 excreted RV during the neonatal period. Of the ones from DSH, 22 excreted RV. Forty three of the 47 blood samples of the first quarter were drawn.

Serotyping was performed on 67 samples, and serotype identified in 24. Mixed serotypes were also found. At HFH, serotypes 1, 2, 3, and 4 were isolated, and at DSH, serotypes 2, 3, and 4. Electro pherotyping was performed in 67 isolates. A pattern was observed in 45, with one mixed pattern.

The test for estimation of IgA in sera has been standardised and that for breast milk is in progress. Genetic changes in the "nursery" RV strains are currently being studied.

The Social Science interest group is involved primarily with behavioral issues that are important in the implementation of public health interventions.

Socioeconomic, demographic, and cultural factors related to patients with diarrhoea at Matlab
Principal Investigators: K.M.A. Aziz, Abbas Bhuiya, M. Yunus, and M. Strong
Funded by: Core Funds from June, 1990 to February 1992

In spite of the availability of free treatment in the Matlab DTC and availability and promotion of ORS in the community over a decade, the diarrhoea-associated deaths among young

children in Matlab have not declined. In view of this, the present epidemiologic and ethno-medical analysis was undertaken to investigate the perceptions and knowledge regarding diarrhoeal disease and its management in the home, as well as utilisation of community resouces and treatment centre facilities

Data collection for this study was done in the hospital and in the community during June to December 1990. From the patients admitted to the hospital, 312 children under 5 years of age were selected as index cases. They included 230 watery diarrhoea and 82 dysentery cases. In addition, the study included 452 watery diarrhoea and 145 dysentery cases from the neighborhood of the index cases, recruited through a house to house survey. The care givers of all cases were interviewed about the diarrhoea affected children and their management during and after illness. They were also asked about their perception about diarrhoea and hygienic practices. Selective socioeconomic information, including type and dimension of houses, land owning, education of the parents, and occupation of the father was also collected. In addition, the diarrhoea mangement and hygienic practices of the care givers of the community cases were observed for 4 hours at home.

Preliminary results showed that the majority of the children brought to the DTC were given ORS prior to hospitalisation. The intake of ORS was much lower among children with diarrhoea who were managed in the community. Those who were not given ORS were believed to have become ill under the influence of evil spirits, because their lactating mothers did not observe the food restriction, or from the appearance of certain colours and characteristics in the stool. Advice given for the mangement of such cases included: referral to the village practitioners, saying of incantations over the child, use of amulets, restriciton and prescription on food intake by the mothers, and the use of herbal medicine.

Breastfeeding was continued during the acute and convalescent stages of diarrhoea. The mothers' knowledge regarding the types of foods to be given to young children with diarrhoea seemed to be consistent in some degree with the recommended feeding advice, but their practice of feeding was deficient.

In conclusion it was decided that in designing effective community-based health education programmes, it is essential to consider both decision-makers and factors that effectively influence them. Educational interventions related to modification of wrong perceptions and feeding practices during the acute and convalescent stages of diarrhoea are required for dealing with the overall diarrhoea mangement, including nutritional aspects.

The Environmental Health interest group is determining environmental risk factors for dysentery, and childhood deaths, as well as developing simple sanitation interventions to interrupt the spread of diarrheal pathogens.

The environment and child survival
Principal Investigators: Bilqis Amin Hoque, Md. Yunus, M. Strong, and M. Chakraborty
Funded by: IDRC (Canada) from January 1991 to December 1993

Infectious diseases, mainly diarrhoea and ARI, are the major causes of deaths in children under 5 years of age in rural Bangladesh. Although environmental factors have been reported to control these diseases, few mortality studies have been undertaken to test this association because they require huge sample sizes. Furthermore, to make environmental interventions more effective and sustainable, we need to refine and identify the associated amenable factors with adequate details.

This project consists of two major phases: an environmental epidemiological study (on-going) to identify and rank the associated factors, and a community intervention/dissemination study to be based on those results

The environmental epidemiological case-control phase is being undertaken in the rural surveillance areas of Matlab. All children (1-59 months old) who die before the middle of 1993 (an estimated 750) will be the cases. Controls will be randomly selected age- and sex matched children. Data collection includes indicators at the individual, familial, and community levels: socioeconomic, personal and domestic hygiene practices, water use, water quality (of about 20% of the samples) environmental pollution, water supply and sanitation facilities, environmental knowledge,

and child management practices.

Data collection began in April 1991 following the training of staff, pretesting, and standardisation of the methods. About two hundred cases and the same number of controls have been studied. The causes of death were diarrhoeal diseases (40%), ARI (18%), other infectious diseases, and accidents. Water quality parameters, such as feacal coliform concentration, iron, calcium, magnesium, chemical oxygen demand, ammonia nitrogen, and nitrate nitrogen were determined for 25–30% of water samples collected from primary and secondary sources. Simultaneous data entry is in progress.

Water supply and sanitation beyond the project period in Mirzapur

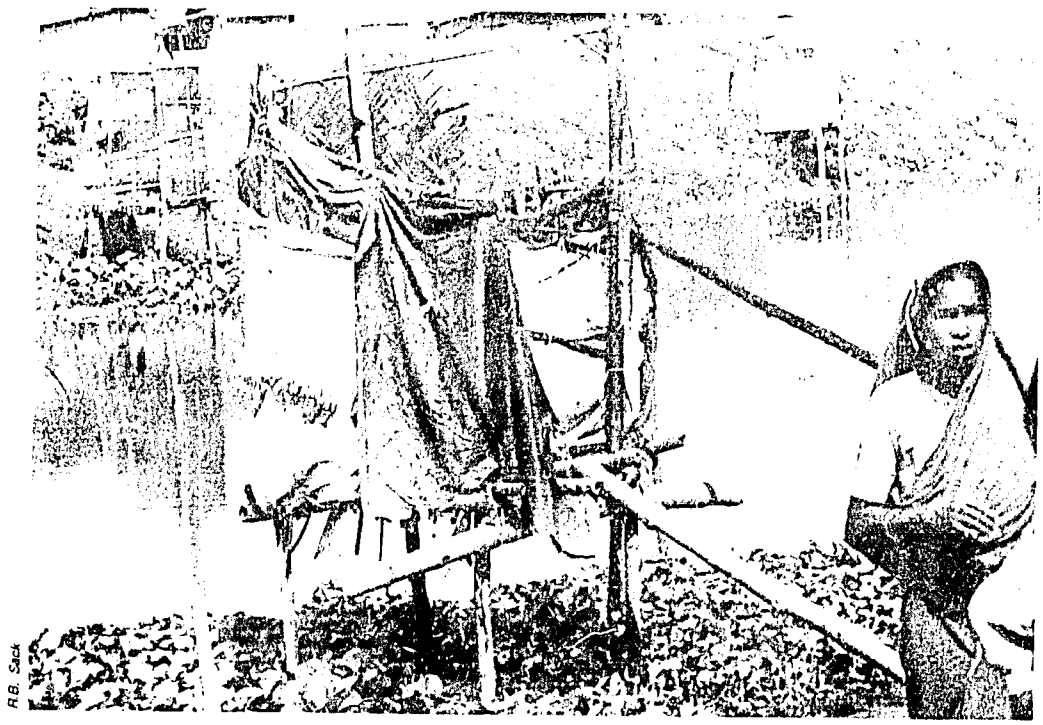
Principal Investigators: Bilqis A.H., T. Juncker, R.B. Sack, A. Hall, and K.M.A. Aziz

Funded by: BADC from June 1991 to June 1992

Although many water and sanitation intervention studies have had significant health impacts, few have reported sustainability of the achievements beyond the project period. Do we know what proportion of people continue to behave the same in a situation when the project support is not available? What are their constraints?

In rural areas of Mirzapur, a sub district about 60km northwest of Dhaka, water supply, sanitation, and hygiene education were provided to about 800 families (interventions), and the health effects are being compared with people of another area with similar characteristics (controls) who were not given these project facilities.

This is a cross sectional study of about 75% of the families from the intervention and control areas. Data are collected on water and sanitation related practices, existing condition of water supply and sanitation facilities, hygiene knowledge, socioeconomic



R.B. Sack

This hanging latrine, (note also two in the background) is a common sight in rural Bangladesh, where health education interventions are trying to discourage their use because they contaminate surface water.

factors, diarrhoea morbidity, and intensity of worm infection.

We have completed the data collection in the control area and in about 50% of the households of the intervention area.

Development of an appropriate hand washing technique
Prinicipal Investigator: Bilqis A. H.
Funded by: WHO from February 1990 to July 1991

Proper handwashing is almost universally a personal hygiene messa je for diarrhoea prevention. But in a community where the majority of the people are illiterate and poor, the chance is that, willingly or unwillingly, they will not wash their hands adequately.

The object of this study was to develop an appropriate technique for washing hands after defeacation in a rural community in Bangladesh. An observational method was used to investigate the existing practices, and an experimental method was used to develop a technique, building on those practices. Relationships were found between the bacterial concentration on hands and the source of water, volume of water, and number of rubs. The washing agents (soap, ash, or soil) gave similar results when hands were washed under similar conditions. The final report is in progress.

In line with the objective of this study, the planning of a second phase is in progress to investigate the appropriateness and effective - ness of the developed technique or an improved model of the technique in a community.

Water quality impact of Meghna Douagoda embankment, Matlab
Principal Investigators. Bilquis A.H.,
M.A. Wahed, A. Felsenstein, and R.B. Sack
Funded by: BADC from July 1991 to July 1993

Although provisions for flood control and irrigation have led to the widespread adoption of HYV rice, the water quality and environmental health impacts of the Meghna Douagoda embankment have not been adequately studied in this country. It is obvious that within the embankment some fertilizers and pesticides will need to be used and that there will be less seasonal dilution of surface water. But the majority of rural people still use surface water for their domestic purposes, except drinking. The objective of this study is to investigate these impacts and to suggest probable appropriate supplementary interventions to improve health benefits from the embankment.

A longitudinal study is in progress. Data will be collected over a period of one year in the areas, one inside the embankment and another outside. Water samples were collected from selected tubewells, ponds, and canals in both areas. The water samples will be tested for BOD, COD, PH, conductivity, NH_3 N, NO_3 N, Ca, Mg, Mn, Zn, Fe, Cu and feacal coliform concentration. Monthly cross - sectional surveys will be done on diarrhoea morbidity of the users of these water sources.

Equipment and chemicals have been procured. Data collection is in progress.

The environment and *Shigella* related dysentary
Principal Investigator: Bilqus A.H. and
D. Mahalanabis.
Funded by: SDC from June 1991 to May 1993

Shigellosis is a major public health problem with high morbidity, mortality, increasing species resistance to antibiotics, and limited benefits from ORS. Although it is known as a water washed disease, very few studies have been undertaken to identify environmental risk factors associated with shigellosis compared with those associated with other diarrhoeas. In addition, this case control study will develop guidelines for an appropriate widely replicable intervention.

All children 1 10 years of age with Shigella - proven diarrhoea visiting the Centre's Clinical Research Centre in Dhaka will be the cases. Two controls will be studied: one age - and sex matched non *Shigella* proven diarrhoea patient, and another age and sex matched well child from the same area as the case. The main prognostic and risk variables of interest are: water sanitation, feeding practices, personal and domestic hygiene, nutritional states, and socioeconomic and demographic factors.

The data collection began in August. One

hundred and seventy cases (and the 340 controls) have so far been studied. Data entry has begun.

Environmental health research activities during the cyclone

Principal Investigators: Bilqis A.H., R.B. Sack, S. M. Siddiqi, and M. Bateman
Funded by: USAID from May 1991 to November 1991

Post disaster diarrhoea epidemics pose common health problems in this country. A group from CHD visited some of the cyclone affected areas to assess existing environmental health conditions. We interviewed local people, relief personnel, checked water supply and sanitation facilities, and collected some water samples and water purifying tablets to test their quality.

Environmental health conditions, as expected, were found to be poor, and relief personnel lacked environmental health knowledge. Compared with all available water sources, the quality of water from tubewells was the best and most appropriate. But a number of existing tubewells were inadequate and, therefore, scarcity of water was acute. More than 60% of the water purifying tablets were found to have lost potency, and people were confused about how to properly use them because various types of tablets were being distributed.

To develop and standardise a water quality treatment method at the household level, laboratory tests were undertaken treating surface water with bleaching powder and alum. Although alum treatment was done earlier, it was included here to further standardise these methods with available bleaching powder and alum from common markets.

Both methods proved to be feasible; however, the bleaching powder available in the markets varied in chlorine strength from nil to 28%. The efficiency of these methods was compared with that of the water purifying tablets. Simple directions on the proper use of the methods were published in diarrhoea prevention leaflets produced by ICDDR,B and distributed among various agencies.

We conducted two training courses on environmental health and field diarrhoea management with more than 125 relief personnel. About 82% of them felt such courses would be helpful for relief personnel if given to them before being sent to the field.

LABORATORY SCIENCES DIVISION

Associate Director: Moyenul Islam (acting)

The laboratories of the Centre are organised under the Laboratory Sciences Division (LSD), which has the following objectives:

- To provide diagnostic laboratory services to patients of the Dhaka Clinical Research Centre and Matlab Treatment Centre.
- To conduct research in microbiology, immunology and pathogenesis of diarrhoeal illness and related disorders.
- To provide laboratory support to clinical, community, field, and environmental studies carried out by scientists of the Centre.
- To promote training of graduate and post graduate students in research methodology and laboratory diagnostic procedures.

There are currently 3 international level scientists, 30 national level, and 108 support staff members working in the Division. Three are on training in Belgium, and 2 in Sweden. Many of the LSD scientists presented papers and otherwise participated in the ICDDR,B's Annual Scientific Conference in October. One, Dr. John Albert, accompanied the team of experts who flew to Ecuador to help their medical personnel combat the epidemic of cholera there. In addition, the Environmental Microbiology Laboratory cultured stool specimens brought back from the cyclone area.

To achieve its objectives, the various units of the Division are organised into groups depending upon the nature of their primary activity: Research, Research support, Diagnosis, or Managerial and technical support.

The **Research Laboratories** are: Enteric Bacteriology, Molecular Biology, Virology, Bacterial Genetics, Immunology, Parasitology, Environmental Microbiology, Histopathology, and Biochemistry and Nutrition.

ENTERIC BACTERIOLOGY

Head: M. John Albert

The Enteric Bacteriology Unit is involved in research in the more general areas of diarrhoeal diseases. For example, the unit does case control studies to find out whether a particular organism is the causative agent of diarrhoea, conducts studies on the pathogenesis of diarrhoeas, defines new aetiological agents of diarrhoeas, and develops simpler assays for diagnosis of bacterial diarrhoeal pathogens. Solving interesting problems and characterising unusual bacteria isolated by the Clinical Microbiology Laboratory are also part of its activities. Scientists from this group collaborate with those within the LSD and with scientists from other Divisions.

In 1991, one important protocol in progress was: The role and characteristics of diarrhoeagenic *Escherichia coli* in clinical and epidemiological investigations. The works of this protocol follow.

Diarrhoea due to *E coli* in Bangladesh

Principal Investigator : M. John Albert
Funded by: USAID from 1990 to 1992

The five categories of *E. coli* that are known to cause diarrhoea are: enterotoxigenic *E. coli* (ETEC), enteropathogenic *E. coli* (EPEC), enteroinvasive *E. coli* (EIEC), enterohaemorrhagic *E. coli* (EHEC) and enteroaggregative *E. coli* (EAggEC). In this study we are screening *E. coli* from children with acute diarrhoea and persistent diarrhoea and their matched controls to study the aetiologic roles of these organisms in diarrhoea in Bangladesh. The acute and persistent diarrheal patients and the controls for persistent diarrhoeal patients are recruited from the Clinical Research Centre and the healthy controls for acute diarrhoeal patients, from Dhaka Shishu Hospital.

We plan to study about 400 children with acute diarrhoea and an equal number of matched controls, and 80 children with

persistent diarrhoea and an equal number of matched controls. Nearly 50% of children with acute diarrhoea and controls have already been studied, and only a few patients and controls in the persistent diarrhoea study remain to be studied. Preliminary results indicate that all categories of *E. coli* except EHEC are prevalent in Bangladesh. ■

Sharing of virulence associated properties between EPEC and *H. alvei*
Principal Investigator: M. John Albert
Funded by: Core funds from 1991 to 1992

We have recently reported that a strain of *Hafnia alvei* isolated from the stool of a child with diarrhoea produced diarrhoea in rabbits. Intestinal pathology of the affected animals suggested that the lesion produced by the organism was similar to that of enteropathogenic *E. coli* (EPEC). This characteristic lesion is called attachment effacement (AE) lesion, because bacteria attach closely to epithelial cells of the small intestine and destroy the brash border.

We have since isolated six additional strains of *H. alvei* from children with diarrhoea. These strains, like the original isolate, produced AE lesion in rabbit ileal loop assay. In addition, these six strains and the original isolate produced fluorescent actin staining (FAS) of infected HEp 2 cells (an *in vitro* test for AE lesion of EPEC) and hybridized with a DNA probe constructed from the AE gene of an EPEC isolate. These results suggested similarities between EPEC and *H. alvei* at the phenotypic and genetic levels. We suggest that *H alvei* with these properties should be considered capable of causing diarrhoea. ■

A modified adherence assay allows identification of EAggEC
Principal Investigator: Khaleda Haider
Funded by: Core funds

Adherence patterns of *E coli*, including localised, diffuse, and aggregative identified by specific DNA probes, were tested using CVD, UTH, and modified UTH (UTH M) methods. An increase of post wash incubation time from 2 to 4 hours in the UTH M allowed identification of enteroaggregative *E. coli* (EAggEC) which were not identified by the UTH method. ■

Smallbowel microbial ecology of severe persistant diarrhoea (See CSD) ■

A second protocol was: The role of plasmids in the virulence of *Shigella dysenteriae* type 1. The following are the studies related to this protocol.

Genetic analysis and phenotypic correlation of the plasmids in strains of *S. dysenteriae* type 1
Principal Investigators: Khaleda Haider and Shah M. Faruque
Funded by: USAID from March 1991 to March 1994

S. dysenteriae type 1 has been shown to universally contain three core plasmids of 140, 6, and 2 megadalton (Mdal) size. A plasmidless strain of *S. dysenteriae* type 1 has been constructed and characterised. Removal of all three plasmids cause significant change in OMP and LPS profiles. The specific roles of each of these plasmids are now being studied by introducing the plasmids into the plasmidless strain.

Studying the role of these plasmids in *S. dysenteriae* type 1 and identifying the plasmid borne virulence genes and factors influencing their expression will help us to understand more clearly the pathogenic mechanisms of *S. dysenteriae* type 1 strains. ■

Isolation and characterization of new *S. dysenteriae* serotypes
Principal Investigator: M. John Albert
Funded by: Core funds from 1991 to 1992

Shigella dysenteriae species consist of 10 serotypes. Recently, researchers reported the isolation of *S. dysenteriae* species strains not reacting with antisera to the 10 recognized serotypes. They proposed that these strains should be designated as new serotypes 11, 12, and 13.

We have been isolating several strains of *S. dysenteriae* from patients with diarrhoea that do not agglutinate with antisera to the 10 recognised serotypes. With antisera to the three new provisional serotypes, we have identified three strains of *S. dysenteriae* 11 and six strains of *S. dysenteriae* 13 among our untypable collection of strains. Moreover, eight untypable strains could not be typed even with

the antisera to 11 - 13 serotypes, indicating that there could be additional new serotypes of *S. dysenteriae* species causing disease in Bangladesh. Further characterisation of these isolates is in progress. ■

Other studies involved cross reacting antigens, a newly identified cholera toxin, and pathogenic *Providencia alcalifaciens*. A study entitled, **The carrier state and role of objects as reservoirs or secondary host of *Shigella*** was also done in collaboration with the Environmental Microbiology Laboratory (See EML).

Cross reacting antigens of *A. caviae* and *S. boydii* 5
Principal Investigator: M. John Albert
Funded by: Core funds from 1991 to 1992

Aeromonas caviae are suspected diarrhoeal pathogens. We have isolated 16 strains of *A. caviae* from patients with diarrhoea, which cross - reacted with *Shigella boydii* 5 antisera in a slide agglutination test. Seven strains were further studied in a tube agglutination test, and one strain in enzyme linked immunosorbent assay (ELISA) and immunoblot. Cross reactions were seen in all these tests even with boiled bacteria and purified lipopolysaccharide (LPS) of O antigens. These observations suggest that the cross reactions occurred at the LPS level. This finding may have implications for cross protection between diarrhoeas due to *S. boydii* 5 and *A. caviae*.■

A cytotoxic enterotoxin of V. cholerae
Principal Investigator: Setarunnahar Saha
Funded by: AIDAB (Australia)

A newly identified cytotoxic enterotoxin has been purified from a cholera toxin gene negative *Vibrio cholerae* 01 strain. The toxin has been tested in the rabbit ileal loop (RITARD) model for enterotoxicity and in HeLa cells for a cytotoxic property. Physico chemical studies demonstrated the toxin to be a heat labile, pH sensitive protein of molecular weight approximately 61,000. Different immunobiological studies showed that the toxin is different from cholera toxin, as well as Shiga toxin, in respect to antigenicity.

The live cells of the strain of 10^8 colony forming units caused diarrhoea in the RITARD model. The convalescent serum of the same rabbit was tested for the presence of an antibody against the identified *V. cholerae* cytotoxic enterotoxin (VCCE). ELISA and ELISA - inhibition experiments showed the presence of VCCE antibody in the serum. This finding suggests that the toxin has an important role in the pathogenesis of diarrhoeal disease. ■

Pathogenic mechanism of diarrhoea due to *P. alcalifaciens*
Principal Investigator: M. John Albert
Funded by: Core funds from 1991 to 1992

P. alcalifaciens have long been suspected as causative agents of diarrhoea, but the mechanism by which they cause diarrhoea has not yet been uncovered. In this study we examinied 3 strains of *P. alcalifaciens* isolated from the stools of patients with diarrhoea for enteropathogenicity.

These 3 strains did not produce conventional enterotoxins or cytotoxins, but adhered to and penetrated cultured HEp - 2 cell monolayer. They produced diarrhoea in RITARD rabbits, and microbiological studies of these rabbits suggested that the organisms colonised the intestinal mucosa; histological studies showed evidence of penetration of intestinal epithelial cells. These data suggest that some strains of *P. alcalifaciens* are pathogenic and that these produce diarrhoea by invading intestinal epithelial cells. ■

MOLECULAR BIOLOGY
Head: Shah M. Faruque

The Molecular Biology Laboratory, which was established in 1989, has now developed into a modern laboratory with sophisticated instruments and a very capable staff trained in molecular techniques. The technical facilities available in this laboratory range from simple gel electrophoresis, nucleic acid preparation, and hybridisations using radio - labelled and non - radioactive probes to the most sophisticated techniques of DNA sequencing and DNA amplification by polymerase chain reaction (PCR).

Besides performing research within protocols developed in this laboratory, the staff members also provide technical support to other protocols which involve molecular techniques, and collaborate with other Divisions. The

Laboratory is at present supporting the activities of 4 research protocols, within and outside the Laboratory. ■

Identification of enteric pathogens using DNA probes
Principal Investigator: Shah M. Faruque
Funded by: USAID from January 1990 to December 1992

Specific DNA probes for *Escherichia coli* pathogenic determinants are being used to assess the role of different categories of diarrhoeagenic *E. coli* causing diarrhoea in Bangladesh. Isolates are obtained for analysis from the Centre's surveillance system and from stored isolates from previous studies. Analysis so far has shown a high prevalence of EPEC, EAggEC, and ETEC in this population. Recently, more than 9,000 isolates, obtained from 300 patients between December 1986 and May 1988, have been screened for pathogenic *E. coli*. Analysis of these results is expected to provide important information on the prevalence and seasonality of different categories of diarrhoeagenic *E. coli* in patients of different age groups in Bangladesh. ■

The impact of rotavirus infection at birth on subsequent infections (See CHD) ■

Genetic analysis and phenotypic correlation of the plasmids in strains of *S. dysenteriae* type 1 (See Enteric Bacteriology Lab) ■

The role and characteristics of diarrhoeagenic *E. coli* in clinical and epidemiological investigations (See Enteric Bacteriology Lab) ■

VIROLOGY

The Virology Laboratory carries out research on suspected or known viral agents of diarrhoea. A diagnostic service is provided for group A rotavirus, and research support for testing viruses other than those that cause diarrhoea (e.g. polio, measles) and/or anti viral antibodies is also provided. Techniques, such as cell culture, polyacrylamide gel electrophoresis, ELISA, probe hybridisation, and Western blotting are conducted by various members of the Virology Group.

One of the following studies conducted by the Laboratory in 1991 used a newly developed test for detecting the presence of astrovirus, some explored pathogenic and non-pathogenic adenoviruses, and others noted the frequency and serotypes of rotavirus. **The effectiveness of trivalent oral polio vaccine in children with gastroenteritis** was another study done in collaboration with scientists in the CHD (See CHD).

The role of astrovirus in diarrhoeal disease
Principal Investigators: L. Unicomb and C. Moe
Funded by: Core funds from May 1991 to March 1992

This completed study was done in collaboration with the Centers for Disease Control, Atlanta, Georgia (USA). Astrovirus has been implicated as a possible cause of gastroenteritis but has not been extensively studied due to lack of suitable diagnostic tests. A recently developed enzyme immunoassay (EIA) was employed on 584 stool specimens from poor urban infants, 292 of whom had diarrhoea; the other 292 were from gender- and age matched children without diarrhoea. The specimens were also matched for duration of storage in the deep freeze. Astrovirus was found in 1.7% of stools from infants with diarrhoea and 2.4% from those without diarrhoea, suggesting that either astrovirus does not cause diarrhoea or that the virus is commonly shed by infants who have developed immunity to infection. ■

Seroprevalence of enteric and non-enteric adenoviruses
Principal Investigators: K. Jarecki-Khan and L. Unicomb
Funded by: Core funds, and Deutscher Akademischer Austauschdienst (DAA) from January 1989 to November 1991

Serum samples from 218 infants between 0 and 24 months of age were examined for the presence of different classes of antibodies to enteric and non-enteric adenoviruses. Generally, the percentage of sera containing antibodies to adenoviruses was higher in samples from the older children, and the second highest prevalence was among the infants less than 6 months of age. Antibodies specific for enteric adenoviruses (i.e. those causing gastroenteritis) were found in as many as 80% of sera from infants by 24 months of age, indicating that enteric adenovirus infection commonly occurs between birth and 2 years of age. ■

The role of enteric adenovirus in diarrhoeal disease
Principal Investigators: K. Jarecki-Khan, L. Unicomb, and A. Hall
Funded by: Core funds, DAA, and ODA (UK) from January 1989 to November 1991

To determine the importance of enteric adenovirus as a cause of diarrhoea, two studies were conducted and completed. The first study examined the presence of enteric adenoviruses in stool samples from children with diarrhoea and from at least 2 matched healthy children per study child. Enteric adenovirus was found in 1.4% of specimens from infants with diarrhoea and 0.8% of those from controls.

A prevalence study was also conducted in which 4,409 stool specimens from infants less than 5 years of age who visited the hospital with diarrhoea were tested for the presence of enteric adenovirus. A total of 2.8% of their specimens were positive for enteric adenovirus when the diarrhoea was generally watery in nature, of short duration, and commonly associated with vomiting. During the 3 year period of the prevalence study, an outbreak of enteric adenovirus diarrhoea occurred which probably accounted for the higher detection rate in this study.

These data suggest that enteric adenovirus may cause diarrhoea in a small number of cases and may be found to cause outbreaks. ■

Surveillance of group A rotavirus in Dhaka
Principal Investigator: L. Unicomb
Funded by: Core funds from 1987, continuous

The presence of group A rotaviruses (RV) in specimens collected in Dhaka from 1987 have been studied. A constant surveillance of RV frequency and serotypes is maintained in order to monitor seasonal changes of prevailing RV strains and detect appearance of epidemiologically important strains and/or new serotypes.

During 1991, 8,980 specimens from the Clinical Research Centre and from research studies were tested and 1,201 (13.5%) were found to be positive for RV. Positive specimens were tested for serotype and type 4 was predominant, comprising approximately 45% of serotype positive strains followed by serotype 2, and 3. Serotype 1 was least common. ■

The impact of rotavirus infection at birth on subsequent infections (See CHD) ■

BACTERIAL GENETICS
Head: Z.U. Ahmed

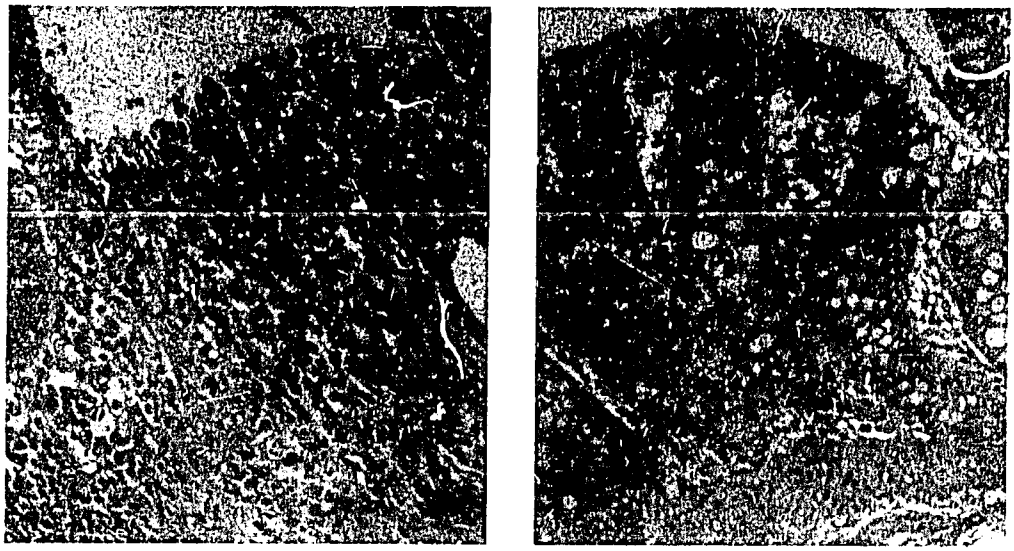
The Bacterial Genetics Laboratory carries out research involving the genetic structure of enteric bacteria. The Laboratory continued in 1991 with what has been its major study for the past few years, that is, the development of a live oral vaccine against shigellosis. Beginning the latter half of the year, new research initiatives were undertaken involving cholera vaccines. One of these is a feasibility study of the local production of a killed oral cholera vaccine, 'improved' vaccine formulations of killed vibrio, and ETEC strains.

A live oral vaccine against Shigellosis
Principal Investigator: Z.U. Ahmed
Funded by: USAID from July 1987 to June 1991

During the early part of 1991, a number of important experiments were completed in Bonnet monkeys at the National Institute of Immunology, New Delhi, as part of a collaborative research programme involving studies with a thymine requiring and temperature sensitive strain of *S. flexneri*, a potential vaccine candidate. These experiments further substantiated the safety, immunogenicity, and protective efficacy of the vaccine strain. Encouraging results were obtained on the ability of the strain to confer immune protection against a heterologous experimental challenge with virulent *S. flexneri* serotypes 2a, and 3a, and *S. dysenteriae* serotype 1.

Our studies with the *thyA* Ts double mutant, strain TSF21, represent a lead work on *thyA* attenuation of *Shigella*. The strain has been found to possess many of the characteristics desired in a live vaccine. Its high level thymine requirement and temperature sensitive growth allow a self limiting infection of the colonic epithelium after oral administration which mimics some important aspects of natural infection with a concomitant stimulation of protective immunity. The precise genetic lesion in the mutated *thyA* gene has not yet been determined.

The results obtained tend to suggest that this approach bears a degree of promise towards



Protective efficacy of the *S. flexneri* Y attenuated mutant candidate vaccine strain TSF21.
The photograph shows the histology of the colon of Bonnet monkeys after experimental challenge with the virulent parent strain. The mucosa in the immunised animal is intact with only mild infiltrations of mononuclear cells. The unimmunised control animal shows damaged mucosa with excessive leucocytic infiltration and irregular dilation of intestinal glands.

the development of a live oral vaccine against shigellosis, based on a mutated *thyA* gene. ■

IMMUNOLOGY

The Immunology Laboratory has wide-ranging expertise and carries out studies on purified bacterial antigens, cellular immune assays and humoral assays. Thus, purification of bacterial antigens, analyses by ELISAs, Western blots, SDS-PAGE, lymphocyte proliferation assays, ELISPOTs, immunofluorescence, identification of bacteria by latex agglutination and immuno magnetic beads, granulocyte function assays (chemotaxis, polarisation, phagocytosis) are routinely carried out. For these purposes, the Laboratory's equipment includes an ultracentrifuge, a high speed centrifuge, an FPLC, electrophoretic equipment, a cell harvester, a biohazard hood, a fume hood, a liquid nitrogen tank, and bench top centrifuges.

In the last year, the Laboratory has firmly established an isolated monoclonal antibody (MAb) producing laboratory with its own facilities of tissue culture. The 'mab lab is now capable of regular monoclonal antibody production.

During the year, the Laboratory had 4 ongoing protocols, some of them in collaboration with other laboratories and other divisions. These include, in addition to the 3 described below, studies on **a cytotoxic enterotoxin of *V. cholerae*** (See Enteric Bacteriology).

Study of the immune response to *S. dysenteriae* type 1

Principal Investigators: Tasnim Azim, Firdausi Qadri, Jena Hamadani, M. Abdus Salam and M.A. Wahed
Consultant: Laila Noor Islam, University of Dhaka
Funded by: USAID from August 1989 to December 1992

Children under 5 years of age suffering from dysentery due to *S. dysenteriae* type 1 often develop serious complications such as leukaemoid reaction and haemolytic uremic syndrome (frequently fatal blood disorders). It has been hypothesised that an inappropriate immune response may precipitate these complications. This study, therefore, aims at systematically investigating the immune status of children suffering from dysentery due to *S. dysenteriae* type 1 with or without complications.

A total of 30 children with leukaemoid reaction will be required for this study. So far 54 children, of whom 4 developed leukaemoid reaction, have been examined. ■

Haemagglutination ability and adhesiveness of *Shigella* species (part 2)
Principal Investigators: Firdausi Qadri, Tasnim Azim, Gabriel Mondol, and Dilara Islam
Consultant: M. Sayeedul Islam, University of Dhaka
Funded by: USAID from June 1990 to July 1993

The adhesion of bacteria to the epithelium of mucosal surfaces has been found to be an essential step in the pathogenesis of many diseases, including enteric infections. We have shown previously that strains of *S. dysenteriae* type 1 and *S. flexneri* adhere to and agglutinate mamalian erythrocytes. The adhesion is resistant to mannose and sensitive to sialic acid. Studies have also shown that pili or fimbriae are not present on stains of *S. dysenteriae* type 1 and that lipopolysaccharide is important for mediating the binding of bacteria to erythrocytes as well as to cultured intestinal cells. Further studies have shown that bacteria grown under haemagglutinating conditions produce a loose slime. When viewed under the electron microscope, a loose glycocalyx can be visualised around the bacterium. The slime is polysaccharide in nature and immunologically cross reactive with lipopolysaccharide.

Electron micrograph of a negatively stained preparation of *S. dysenteriaea* type 1, showing loose slime (magnification ×31,000).

Monoclonal antibodies have been produced to the lipopolysaccharide of *S. dysenteriae* type 1 and is being used for further characterisation of the polysaccharide antigens. Monoclonal antibodies have also been produced against other antigens of *shigella* spp. We are at present characterising these monoclonals and studying their usefulness in immunodiagnostics.

Local and systemic immune response to Shigellosis in adult humans
Principal Investigators: Rughana Raqib, S. Tzipori, and A.A. Lindberg
Funded by: SAREC (Sweden) from October 1989 to September 1991

The immune responses of adult Bangladeshi patients to diarrhoea caused by *S. dysenteriae* type 1 (n 20) and *S. flexneri* (n 12) were analysed and compared with that of 20 healthy adults. A significant increase in the number of lipopolysaccharide specific IgA antigen - specific antibody secreting cells (ASC) was observed with a peak 6 to 8 days after the onset of disease. The mucosal IgA responses were similar. Serum IgA titers were highest 9 to 11 days after the onset of diarrhoea and were significantly higher than the control group. The serum IgA levels in *S. dysenteriae* 1 group were almost twice the level measured in the control group. The mean IgA titers in the *S. flexneri* group, however, were only slightly higher than that seen in the control group during the acute phase, suggesting previous exposure to *Shigella*. A strong specific cellular immune response to the homologous *S. dysenteriae* 1 and *S. flexneri* O PS antigens was observed in both groups 6 to 8 days after the onset of symptoms. These results show a good correlations between mucosal, cell mediated, and ASC responses which may play concomitant protective roles in the host defense against shigellosis.

Rectal biopsies obtained at proctoscopy from

the same patients and controls were also studied regarding the expression of HLA - DR antigens. The epithelium of the colonic mucosa from 21 of 32 patients was HLA - DR + . The number of HLA DR + intraepithelial lymphocytes in biopsies from patients with *Shigella* infection was significantly higher than in the controls. The infiltration of CD8 + cells in the surface epithelium and in the lamina propria and of CD4 + cells in the lamina propria alone was also significantly higher in patients than in controls. These findings indicate that a strong cell mediated immune response develops in the gut during acute *Shigella* infection. ■

Detection of *Shigella* spp. in faeces by immune isolation and PCR
Principal Investigators: Dilara Islam, S. Tzipori, M. Islam, and A.A. Lindberg
Funded by: SAREC form 1989 to 1991

A rapid and sensitive method for the detection of *S. dysenteriae* type 1 and *S. flexneri* in faeces has been developed. Separation with immunomagnetic particles (IMP) was used for the isolation of bacterial cells. The whole detection procedure requires 2 to 3 hours and the sensitivity is 10^3 CFU/ml as determined by viable cell counting. The assay was compared for its sensitivity, specificity, and speed with latex agglutination and indiret immune flourescence using the routine isolation of *S. dysenteriae* type 1 and *S. flexneri* species as standard.

A combination of immunomagnetic separation (IMS) and a polymerase chain reaction procedure (PCR) was also used for direct isolation and identification of the same *Shigella* species from faeces. The method is simple and fast (7 h) with detection limits of ca 10 *shigella* species in a sample. The combined IMS PCR method correctly identified all of the 2 species in faecal specimens and also permitted detection of 17 *Shigella* positives in 113 specimens from diarrhoeal patients where they were not detected with the conventional culture. PCR is possible because of a newly acquired machine. (see Environmental Microbiology) ■

PARASITOLOGY
Head: Rashidul Haque

The Parasitology Laboratory performs research on amoebiasis and ascariasis. Among the equipment the Laboratory maintains for this purpose are optical microscopes, an inverted microscope, and a cellulose acetate electrophoresis apparatus. Our staff have established several diagnostic techniques to distinguish between pathogenic and non-pathogenic strains of *Entamoeba histolytica* and produced larval antigens of *Ascaris lumbricoides* to study the levels of antibodies to *Ascaris* and cell mediated immunity.

Work on two important studies continued in 1991. One involved the development of a simple field test for identifying disease causing *E. histolytica*, and the other, a means of identifying the risk factors for repeated infection with roundworms. Another study was done in collaboration with the Clinical Sciences Division: **Albendazole as a treatment for infections with *Giardia intestinalis*** (See CSD).

Techniques to identify pathogenic strains of *E. histolytica*
Principal Investigators: Rashidul Haque and Andrew Hall
Funded by : USAID from January 1990 to December 1992

E. histolytica is a protozoan parasite which causes a wide range of diseases, including dysentery. The prevailing hypothesis is that there are two distinct, albeit morphologically identical, species of *E. histolytica*, a pathogenic one which can cause disease and a non-pathogenic variety which is a commensal and will never cause disease. However, little is known about its contribution to dysentery and diarrhoea in Bangladesh. This ongoing study aims to establish techniques to identify the pathogenic strains for use in clinical and epidemiological studies in Bangladesh.

An ELISA is being established using monoclonal antibody (MAb) to detect pathogenic specific faecal antigen. The ELISA has been applied to 180 stool samples from patients with symptomatic or asymptomatic amoebiasis, with other parasitic infections or with no detectable parasitic infections. The isolates of *E. histolytica* were characterised into their zymodemes. The sensitivity and specificity of the ELISA for pathogenic infections were 86% and 100% respectively. This MAb should therefore yield new, simple, direct field tests that do not require isolation of the parasite and zymodeme characterisation. ■

Repeated infections with *A. lumbricoides*
Principal Investigators: Andrew Hall, K.S. Anwar, Rashidul Haque, and Tasnim Azim
Funded by: ODA

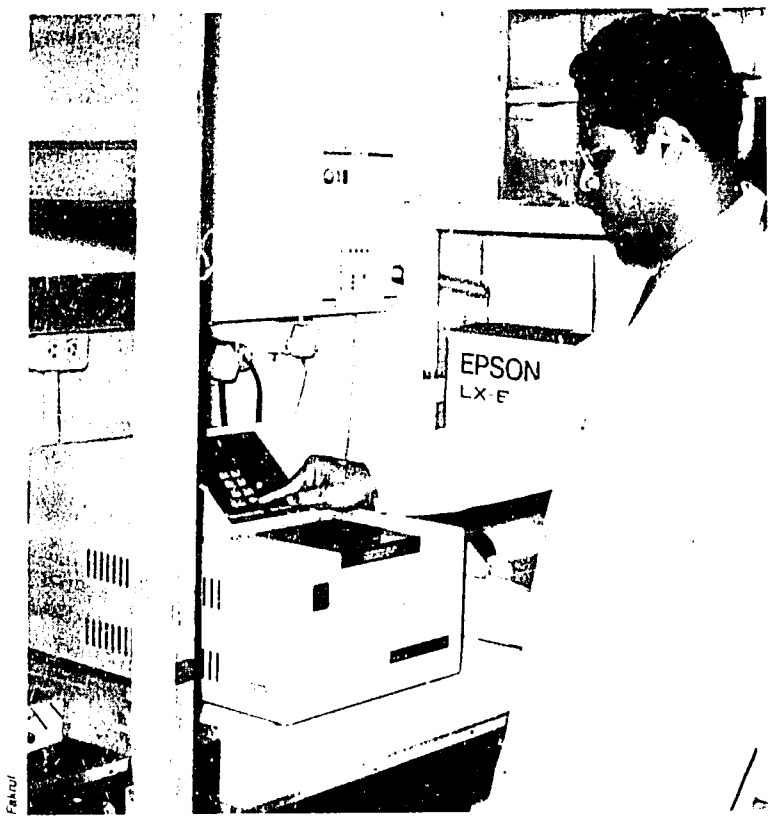
A prospective study of the intensity of reinfection with the intestinal roundworm *A. lumbricoides* had identified about 40 children who were repeatedly heavily infected (See 1990 Annual Report p.23). After 3 rounds of treatment 6 months apart, these children passed an average of 35 worms each. They were compared with a similar group of about 40 children who passed only an average of 7 worms at each round and were thus repeatedly lightly infected.

The aim of this case control study, done in collaboration with the Institute of Public Health, was to examine principally nutritional and immunological factors associated with a possible predisposition to repeatedly heavy infection. Cell mediated immunity was assessed, a blood sample was taken from each child, and the proportions of different types of mononuclear cells were estimated and their ability to proliferate was assessed; levels of antibodies to *Ascaris* were estimated; and concentrations of classes of antibodies and of vitamin A, iron, zinc, copper, and transferrin in plasma were also estimated. Field work finished in April, but tests on plasma samples are still being carried out. ■

ENVIRONMENTAL MICROBIOLOGY
Head: Md. Sirajul Islam

The Environmental Microbiology Laboratory conducts independent research, collaborates with other laboratories, and supports studies from other Divisions by testing environmental samples, e.g. water and food. Samples from various national and international institutions of Bangladesh are also tested here. A total of 1,475 samples were tested during 1991.

Three studies began during the year. One evaluated techniques for detecting *Vibrio*



Fakrul

Dr. Md. Sirajul Islam using the new, very sensitive polymerase chain reaction machine to detect *Shigellae* in stool and environmental samples

cholerae in stool and water samples, another looked for the organism in reservoirs, and a third investigated the transmission of *Shigellae* by certain objects previously suspected of being carriers but never confirmed because the methods used were not sensitive enough to detect the organism.

The identification of *V. cholerae* 01 in stool and water samples
Principal investigator: Anwarul Huq
Funded by: U. of Maryland, USA

A comparative study of 3 different laboratory methods for the qualitative detection of *V. cholerae* 01 in stool and environmental water samples was carried out. The techniques evaluated were the conventional culture method, the fluorescent antibody method, and dipstick, a newly developed rapid method. Fifty stools and 15 water samples were collected from cholera prone areas of Bangladesh and tested. The study was carried out from the 18th to the 30th of August. Analysis of the data is in progress. ■

Cryoprotective proteins as receptors for *V. cholerae* 01 in freshwater planktons
Principal investigators: K. Amako and Md. Sirajul Islam
Funded by: US Japan Cholera Fund

A study was carried out to investigate the presence of cryoprotective proteins (CPP) in the surfaces of both phyto and zoo plankton collected from various freshwater reservoirs of Bangladesh. The field work was carried out from the 8th to the 21st of December, 1991. Analysis of the data is in progress. ■

The carrier state and role of objects as reservoirs or secondary hosts of *Shigellae*
Principal investigators: Md. Sirajul Islam and M. John Albert
Funded by: SDC funds from October 1991 to September 1993

Various epidemiological studies have shown some circumstantial evidence of the transmission of *Shigella* spp. by various animate and inanimate objects, such as hands, door handles, utensils, and clothes. However, the organism could not be isolated from these environmental objects; therefore, it was not clear whether they were contaminated or not. Previous studies using conventional techniques had limitations due to the low numbers of organisms. However, because of the recent development of a very sensitive technique, using the newly acquired polymerase chain reaction (PCR) machine, *Shigella spp.* can now be detected even if they are present in numbers as low as 10 organisms in a sample.

It may now be possible, thereby, to have direct proof of the role of these various animate and inanimate objects in transmission of disease, and by using both PCR and conventional techniques, to compare these two methods. It may also be possible to detect healthy carriers from the community who had previously gone beyond detection, and to measure the time period of excretion of *Shigella* spp. by convalescent patients.

The procedures have been standardised for using the PCR technique to detect *Shigella* spp. on objects, and preliminary results on laboratory based survival studies showed that *S. dysenteriae* can survive longer in autoclaved drain water than in autoclaved pond, river, and lake water. ■

HISTOPATHOLOGY

The Histopathology Laboratory is involved both in providing services in support of patient care and in research. It is adequately equipped to process tissue and carry out routine and some special staining procedures, including the peroxidase antiperoxidase method.

Its services in support of patient care involve biopsy and cytological examinations and interpretation of bone marrow aspirates. Besides the patients of the CRS, these services are also given to those attending the Staff Clinic, Travellers Clinic, and Mirzapur Kumudini Hospital, and private cases referred by medical practitioners.

The Laboratory continued one research study during the year, which investigated the causes of death in the hospital.

Studies on fatal cases of diarrhoeal illness and acute lower repiratory infection
Principal Investigator: M.M.Islam,
Funded by: UNDP from December 1989 to November 1994

Twenty-nine autopsies were conducted during 1991. The findings were reported to clinicians, and important cases were presented at monthly clinicopathological conferences at the hospital. Proceedings of selected conferences are published in the Centre's journal (JDDR). The study is continuing and data are being analysed. ■

BIOCHEMISTRY AND NUTRITION

Head: M.A. Wahed

The Biochemistry and Nutrition Laboratory performs specialised assays for biochemical and nutritional studies; 2,800 assays were performed during the year, supporting 27 research projects. Its staff also maintain and organise codes of various double blind studies, and prepare specialised study syrups (zinc, vitamins, and iron). Besides collaborating with other Divisions, the Laboratory carries on activities with both national and international institutions. An osometer was obtained during the year for measuring the osmolality of food samples.

The Laboratory's scientists collaborated on the following studies in 1991:

Amylase-rich flour preparation, its effect on viscosity reduction, and its use in weaning food production (See CSD: Development and evaluation of ARGC). ■

Precooked cereal-based oral rehydration solution (ORS) development (See CSD: Precooked ready-to-use rice-ORS in children with mild diarrhoea). ■

Micronutrients in the treatment of acute diarrhoea and acute respiratory infections (See CSD) ■

Absorption promoting ORS in animal models (See CSD) ■

Study of the immune response to *S. dysenteriae* type 1 to identify abnormalities leading to the development of leukaemoid reaction (See Immunology) ■

Asem Ansari

In the Biochemistry and Nutrition Laboratory a research trainee is testing the effect of Amylase-rich flour (ARF) on reduction of viscosity by using a viscometer. ARF is produced by germinating wheat and is used to thin the consistency of thick porridges. (see report in CSD)

Research support is provided by the Animal Resources Branch

ANIMAL RESOURCES
Head: K.A. Al-Mahmud

The Animal Resources Branch provides active technical support to the scientists doing animal experiments. This includes surgery on research animals, inoculations, and observation and recordkeeping of animals under experiment. Its scientists are either directly or indirectly involved in research studies involving animals. Technical support also includes supplying animal blood, particularly for culture media preparation and some laboratory tests.

During 1991, the Branch provided the following research support to the scientists of the Centre covering about a dozen research protocols and exploratory studies: Hyperimmune sera were produced against various antigens using 103 rabbits and 134 Balb/c mouse; Ileal loop assays of different toxins and bacteria were performed on 76 rabbits and 8 rats; RITARD Model tests were done on 55 rabbits to ob serve the diarrhoeagenic properties of various enteric pathogens; Absorption promotion stud ies were conducted on 18 rabbits and 87 rats; Sereny tests were performed on 67 guineapigs to observe the invasive property of different bacteria; ST tests of 170 samples were done using 510 infant mice; and Toxicity tests were done on 4 rats and 8 mice.

Annual production and supply is based on breeding policies undertaken by the Branch, depending on the requirements of the scientists. Animals are also supplied to national research institutions.

At the end of the year, the Branch opened a Veterinary Clinic for small animals. Through this effort of extending its veterinary services to private individuals, the Centre hopes to earn some revenue for the Branch.

The **Diagnostic Laboratories** are the Dhaka Clinical Laboratory which has 3 units (Microbiology, Biochemistry and Pathology), and the Matlab Field Laboratory

CLINICAL LABORATORY
Head: Md. A. Hossain (Acting)

The Clinical Laboratory in Dhaka provides diagnostic support by performing tests on specimens of patients from the Centre's hospital and treatment centres, the Staff Clinic, Traveller's Clinic, national institutes (on agreement), and some private hospitals/clinics. It also supports research studies, provides training to Fellows from international and national institutes, provides in-house training, and carries out methodological research.

In 1991, the Laboratory supported 16 research protocols and collaborated with the Institute of Post graduate Medicine and Research on one study: **An evaluation of coagglutination reversed passive haemagglutination and enzyme linked immunosorbent assay techniques for the diagnosis of rotavirus diarrhoea** (Md. A. Hossain, N. Islam). Field support was also given to the CHD's team of investigators, who responded to a call for help with a cholera epidemic in North Bengal in April. Eighteen of the 20 rectal swab specimens collected there were positive for *Vibrio cholerae* 01. The staff continued their assistance to the Institute of Public Health in carrying out quality control of electrolye contents of their IV fluids, and provided technical facilities to BRAC for testing the quality of ORS packets.

During the year, a sodium-potassium analyzer (IL 501) was purchased for the biochemistry section as a back-up to the Beckman System E4A analyzer and one spectrophotometer was ordered to meet the increased demand of that section.

To accommodate the increased workload of private patients, the waiting room facilities and specimen reception area were reorganised and remodeled. Extra technicians were also employed.

More than 88,000 specimens were tested by the three sections of the Laboratory during the year, about 198,000 tests were performed on these specimens. A variety of samples included blood, stool, rectal swabs, urine, throat swabs, sputum, and pleural fluid. The most common diarrhoeal agents isolated from stool samples were species of *Shigella* (2,304). *V. cholerae* was next with 1,418, a much higher figure than the previous year's 416. Species of *Aeromonas* were found in 1,250 samples and *Salmonella* in 532. Finally, 246 were positive for *Plesiomonas*, 174 for *Campylobacter* spp, and 112 for other vibrios.

MATLAB FIELD LABORATORY
Head: R. Rahman

The Matlab Field Laboratory provides full diagnostic services to the Diarrhoea Treatment Centre (See CHD) and supports all field and hospital based research protocols. The Labo - ratory provides a number of individual tests, including microbiological culture and sensitivity, serum protein, electrolytes, glucose, and blood cross - matching. For better management of complicated diarrhoeal cases, additional tests are being introduced, beginning with tests for urea and creatinine in 1991.

During the year, 15,597 tests were performed on samples of stool/rectal swab, blood, urine, and throat swabs, among others The major pathogens isolated were species of *Shigella* (570). Classical, El tor, and non 01 *V. cholerae* were next with 397, followed by species of *Salmonella* (75).

Interaction between technicians in Dhaka and Matlab was improved, in part due to improve ment in the communications system, and also because determined effort was given to providing more efficient service. Some renovation work was done to separate a specimen reception area from the main work area, and an air cooler was installed.

The **Managerial and Technical support** services are provided by the Laboratory Manager's Office, the Logistic Support Branch, the Laboratory Archives, and the Bio engineering Cell.

LABORATORY MANAGER'S OFFICE
Head: A. Ali

Providing logistic support, the Laboratory Manager's Office identifies and selects materials, spares, and instruments for the various laboratories in LSD; 277 requisitions were processed in 1991. The Office also collects information on newly introduced laboratory materials and instruments, and keeps a continuous follow up of requisitions and correspondence.

The Office also holds meetings (for both staff and students) to discuss problems, safety, dissertations, and other matters of importance.

Performance improvement is a continuous process and in 1991 progress was made in quality control by introducing computerised worksheets, and in safety by replacing some toxic reagents with new non toxic ones and introducing improved methods for disposal of radio isotope waste. To remove the mutagenic agents from laboratory wares and the tops of tables, a new type of detergent has been used A Safety Manual for use by all the laboratories has been completed.

LOGISTIC SUPPORT
Head: Q.S. Ahmed

The Logistic Support Branch includes three sections: Media Prepartion and Washup, Bacterial Stock Culture Collection, and IV Fluid Production. As routine activity, this Branch supplies a large quantity of culture media and intravenous fluid to the Centre's laboratories and to the Dhaka and Matlab hospitals.

In 1991, the Media Section prepared 2,695 litres of various kinds of culture media, and the IV Section prepared 46,120 bottles containing various quantities of injectable solutions and distilled water requested by the pharmacy and research projects.

For quality control, the prepared IV fluids are routinely tested for electolytes and sterility at the Clinical Biochemistry Laboratory, and the Institute of Public Health respectively.

Facilities are available to freeze dry different volumes of samples ranging from 1 ml to 1000 ml bottles. The clinical strains of *Vibrio cholerae*, *Shigella* spp., and *Salmonella* are usually lypholised, as are the biological specimens of different volumes from research projects. The Branch also prepares *V. cholerae* and *S. flexneri* antisera by immunising rabbits. Last year about 660 ml of different diagnostic antisera were prepared for the laboratories.

Support and materials have also been provided to other institutions, e.g. Dhaka University, IPH, and Save the Children Fund. Food and water samples were received from international institutions which were tested for coliform and other bacterial pathogens.

ARCHIVE
Head: M.A. Malek

The Archive Unit provides support by

computerising data for the treatment centres and laboratories and giving technical help when needed for software and programming problems. They also produce blood culture reports, *Shigella* sensitivity reports, and month ly financial recovery reports for the Clinical Laboratory, treatment centres, Travellers's Clinic patients, Staff Clinic patients, and private patients. The 'Jnit is also providing support for producing monthly financial reports for media and I.V fluid preparation. In 1991, this Unit processed 98,315 records.

Archiving data for future use, the Unit produces query reports and data analysis. A database of 350,000 pathology, microbiology, and biochemistry records has already been developed. About 9,000 records are added every month. Data collected for the Vaccine Trial Project are archived under this Unit. Information is stored in the Main Frame computer which is used by the scientists of the Division for analytical purposes.

About 80,000 blood, breast milk, and stool specimens are stored in the cold room and refrigerators which are used by the scientists. The specimens are divided into different groups and sub groups and kept here on a planned schedule so that a particular specimen or a group can be retrieved whenever required. A database of specimens has been developed and the different lypophilised strains have been proposed to be computerised for tneir easy retrieval.

BIOENGINEERING
Head: M. Sobhani

The function of the Bioengineering Cell is to provide prompt technical support to the scientific staff for the development of research activities. The Cell was created in 1980 to provide maintenance, installation, modification, preventive maintenance, and procurement of equipment and training to use it. Among the new installations made in 1991 were: one Centrifuge Universal, one Centrifuge IEC Centra, a Centrifuge RT6000, an IL501 N^+ K^+ analyzer, a CO_2 incubator, osmometer, a table top glass still, and a polymerase chain reaction machine.

The Cell also provided service to several other Dhaka institutions among which are: The Institute of Public Health, The Baptist Mission, the Kumudini Trust, and the Diabetic Centre. In November we served as resource persons in the National Workshop on Maintenance and Repairs at the Department of Chemistry, University of Dhaka.

Training:

Members of the LSD lectured, taught, and assisted in the international and national courses on laboratory diagnosis and proce- dures, and the fellowship programme, organised by the Training Branch. The Division also actively participated in training of graduate and postgraduate students of collaborating academic institutions. (See Training)

A 3 day orientation on biochemistry was provided by the Clinical Laboratory to 3 participants of the Armed Forces Institute of Pathology and Transfusions, Dhaka Canton- ment, GoB.

A 3 week course was held in the Immuno- logy Laboratory in May on "Extraction and purification of bacterial lipopolysaccharides." Fourteen participants of the course included staff and research Fellows in LSD as well as those from national institutions.

Lectures were given to scientists of various local institutions by several members of the LSD, and cross- sectional training within the various units of the LSD continued.

POPULATION SCIENCE AND EXTENSION DIVISION

Associate Director: Michael Strong

The Population Science and Extension Division (PSED) collects data in Matlab and the extension areas, undertakes demographic and health research on these data, and assists others from inside and outside the ICDDR,B to conduct research using the longitudinal surveillance framework. This research links the demographic, socioeconomic, epidemiological, and biological factors at work within poor rural areas, and gives a broader community and population oriented perspective to the Center's work. The PSED's Extension Project has as its primary objective helping to improve the national health and family planning services in Bangladesh. The PSED is also responsible for the activities of the Computer Information Services and the Data Archiving Unit.

Scientists of the PSED are demographers, statisticians, social scientists, and health management experts. In 1991, there were 4 international (2 of them seconded) and 174 national staff members, and 30 Community Health Workers. Many of them presented papers at the First Annual Scientific Conference, at the annual meeting of the Population Association of America, and elsewhere.

Population studies at the ICDDR,B involve data collection, demographic analyses, the interpretation of these data within the broader context of the social, economic, and health issues of interest to the Centre, and working with the Government of Bangladesh to improve health and family planning delivery. The ICDDR,B currently has four population surveillance systems. The oldest of these, the **Demographic Surveillance System (DSS)**, monitors demographic trends in Matlab and provides a sampling frame and background information for research studies there. The **Record Keeping System (RKS)**, part of the Maternal and Child Health Family Planning (MCH FP) project in Matlab, provides information for service delivery workers and data for research and the evaluation of interventions. The **Sample Registration System (SRS)**, part of the Maternal and MCH FP Extension project, monitors demographic trends in Abhoynagar and Sirajgonj and collects data for research, primarily on the effectiveness of government family planning activities. Finally, the new **Urban Surveillance System (USS)** will monitor demographic trends in slum areas of Dhaka and provide a framework and data for research and the evaluation of interventions. Taken individually, each system is an important component of ongoing research activities. Taken together they provide the ICDDR,B with an unparalleled view of rural and urban people in various parts of the country and living in differing health care and socioeconomic settings.

Demographic Surveillance System

Project Director: Michael A. Strong
Funded by: The Netherlands

Since 1966 the Demographic Surveillance System (DSS) has collected data on vital events from a population that comprised initially some 112,000 people and has now grown (despite a contraction in geographical coverage) to over 200,000. In size and historical depth the DSS is unique, and has been described as a jewel in ICDDR,B's crown. Data collection and PC based data entry continued in Matlab uninterrupted by the tumultuous and sometimes tragic events taking place elsewhere in Bangladesh in 1991. The data collection forms, revised at the end of 1990, and the corresponding data entry programme, worked well. Forms and procedures for 1992 were revised at the end of 1991, and a comprehensive instruction manual for field staff was drafted. Data base work continued roughly on schedule, although funding uncertainty required a continued degree of frugality with respect to computer use.

With supplemental funding from UNICEF, the DSS is also conducting measles surveillance in the Comparison area, where measles

vaccination is carried out by the Government. During their routine visits, the Community Health Workers ask about active measles cases. When possible physicians, from the Matlab hospital validate these cases. These data are being used to document the incidence of measles below the regular EPI age at immunisation, and will help develop new strategies to deal with this problem.

MATLAB: The DSS has been an important component of the health related research conducted by the Centre and its predecessors in Matlab, a rural upazila south east of Dhaka. The first field station was started there in 1963. Beginning with a census in 1966, increasingly detailed information about demographic events – pregnancy outcomes, deaths, marriages and divorces, and migration – has been collected. In 1977 the area under surveillance was divided into two roughly equal parts: in one, usually called the 'Treatment area', a Maternal and Child Health – Family Planning project was started; in the other half, the 'Comparison area', only normal family planning and health services are available. Everyone in the Matlab area has access to the Centre's hospital in the town of Matlab bazaar. (See Matlab, CHD)

Population Research

Research projects conducted and presented or published in 1991 using DSS data again reflect the breadth of studies made possible by data from Matlab. Highlights of various studies, conducted by ICDDR,B staff and others using PSED data, are presented below.

MORTALITY: Although there is great interest in the 'health transition', there are virtually no longitudinal data sets in the developing world capable of addressing many of the issues involved. A paper, using DSS data, shows how Matlab is an exception, and traces mortality by age, period, and cause of death, and indicates how Matlab data are accurate enough for a variety of investigations. For example, a modest mortality decline between 1966 and 1989 is traced. Little change in the cause structure of death is seen except during epidemics or, at the end of the period, as a result of health interventions. (M. Strong)

Two studies examined the risk factors associated with foetal loss and mortality in early infancy. The 22,122 pregnancy outcomes recorded in Matlab between 1982 and 1984 were analysed to determine the risk of perinatal mortality. Multivariate analysis identified several significant risk factors: a history of previous foetal wastage, parity one; and an interval since the previous pregnancy of less than 24 or more than 60 months. Socioeconomic factors were not found to be significant. Similar findings related these factors to pregnancy loss (G. Mostafa, V. Fauveau, B. Wojtyniak, A. Foster)

Work on child survival research continued during 1991. The relationship between a variety of covariates and childhood mortality was examined. The effects of the sex of the child, health programme, age of mother, and birth order were found to be dependent on the age of the child. The effect of mother's education, however, was dependent on the sex of the child, confirming previous findings. (A. Bhuiya, K. Streetfield)

BIRTH INTERVAL STUDIES. An important previous study by the PSED investigated the relationship between birth interval and childhood mortality using Matlab data. It found that the effects of previous birth intervals are concentrated in the neonatal period, whereas the subsequent intervals effect mortality during early childhood. The impact of short birth intervals on mortality, however, is substantially less than that found in many previous studies. (M. Koenig et al.)

Several studies presented in 1991 continue work in this area. One reports similar findings using MCH FP Extension area data during 1985 1989, a more crisis free period than the previous study. (K.A. Mozumder, F. Rahman, M.A. Koenig) Another looks at the effects of the previous birth interval and death of a previous child on infant and child mortality using longitudinal data from Teknaf, an area of Bangladesh with exceptionally high fertility (See 1990 Annual Report, p 29). Results showed a very high risk is associated with very short intervals, although these intervals are comparatively rare. (N. Alam, L. Wai)

Two papers using Matlab data look at birth spacing effects. The first examines the dependence of mortality on the preceding birth interval, the correlation of mortality risk among successive births to a woman, and other

explanatory variables. The strongest direct dependency of neonatal mortality is on the immediately elder sibling's fate, through the preceding birth interval: little additional mortality risk is associated with a short preceding birth interval if the preceding sibling died neonatally. (E. Zenger) The second compares birth spacing and infant health in Bangladesh and the Philippines. (J. Miller, A. Pebley)

EFFECTS OF GENDER PREFERENCE: There continues to be considerable interest in the effects of families' preference for sons in the sub continent. A review of recent research on the demographic effects of gender preference in Bangladesh revealed that, although son preference has not changed much over the past decade, its impact on fertility has changed considerably. Higher female than male mortality during childhood has not shown any evidence of diminishing over time, and is found in various areas and population subgroups. (M.K. Chowdhury)

The effects of son preference on mortality were also examined by two studies using DSS data during the year. One investigated the role of family composition factors that may differentially influence male and female child survival in Bangladesh. Results suggest that the presence of one or more older male surviving siblings increases the mortality risk for a male, and the presence of one or more older female surviving siblings increases the mortality risk for a female child. The disadvantage of female children does not seem to depend on socioeconomic factors, but it does depend on the birth order and the presence of other female children in the family. (P. Muhuri, S. Preston)

A second report found that the causes of death which contributed the most to higher female than male mortality during childhood were severe malnutrition and diarrhoea. The risks of dying were 2.5 and 2.1 times higher for girls than boys for these two causes, respectively. The data suggest that gender differentials in mortality may not be as much affected by preventative measures against diarrhoea as by efforts to provide equivalent curative services. (V. Fauveau, M. Koenig, B. Wojtyniak)

The effects of gender preference on fertility was the subject of another two papers. The first reported results of a five year longitudinal study conducted in Matlab. As expected, it was found that the impact of gender was only observed when a society is in demographic transition. A preference for sons only influenced subsequent fertility among women who used contraception. For them the number of surviving sons, for a given number of children, had a significant and negative effect on the risk of subsequent birth. These findings suggest that preference for sons represents a significant barrier to fertility decline in Bangladesh. (M. Raharnan et al.)

The second paper extended the results of the first and estimated what fertility reduction would be in the absence of son preference. It followed a cohort of 22,189 women aged 15 - 44, taken equally from the two areas of Matlab, for 3.5 years. It was found that in the absence of son preference overall fertility would decline by 8% in the Treatment area as against 4% in the Comparison area. (M.K. Chowdhury, R. Bairagi)

FERTILITY: Another paper examined the correlation between subsequent lengths of postpartum amenorrhoea. Matlab data indicate that previous length of amenorrhoea has significant predictive value for the subsequent length of postpartum amenorrhoea. Consequently, it was suggested that information on previous experience with postpartum amenorrhoea be incorporated into guidelines for the introduction of family planning in the postpartum period. (K. Ford)

Results of multivariate analysis using Matlab data in an Easterlin synthesis framework show the importance of family supply factors in reducing the resource and social or psychic costs of fertility limitation. Demand for both birth spacing and birth limiting are important explanatory factors, especially in the MCH - FP Treatment area. (D. De Graff)

A cost effectiveness analysis of the family planning programme in Matlab was published in 1991. Although in the aggregate the Matlab MCH FP project is more expensive than the government family planning programme, it is also more effective, generating enough output to offset the extra costs of the intensified delivery system. (G. Simmons et al.)

On the request of the UNICEF, a study was

done on the effects of age at marriage on fertility and mortality in rural Bangladesh. It was found that fecundability (monthly probability of conception), at least up to 25 years of age, does not depend on age at marriage and that fertility, and in fact mortality, will be affected moderately if the minimum age at marriage is raised to 18 years. (M.K. Chowdhury, R. Bairagi)

Results from other fertility research are presented in the MCH-FP Extension Project (PSED) and the MCH-FP Project (CHD) reports.

NUPTIALITY: A review paper on this subject noted that over the past 30 years there has been an increase in the age at first marriage for both men and women in Bangladesh. Between 1975 and 1987 the mean age at first marriage for women in Matlab rose from 16.0 to 18.9 years, while men's age at first marriage remained almost constant at 24 years. (A.K. Shaikh)

Matlab data for 1974-1982 were used to show that divorced and never married young adults had significantly higher mortality than their currently married peers. Results showed that a significant proportion of this higher mortality risk was accounted for by differences in disability, thus supporting the hypothesis that marriage, and remarriage after divorce, were selective on the basis of health status. (O. Rahman)

HEALTH: Population scientists using Matlab data also made significant contributions in the health area in 1991. Increasing attention has been focused on the large gap between the anticipated and realised mortality impacts of primary health care programmes in developing countries. One study examines the failure of health technologies to adequately address the causes of death during the early months of life. As important as immunisation programmes are, they do not address such major causes of death in infancy as low birthweight/prematurity, acute respiratory infections, diarrhoea, and malnutrition. (M. Koenig et al.)

In the 1974 Matlab cholera vaccine trial, tetanus toxoid was given to the control group. Using the DSS surveillance of these people since then it was possible to subsequently follow women in this group and their newborn children. Forthcoming findings conclude that two doses of tetanus toxoid confer more significant protection from neonatal tetanus than has previously been documented. Analysis of 4-14 day mortality rates has shown that mortality levels among children whose mothers received two doses of tetanus toxoid were significantly lower than the rates for unimmunised children for virtually the entire fifteen year follow up period. (M. Koenig et al.)

To better understand the roles of specific maternal and domestic hygiene practices in preventing diarrhoea, 611 rural children under age five living in southeast Bangladesh were studied. This epidemiological study published in 1991 found no effect of mother's hand washing or household cleanliness for children above one year old, indicating that older, more ambulatory children are exposed to more risks and that health education must take a child's age into account. (N. Alam)

METHODOLOGICAL RESEARCH: Matlab data are also extremely useful for methodological research, since in many areas precise outcomes are known. In one such study, equations are obtained for answering the question: what should be the follow up time intervals for comparing two demographic rates? It seems, according to the data, that a period of three to four years of follow up is satisfactory in Bangladesh. (R. Bairagi, M.K. Chowdhury). In another methodological work, it was demonstrated that some anthropometrical indicators of nutritional status are valid and more reliable than mortality data itself for identifying the causes of death.

New and Ongoing Research

BRAC/ICDDR,B Intervention Study
Funded by The Ford Foundation

One of the most exciting initiatives started in 1991 was the beginning of a long-term intervention study by the Bangladesh Rural Development Committee (BRAC) and the ICDDR,B. BRAC is an internationally known and respected NGO working to improve the situation of poor people, especially the landless and those who sell manual labour. In the normal course of moving into new areas near Comilla, BRAC has decided to start activities in

several villages in the Matlab area and would like to collaborate with ICDDR,B on a research project to study their impact on outcomes such as health, population indicators, empowerment of women, and the cost of these interventions. Once again, the DSS would serve as the data framework for this intervention and provide part of the research leadership in the social science component.

Bangladesh Consortium on Reproductive Health
Funded by: The Ford Foundation

Another new area which was proposed in 1991 was the initiative sponsored by the Ford Foundation to examine reproductive health. It is increasingly clear that the alienation of women from the formal health care system is one of the most important health problems in Bangladesh; women lack the power to demand, and access to, the health care that is rightfully theirs. The results of this are shown in public health and demographic indices: high incidence of reproductive tract infections; maternal mortality that is 200 times higher than in developed countries, and few trained female health professionals. Therefore, the ICDDR,B, BRAC, BIRPERHT, BIDS, and the Population Council plan to form a Bangladesh Consortium on Reproductive Health to address this problem here.

Health care and living arrangements of the elderly
Principal Investigator: Omar Rahman
Funded by: RAND

In recent years there has been an increasing interest in the fate of the elderly in developing countries. The importance of adult sons as a buffer against the adversity of old age in rural developing societies such as Bangladesh is a source of considerable controversy in the demographic literature. Some researchers have claimed that persistent levels of high fertility in these countries, despite increasing access to family planning services, is due to the desire to ensure an adequate number of surviving sons. The debate about the value of sons or other kin in improving the health of the elderly has been constrained by the lack of empirical evidence.

For this purpose, the Matlab data base is an excellent resource, since the composition of families can be traced over time. Two related studies of the elderly are augmenting these data with new field work. The first has taken a sample of elderly Matlab residents in 1982 to see how the presence of adult kin improved the survival chances of the elderly. Pre-testing for this study began in 1991. The second study will collect information on morbidity and health status measures, health care utilisation patterns, the availability of kin and their characteristics, and socioeconomic data to assess the functional health status of the elderly. Pre-testing of this questionnaire began in 1991 as well.

The effect of family planning on fertility in Matlab
Principal Investigator: Abdur Razzaque
Funded by: Australian National University

Despite decades of research in developing countries there is still uncertainty about the factors that motivate couples to limit their family size and adopt birth control. Studies in Matlab and elsewhere in Bangladesh have documented the overall impact of family planning programmes on fertility. No study thus far has examined the family building patterns -- the initiation of childbearing and subsequent reproductive behaviour -- linking family size preferences to subsequent fertility and determinants of reproductive preferences. This study will use DSS data to look at patterns of contraceptive use, including spacing and stopping patterns, and the factors associated with levels of desired fertility. It will use data from in depth surveys conducted in Matlab in 1984 and 1991, the 1982 Matlab socioeconomic survey, and DSS vital registration data linking all of these together and recording the primary outcome, births each year.

Measuring maternal mortality
Principal Investigator: Md. Shahidullah
Funded by: Australian National University

It has been recognised for many years that maternal mortality rates are distressingly high in most developing countries. It has been difficult, however, to quantify this problem because these same countries also lack death registration systems capable of monitoring maternal deaths. For this reason researchers have turned to indirect techniques, such as asking adults if any of their sisters have died from pregnancy or childbirth related causes.

This 'Sisterhood Method' then makes use of model fertility and mortality distributions to convert these data to conventional measures of maternal mortality. A study is currently under way using Matlab data to test the reliability of responses to sisterhood questions and see if it can be extended. Since the DSS records all maternal deaths in Matlab, it was fairly easy to obtain a sample of the siblings of these women who died. These siblings were then interviewed to see if all maternal deaths could be identified and if the siblings knew additional information, such as a rough idea about the timing and cause of death. When completed this methodological study will be very useful for those who need rapid and inexpensive ways of estimating the magnitude of maternal mortality and the health services needed to cope with this problem.

The patient as linguistic agent: health complaints in Bangladesh
Principal Investigator: James Wilce
Funded by: Fullbright Foundation

This anthropological study in Matlab is investigating health complaints in households and in various medical settings. It is a qualitative study in the tradition of discourse analysis in medical anthropology and has the potential for a fruitful complimentarity between qualitative and quantitative research. It can, for example, compare findings about the referential content of health complaints with epidemiological data regarding various diseases. From the other perspective, depth may be added by this study to the surveys conducted by the ICDDR,B: a qualitative approach, for example, to variation in the kinds of interaction between patients and two categories of medical practitioners (doctors, pharmacists, and government or NGO health workers as practitioners of cosmopolitan biomedicine, and kabirajs, pirs, and ojhas as traditional practitioners).

Technical Assistance

In January 1990 the DSS and the Census Division of the Bangladesh Bureau of Statistics (BBS) pre tested the census form being drafted for the 1991 national census in two villages in Matlab. Following on the success of this work, further collaboration took place during 1991. At the request of the BBS, after the national census was completed the DSS calculated the population living in the unions of Matlab on Census Day 1981 and 1991. These data will allow the Census Bureau to estimate intercensal growth as well as coverage problems.

In an exercise similar to the 1990 village study, the BBS and the DSS jointly tested the questionnaire for the in depth national Sample Census. Twenty families living in two villages, Dhakirgram and West Baishpur (inside the embankment), were selected and DSS records and staff temporarily removed. Then, accompanied by the Secretary of the BBS, an interview team administered the draft questionnaire. The DSS then extracted detailed data on these families for comparison. The resulting data and field experiences are being evaluated to improve the final survey.

The DSS has also been assisting the BBS in its planning for the upcoming Comprehensive National Health Survey, part of the Household Survey Capability Programme. This survey will give baseline health data on a national probability sample of households. DSS staff have attended several meetings with the BBS, providing advice on lay reporting and classification of morbidity and mortality, questionnaire design, and field operations. We are still planning to pre test this survey in Matlab and elsewhere.

Other technical assistance includes: providing nutrition researchers in the BBS with articles from Matlab which included data on caloric intake of young children in Bangladesh; and providing the Management Development Unit (MDU) of the Ministry of Health and Family Welfare with detailed cause and age specific mortality data.

The Maternal and Child Health Family Planning Extension Project
Project Director: John G. Haaga (Rajshikesh Maru, acting from January to July)
Funded by: USAID

The Extension Project is a collaborative effort of the ICDDR,B and the Ministry of Health and Family Welfare (MOHFW) of the Government of Bangladesh (GoB), with support from the Population Council and the University of Michigan (USA). Its purpose is to use operational research and technical assistance to improve the delivery of Maternal and Child

Health and Family Planning (MCH FP) services through the MOHFW system. To achieve this goal, project staff:

- identify barriers to effective delivery of services;
- test the feasibility of proposed solutions, in the actual conditions of the MOHFW system (usually, but not exclusively, in the two rural upazilas, Sirajganj and Abhoynagar, where the project has field stations);
- evaluate interventions, in terms of both process and impact;
- assist the MOHFW to implement selected changes on a wider basis.

The Project was set up in 1982 to meet a concern that small scale or special purpose research projects, including those conducted by the Centre in its Matlab field station, could not be replicated on a large scale within the regular government programme, subject to its resource and management constraints.

The family planning components of the Matlab MCH FP Project had succeeded in raising contraceptive prevalence rates, though many had said that fundamental social change in the Bangladeshi countryside had to precede widespread adoption of effective contraception. But the Matlab success seemed to depend on elements that were lacking in the government programme. How many of these elements from Matlab and other experimental situations could work elsewhere in rural Bangladesh, and how would they have to be changed to become part of the regular public services? The Extension Project was designed to answer these questions. It works through the government system, and draws lessons about the process of changing that system, rather than setting up a separate system of service delivery for research purposes.

DEMOGRAPHIC AND EPIDEMIOLOGIC RESEARCH

The Project's demographic and epidemiologic research is aimed at understanding the determinants of contraceptive use and fertility decline, and the impact of child survival and maternal health interventions in the Matlab and Extension Project sites.

Studies during 1991 examined the potential impact of contraceptive use on child survival. One paper examined the effects of short preceding birth intervals on neonatal and postneonatal mortality, showing that children born within 24 months of the birth of an older sibling are at higher risk even when prematurity, socio demographic factors, and parental health related behavior are controlled for. (M.A.Koenig, R.A. Mazumder, and M.A. Rahman)

A draft paper based on Matlab data documented a decline in average lengths of post partum amenorrhoea, not explained by a decline in overall breastfeeding durations, which could have effects on birth spacing.

Further studies involved analyses of contraceptive use trends, continuation rates of high and low dose oral contraceptives, and the clustering of infant mortality. (Sarah Salway, N. Roy, M.B. Hussain, U. Fob)

Project staff and consultants also worked on coding and analysis of data from verbal autopsies, documenting causes of maternal and child deaths in the project sites.

MANAGEMENT AND OPERATIONS RESEARCH

A management intervention was begun this year to improve programme performance in low performing unions of Abhoynagar and Manohardi upazilas. Project staff have worked with MOHFW counterparts to identify the persistent low performing areas, reasons for their particular difficulties, and possible local solutions. This has included setting targets on the basis of negotiations rather than unilaterally. They helped MOHFW colleagues design and implement a client survey for programme planning purposes in Manohardi upazila in Narsingdi District, one of the upazailas participating in the management intervention.

Project staff carried out an evaluation of the effects of the increased density of family planning workers resulting from the GoB's nationwide recruitment (discussed later). One paper showed that the workers themselves and their supervisors perceived significant improvements. Data from the Extension Project areas showed increased coverage and more frequent visits (M. Rahman, et al.).

J Haaga

Top left, clockwise: 1) A Family Welfare Visitor and Family Welfare Assistant conducting a health and nutrition class in a village home. Much of the work of the Extension Project covers ways to make these outreach activities more effective. 2) Extension Project staff responsible for the innovative Record - Keeping system and Sample Registration System. 3 & 4) A Family Welfare Assistant visiting a village in Sreeharpur union in the Abhoynagar Extension Project site. Project staff work with government colleagues to improve the training and effectiveness of FWA's. 5) Family Welfare Visitor providing health education at a satellite clinic.

Another paper described the process of nationwide recruitment and the lessons learned from it. (Sajjad Huseein M. Rahman, R. Maru) A briefing paper issued this year summarised findings on ways to improve the supply of drugs and equipment to satellite clinics

Another set of papers examined clients' perspectives on the quality of care in the family planning programme, mainly using data from surveys conducted in 1989 and 1990 in the Extension areas. Quality of care as defined in the data used here includes: whether the family planning worker (a) is appreciative to the need for clients' privacy, (b) is responsive to clients problems, (c) is sympathetic to and respectful to clients problems, (d) provides enough information, and (e) spends enough time. The analysis shows considerable variation across areas in clients' perceptions of the quality of family planning services. Longitudinal data show a clear association between clients' perceptions of the quality of care and the probability that they will subsequently adopt modern methods of contraception (Whittaker, et al; Hossain et al.).

Following the experience of the Matlab MCH FP Project, the Extension Project tested door step delivery of injectable contraceptives by Family Welfare Assistants (FWA). Injectables are a popular method of contraception for Bangladeshi women, but had previously been available in the government programme only through clinics, which limited the access for many women. Data from the Extension Project sites showed that injectables accounted for much of the large increase in contraceptive prevalence observed in the those areas. During 1991 Project staff worked with the Ministry to develop guidelines for the schedule of doses and for proper disposal of used syringes. They also prepared plans for implementing and evaluating a pilot test of expansion in eight upazilas, to be followed by nationwide implementation if the results are successful. A paper on this subject reviewed the evidence that supports this decision, discussed what was learned about logistics, training, side effects management, and supervision needs, and presented plans for the expansion of the programme. (F. Rahman, M. Islam)

Work on an evaluation of current MCH interventions was begun as was research on new ways of organising and assuring quality in MCH services. (Therese Juncker)

TECHNICAL ASSISTANCE

The main activities for which the project provided technical assistance to the MOHFW during 1991 were (a) completing the process of recruiting female family planning workers and (b) strengthening the family planning management information systems.

Based in part on findings from earlier project research, the GoB decided in 1984 to recruit an additional 10,000 FWAs to increase the worker client ratio to effective levels. Project staff worked for several years with the government nationwide to design and implement a system to ensure that open selection criteria were followed, and recruitment proceeded at a pace compatible with training capacity. Recruitment was completed during 1991, almost meeting the original targets. They wrote reports and presented briefings on the innovative recruitment process, which was subsequently adopted in part for recruitment of female health workers as well. Project staff also conducted several follow up studies to analyse the effects of the increased work force on client contacts and workers' and managers' ratings of programme performance.

Much of the work of the Extension Project has entailed identifying information needs at several management levels in the family planning programme and testing the solutions. A client - oriented record - keeping system for the family planning workers was developed by the Project in previous years, based on a system developed in Matlab and modified and tested in the Extension sites. These FWA registers were implemented nationwide for a three - year period in late 1989. During 1991, the Project provided training of trainers for the use of the system, and worked with the MIS Unit to plan further simplification and a nationwide training plan.

DEMOGRAPHIC AND HEALTH SURVEILLANCE

To support demographic and epidemiologic research in Matlab, Extension Project staff maintain the computerised Record - Keeping System (RKS) in the treatment areas. Data on demographic events, health - related behavior, and health service delivery are coded and

entered into microcomputer data bases Besides data files for research purposes, the RKS also produces regular reports for feedback to health service managers and Community Health Workers in Matlab.

For applied research and evaluation in the Extension sites, the staff collect data for regular demographic surveillance of a panel sample of households in selected unions of project sites and comparison areas. This Sample Registration System is supplemented periodically by survey modules exploring topics in depth. Interviewing, data entry and editing, and data base management are all carried out by field and Dhaka based staff.

Project staff have recently provided assistance both to the Centre's Urban Surveillance System and to projects in other countries that have adapted the software and design of demographic and service data collection developed by the Extension Project.

DISSEMINATION

The project maintained an active programme of dissemination of research results both within Bangladesh, to government and international agencies, and internationally, through publications and conference attendance. During 1991, four briefing papers were distributed, four papers were published in international journals and books (see Publications), and briefings were given to MOHFW, USAID, UNICEF, and WHO officials. Several papers were presented at the Centre's First Annual Conference in October and one to a regional workshop for managers of Asian population programmes in Nanjing, China ('Strategic Management of the Bangladesh Population Programme - R. Maru). Project staff also gave presentations at AID and ICOMP workshops for NGO family planning managers. The Project Director served on an advisory group for the government on contraceptive pricing.

An important means of dissemination is through visits of senior government and international agency officials and academics to the project's field sites. Despite restrictions on travel during domestic and international crises, there were several such visitors during 1991. (See Visitors)

TRAINING AND STAFF DEVELOPMENT

Project staff in the field sites continued to provide training and counterpart support to their colleagues from the MOHFW implementing MCH and family planning programmes. The Project has staff members working on degrees abroad and participating in various local courses and workshops (See Training)

COMPUTER INFORMATION SERVICES
Manager: Abdullah Hel Mostafa

Computer Information Services (CIS) is a technical support branch for providing mainframe computer services to the entire Centre. It provides computer facility, systems development support, and training. CIS also provides engineering support for maintenance and installation of personal computers.

Much of the activity during the early part of the year centered around personal computer support. A computer system for the Grants Administrations (Finance Division) was developed. This system interacts with the Grants Adminstrator (Donor profile) data base for easy access, queries, and updates. A database management system of staff development information was also developed for frequent queries and updates in this area. A menu driven mailing list system for DISC was completed. In addition to meeting mailing requirements for Glimpse, the Annual Report, CASB, JDDR, and others, it also provides various useful statistical reports.

On the mainframe side, a second CMS BATCH machine was set up for users to submit jobs to run at any specific time. A procedure to run SPSS using tapes directly was also set up. A site macro library was created in SAS for Proportional Hazard model. SAS was updated to version 6.06 and PHREG installed. The RPG library required modification since it did not have the required system modules for linking multiple programme modules. An insurance premium calculation system was incorporated into the Personnel database system.

The engineering support service was busy during the year satisfactorily attending to more than 125 calls. A significant portion of engineers time was spent on attending to mainframe communications disruptions.

The DSS continues to be the biggest user of computer resources (60%), followed by the Finance office (20%), the Personnel office (8%), and the MCH-FP (7%). A total of 104 computer users utilised the mainframe for 13,000 connect hours and 400 CPU hours during the year.

The systems programmer attended a two-week training course on Assembler language programming in July; Lotus 123 and Word Perfect training was conducted for Centre staff members; and CIS staff took part in a 3-week intensive SAS workshop organised by the Training Branch at the end of the year. Assistance (consultation and computer services) was also provided to organisations and businesses outside the Centre.

The CIS underwent 2 external reviews in 1991. The outcome of both of them was quite positive regarding the way the CIS is being run and managed. The review reports made some suggestions and recommendations for further improvements which are under study.

DATA ARCHIVING
Head: M.A. Kashem Shaikh

The Data Archiving Unit provides assistance to scientific studies by extracting files from the Centre's archives and helping researchers to use them, archiving data files created by research projects, reorganising lists, and maintaining data sets.

By the end of the year, the Unit had preserved 1,150 data files, of which 772 were completely documented. Work was underway to archive the massive amount of data which the Urban Volunteer Project has collected. During 1991, 28 files were provided to researchers from the Centre, 33 to those from outside, and 11 to collaborators.

Work was also underway to formalise a data archiving and distribution policy for the Centre. This policy will recognise that all data collected at the ICDDR,B belongs to the ICDDR,B. The Centre should maintain the data which it has collected for the following reasons:

- To protect the ICDDR,B in case quietions of replicability or scientific ethics arise
- To protect the scientists from loss of data
- To ensure that a resource which can be used in further scientific research is retained in good and useable condition at the ICDDR,B

Population dynamics in the Matlab Treatment Area, in the Matlab Comparison Area and in Teknaf, from 1978–1990. The Matlab Treatment Area is served by the Centre's MCH–FP Programme while the Comparison Area is served by the government health services alone.

Vital rates (per 1000 people)	Area	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
ALL DEATHS	Treatment Area	12.5	12.1	11.3	11.9	12.5	12.1	13.4	10.1	9.9	9.4	8.7	8.1	7.6
	Comparison Area	13.8	15.6	14.8	14.4	15.9	18.0	17.3	14.2	12.1	11.1	11.1	9.4	9.4
	Teknaf	14.7	15.9	12.8	14.2	13.3	14.7	17.1	12.8	13.4	17.0	–	–	–
NEONATAL DEATHS[a]	Treatment Area	69.0	70.9	59.3	66.4	58.1	56.4	57.9	51.8	49.6	43.5	43.0	47.0	48.0
	Comparison Area	78.7	74.6	72.7	69.5	68.1	70.3	71.4	69.5	51.8	55.2	57.2	51.5	55.7
	Teknaf	78.8	85.6	75.0	88.2	72.8	88.4	96.0	77.5	81.0	83.8	–	–	–
POST-NEONATAL DEATHS[a]	Treatment Area	45.5	43.5	32.6	36.1	47.5	41.8	56.9	34.2	37.5	34.9	38.9	28.7	27.2
	Comparison Area	47.0	43.3	41.3	45.0	50.2	42.2	55.7	49.0	37.7	39.2	39.8	38.2	35.5
	Teknaf	54.3	57.1	46.8	51.2	46.1	65.4	56.4	45.9	46.2	57.3	–	–	–
CHILD (1–4 YRS) DEATHS	Treatment Area	22.5	17.1	18.6	19.1	18.8	21.9	23.1	16.0	13.1	9.8	7.4	6.4	5.3
	Comparison Area	22.1	26.2	25.4	24.8	27.4	35.3	39.2	24.6	20.1	14.9	14.3	11.3	9.2
	Teknaf	16.8	16.9	13.7	14.9	10.5	12.3	22.1	11.9	12.5	21.6	–	–	–
BIRTHS	Treatment Area	32.1	34.9	37.1	35.3	36.9	33.8	30.7	34.4	33.3	33.5	30.9	28.5	28.1
	Comparison Area	37.7	47.0	45.5	43.8	44.7	42.4	37.3	42.6	40.0	39.1	40.5	36.5	36.1
	Teknaf	45.1	55.6	52.4	51.5	53.2	53.4	54.8	54.4	55.5	57.5	–	–	–
TOTAL FERTILITY RATE[b]	Treatment Area	4.5	4.9	5.1	4.8	5.0	4.5	4.0	4.5	4.3	4.1	3.7	3.7	3.6
	Comparison Area	5.5	6.9	6.7	6.3	6.3	6.1	5.1	6.0	5.5	5.2	5.4	5.2	5.2
	Teknaf	6.7	8.1	8.1	7.7	7.9	7.5	7.8	8.1	8.1	8.6	–	–	–
NATURAL INCREASE	Treatment Area	19.6	22.9	25.8	23.4	24.3	22.3	17.3	24.3	23.4	24.1	22.2	20.4	20.5
	Comparison Area	23.9	31.4	30.6	29.4	28.8	25.8	20.0	28.4	27.9	28.0	28.0	27.1	26.7
	Teknaf	30.4	39.7	39.6	37.3	39.9	38.7	37.7	41.8	42.1	40.5	–	–	–

[a]Per 1000 births [b]Per woman – = Figures not available

EDUCATION AND INFORMATION

Dissemination of information was a topic of great interest in 1991 as the image of the Centre as a source of healing for the world came more and more into focus. Stored information solves very little. So the various dissemination machines of ICDDR,B were in high gear, publishing, training, lecturing, collaborating, and otherwise using every available means to spread the results of research that could help those involved in the healing arts here and abroad more effectively manage diarrhoeal disease and other developing world problems.

The departments of the Centre reported under this heading are all administered directly by the Director's office. (See organogram in Introduction)

THE DIARRHOEAL DISEASES INFORMATION SERVICES CENTRE

Head: M. Shamsul Islam Khan

The Diarrhoeal Diseases Information Services Centre (DISC) continued to receive substantial support from the Swiss Development Cooperation (SDC), which greatly facilitated the maintenance of some ongoing activities initiated in 1988 and the undertaking of new programmes. The SDC phased out on 31 December and after continued assistance for nearly 10 years, the International Development Research Centre (IDRC) discontinued funding in April. These institutions have extended financial support to the DISC since 1982 and 1988 respectively, and their assistance has been instrumental in reshaping and upgrading the library services, improving the quality of the publications, disseminating the Centre's research findings, and improving the information support system for the Centre's scientists and researchers of national academic and scientific organisations.

In 1991, the DISC, with 11 regular staff members and one part time Editorial Advisor, continued to serve and extend its various facilities to the Centre's staff, including those in the field stations located at different places in the country, the researchers, physicians, teachers, students, nurses, and allied health personnel from within the health complex and surrounding institutions as well as trainees and visitors from other countries.

The DISC started to acquire the weekly Current Contents: Life Sciences on diskettes. The upgraded information delivery and retrieval system within the DISC, with databases (MEDLINE, 1966 1991 period and POPLINE from the beginning) on CD ROMs and Current Contents on diskettes, provides access to a much wider spectrum of scientific information.

During the year, the library's infrastructural facilities and physical environment were further improved. Continued efforts were made to upgrade the DISC's service delivery and dissemination channels to support its reputation as a specialised information centre of excellence for diarrhoeal disease related topics.

The desktop publishing unit, as in previous years, produced the Journal of Diarrhoeal Diseases Research, Glimpse, annotated (specialised) bibliographies, the Centre's annual report, ICDDR,B News, Current Awareness Service (CAS) Bulletin, and other internal publications, including leaflets and brochures.

The DISC continued to generate funds through journal subscriptions, memberships and through the sale of priced documents, and earned a total of 275 subscriptions for the JDDR (including DISC memberships) and Glimpse.

INFORMATION SERVICES:

** 16,026 readers used the library, other than the Centre's own staff (2.51% increase over 1990).

** 119,967 pages of photocopies of 10,465 items were supplied (2.47% increase).

** 15,747 books and journals were loaned to the staff members, and 3,567 books and bound journals (including loose journal issues) were given to national institutions under the inter library loan arrangement. A large number of researchers and physicians of other organisations were greatly benefited by this effort.

** 372 duplicate journal issues were offered to the national institutes, such as Institute of Nutrition and Food Science, Dhaka University, National Institute of Preventive and Social Medicine, and Bangladesh Central Public Library, Dhaka (447.05% increase).

** 329 new books and 200 volumes of bound journals were added to the library; 176 purchased, the rest received either on complimentary or exchange basis.

** 389 current journals were received, 213 on subscription, and 176 on exchange (38 titles) or complimentary basis (138 titles); 7 journal subscriptions were deleted and 7 journals were added to the subscriptions list to begin January 1992.

** 277 MEDLINE and POPLINE searches were made and offered to scientists, 133 for ICDDR,B scientists and 144 (51.99%) for outsiders (92.36% increase).

** 24 issues of the CAS Bulletin, along with 4 issues of the book acquisitions lists, and 57 issues of the Fast Bulletin were generated to inform the Centre's scientists and other library users about the incoming books, availability of relevant journal articles and incoming journal issues. Information on 1,402 relevant articles and documents, and 330 publications was disseminated through the CAS Bulletin.

** 2,787 informal reference queries, including checking of reference citations, were met (111.14% increase).

** 59 reprints of papers on diarrhoeal disease related subjects were procured from various sources.

All library shelves were rearranged, and the library floor was fully covered with new carpet. Twenty wooden book shelves were added to accommodate incoming books and journals, and three personal computers with related facilities were acquired to facilitate word processing and database related work as well as to strengthen information retrieval facilities.

PUBLICATIONS SERVICES:

The publication schedules of both JDDR and Glimpse have been maintained on time. The JDDR was given a new look by changing the cover design and using good quality paper. The journal continued to be indexed by all the renowned international indexing systems, including Index Medicus, Current Contents, and Excerpta Medica. Four issues of the JDDR (and Bibliography on Diarrhoeal Diseases) and six issues of Glimpse were published. The annotated bibliography in the JDDR highlighted information on 411 important articles. Publication of the in house newsletter launched in 1990, was continued; 6 issues were published.

A 133 page annotated bibliography on Laboratory diagnosis of diarrhoeal diseases, 1985 1991 was compiled and published. Volume 15 (title: Registration of demographic events 1984) of "Demographic Surveillance System was also published in December 1991. In addition the DISC published a 64 page monograph entitled "Community participation in the management of diarrhoeal diseases" and a 99 page special publication entitled "Scientific achievements of the ICDDR,B, 1979 1990." This special publication includes a comprehensive list of the ICDDR,B publications (original research articles, monographic materials, book chapters, etc.) published internally and externally during 1979 1990. These are all available in the library for consultation. The DISC also arranged the production of the Centre's 1991 work plan, proceedings of the ICDDR,B Annual Scientific Conference, Trustees directory, and EPI manual.

During the year, 32,790 copies (23.80% increase) of the Centre's publications and brochures were mailed or distributed to relevant points worldwide; this includes 22,464 copies of the newsletter (Glimpse), 3,026 copies of the Annual Report, 1,773 copies of JDDR, 2,138 copies of other scientific reports, 1,595 copies of specialised bibliographies, 725

copies of the CAS Bulletin, 895 promotional brochures, and 174 reprints of the Centre's external publications. The Glimpse copies were distributed to 129 countries of the world

The Head of the DISC attended a meeting in Bangkok to consider feasibility of producing CD ROMs with selected Asian information in January, Congress on Information Services in the Nineties, in Singapore, in September, and SATISFile Developers' Workshop, in Woudschoten, Amsterdam, in June.

Anyone interested in making use of these facilities may contact the Head of DISC at the address given in the front of the report. See **Publications** for reference information on DISC publications

AUDIO VISUAL UNIT
Head: Asem Ansari

The Audio Visual Unit, previously called the Medical Illustration Cell, prepares graphs, charts, photographs, slides, drawings, and posters; produces video films of important events and activities of the Centre; and provides film developing and audio visual services.

Because of the nature of the work carried out by this office, it was decided in 1991 that the cell should change its name and administratively fall under the Director's office. It was previously a part of the Laboratory Sciences Division.

In 1991 the Unit:

** designed and produced ICDDR,B T shirts for sale to the Centre's staff and others.

** assisted with the designing and production of the Hospital Endowment Fund brochure.

** designed a new variety of popular greeting cards, including Eid cards

** acquired an Apple Mackintosh Computer (with laser printer), with assistance from BADC, for graphic designing and desk top publishing. This equipment has greatly facilitated the output of the Unit. A scanner has also been attached to this system.

TRAINING BRANCH
Coordinator: R.L.Akbar

Training in areas of the Centre's competence is a stated objective of the Centre. In view of this objective, as in previous years, the Centre's training programme has organised national and international training courses, offered fellowships, and organised workshops and seminars. During 1991, a total of 591 scientists, physicians, health administrators, health personnel, trainers, and students from 18 countries received training at the Centre. A member of the branch's staff, Dr. A.S.M. Mizanur Rahman was part of the team sent to Ecuador to help with the outbreak of cholera there.

INTERNATIONAL COURSES:

Four international training courses, 2 study visits, and one workshop attended by 50 participants from 11 countries were arranged during the year. Their tuition fees, travel, and living expenses were provided by grants from Japan, CIDA, and USAID Swaziland and Egypt.

Twenty one physicians, nurses, and diarrhoeal disease control programme managers from Bangladesh (2), Malaysia (1), Myanmar (4), Uganda (2), Ethiopia (3), China (4), Thailand (1), Swaziland (3), and India (1) attended 2 courses on the "Clinical Management of Diarrhoeal Diseases". These courses were designed to provide participants with the skills necessary to diagnose and treat diarrhoea in both the hospital and the community. In addition, the participants were taught how to organise courses for health personnel in their own countries.

Two 3 week courses on the "Laboratory Diagnosis of Common Diarrhoeal Disease Agents" were attended by 14 participants from Ethiopia (2), Myanmar (1), China (1), Maldives (2), Thailand (1), Nepal (1), Sri Lanka (2), Pakistan (1) and Bangladesh (3). The course taught participants the principles of laboratory procedures. They learned to isolate and identify pathogens responsible for causing diarrhoea and to prepare their own culture media in their home laboratories.

Two study visit's were organised for two groups of 12 officials of the NCDDP of Egypt The objective of their visits was to strengther

and update their knowledge and skills in management and control of diarrhoeal diseases to further improve the NCDDP programme of Egypt.

After a decade of experience in providing training, the Centre felt that facilities and manpower resources of the Centre could be better utilised for research training to contribute to the development of badly needed health research manpower and to research capacity building in developing countries. To achieve this, the Centre's training strategies were recast, a Research Methodology Workshop and other special training courses were organized, and plans were prepared to institute fellowships on Health Research Training in 1992.

The Research Methodology Workshop was attended by 13 participants, including 9 staff of the Centre and four others (3 from Bangladesh 1 from India). The workshop taught the participants the fundamentals of formulating and implementing research proposals and management and analyses of data sets.

The Centre has modified the course on the clinical management of diarrhoea to put more emphasis on management of invasive and persistent diarrhoea, complications, and drug resistance. To respond to the emerging problem of cholera epidemics in Latin American countries, the Centre plans to offer a course on the management of cholera outbreaks.

NATIONAL COURSES:

In 1991 the Centre organised eight national training courses: 4 courses on Clinical Management of Diarrhoeal Diseases, 2 on Microbiology and Parasitology, one on Biostatistics, and one on Epidemiological Methods of Public Health. A total of 99 participants attended these courses.

The 4 courses on Clinical Management were attended by 21 post graduate students of the Institute of Child Health, IPGM&R, 9 private medical practitioners, 18 students of the NIPSOM and 14 nurses from Dhaka Medical College. These courses aimed at providing adequate knowledge and skills in managing patients in both hospital and community with emphasis on the use of ORS and the role of nutrition for the management of diarrhoea.

The course on Biostatistics was organised at the request of the UNICEF, Dhaka for its programme staff and aimed to help participants improve their statistical skills in order to enable them to (a) improve their efficiency in executing, monitoring, and evaluating projects, (b) make better and more accurate use of data for analysing reports, and (c) recognise when and what type of expertise is required to help design research studies and evaluations or for data collection and analysis.

The course on Epidemiological Methods in Public Health, offered for the first time at the Centre, was organised in collaboration with national institutions and was attended by 14 participants. The course aimed to impart training to participants to plan, design, and undertake epidemiological studies, to apply appropriate methods in data collection, to analyse and interpret data, and to formulate, implement, and evaluate health interventions. The course, like all other courses, was evaluated and found useful to those who are planning to build a career in public health, and it may thus contribute to the national institutions in developing trained health manpower to conduct essential health research in areas of public health and preventive medicine.

The 2 courses on Microbiology and Parasitology, attended by 16 students of the Zoology Department of Dhaka University, taught the participants the principles of laboratory procedures, to isolate and identify the most common bacterial and parasitic agents of diarrhoeal diseases.

FELLOWSHIP PROGRAMMES:

In addition to courses, the ICDDR,B offered fellowships (training on individual basis) to 71 persons for training in different aspects of diarrhoeal diseases and research. The main objective of this programme is to provide fellows with specialised skills and insight into research methods. The different Fellowship Programmes are described below:

SAARC Fellowship: In 1991 the Centre continued to offer fellowships to the countries of the South Asian Association for Regional Cooperation (SAARC). Fellows from Bangladesh (2), Sri Lanka (1), Bhutan (2), Maldives (1) and India (1) were provided theoretical and

practical training in current practices in treating diarrhoeal diseases, epidemiology, and prevention of diarrhoea and orientation in basic research. In addition, one fellow was trained in laboratory methods for isolating and identifying the common diarrhoea pathogens.

Government Fellowship: The Government fellowship programme which began in 1989 at the request of the Director-General of Health Services, Government of Bangladesh, continued and offered 8 one-year fellowships in 1991 to 8 physicians from 8 medical colleges on the basis of merit. These fellows were provided intensive training on the clinical management of diarrhoeal diseases with an orientation in clinical pathology.

Fellowship for nurses: Aiming to create trained nurses for management of diarrhoeal patients in the country, the Centre offered 10 fellowships on a competitive basis. The objective of the programme is to provide the nursing trainees with adequate hands-on training to enable them to acquire adequate knowledge and skill to competently manage diarrhoea patients and the diarrhoeal treatment units.

Other Fellowship: Ten fellows from 7 countries received training in different aspects of diarrhoeal diseases with an insight into research methods. The fellows include trainees from a number of western universities who chose this for their elective. They worked in the hospital at the bed side of patients for hands-on training in clinical management of diarrhoeal disease and assisted with the current research protocols.

Research Traineeship: To provide opportunity to Bangladeshis to develop their research capacities, ICDDR,B has instituted a programme for providing training through its ongoing research protocols. The programme is based primarily on practical experience in the Centre's ongoing research. Fellows in this programme are graduates in medicine, social science, and other basic and applied sciences. The duration of their training is a minimum of one year, but they stay until their particular research protocol is completed.

POSTGRADUATE STUDENTS:

In the Centre's laboratories, 6 M.Sc. and 8 M.Phil students of the Dhaka University, one Ph.D. student from Gotteingen University, Germany, and two from Karolinska Institute, Sweden, carried out their research studies.

SHORT-TERM COURSES:

During the year, a series of one- and 2-day courses were provided to students and health professionals from Bangladesh medical colleges and other government and non-government institutions on the management of diarrhoea with ORS.

SEMINARS:

To provide opportunities for an exchange of information and views, 18 seminars were organised during the year in addition to the interdivisional scientific forums (See Introduction) and clinical seminars at the Clinical Research Centre. Both resident and visiting scientists presented seminars on diarrhoea and other related topics.

STAFF DEVELOPMENT

Manager: B.R. Saha

A "systematic staff development programme" is an objective of the Centre. In view of this objective, as in previous years, the Centre endeavoured to develop the skills of its staff to sustain its ongoing research and training and to create a well trained manpower to meet future requirements. This was done by organising workshops in the Centre and sending staff members to national and overseas institutions. Staff members also attended scientific conferences to present papers on the findings of their research. Besides fellowships for study or training for individual staff members from a number of agencies, the ICDDR,B received direct financial support from the Swiss Development Cooperation for the programme.

OVERSEAS: At the beginning of 1991, 25 staff members were studying overseas. During the year 16 more left to begin courses or training and 12 returned, three of them leaving the Centre. Thus, at the end of the year, 29 staff members were on overseas study or training in Australia, Belgium, Canada, France, India, Japan, Sweden, Switzerland, the UK, and the USA. The subjects of their studies included Gastroenterology, Nutrition, Population

Dynamics, Public Health, Demography, Immunology, Microbiology, Molecular Genetics, and Community Health.

In addition, 15 staff members attended scientific conferences and workshops in overseas countries to present papers on the findings of their research. Their attendance in the conferences and workshops also gave them the opportunity to exchange ideas with the researchers of other institutions and countries who attended.

A brief description of some of those who are either currently on training or have returned after completion is given below:

Dr Samir Kumar Nath, Senior Medical Officer, Clinical Research Centre (CRC), Clinical Sciences Division (CSD) gained a Ph.D in Gastroenterology from the University of Paris VII, France. His dissertation title is: 'Relation between absorption and secretion of electrolytes and organic substrates by the intestinal epithelium in experimental diarrhoeal models.'

Dr Shafiqul Alam Sarker, Senior Medical Officer, CRC, CSD, gained an MD in Gastroenterology from the University of Basel, Switzerland.

Ms Shahnaz Ahmed, Community Health Services Coordinator, Urban Health & Extension Project, Community Health Division (CHD) gained a Masters degree in Community Health from the London School of Hygiene and Tropical Medicine (LSHTM), UK.

Mr Ashish Kumar Chowdhury, Chief, Clinical Biochemistry Section, Laboratory Sciences Division (LSD) and **Dr Goutam Podder**, Senior Research Officer, LSD returned from Belgium after completing one year of training in Clinical Biochemistry and Virology respectively.

Dr. Md. Khalequzzaman, Assistant Scientist, Matlab Health & Research Centre, CHD and, **Dr. Fakir Anjuman Ara**, Training Physician, Training Branch, left to begin their studies in Public Health leading to MPH degrees at the Johns Hopkins University, USA and the University of Leeds, UK, respectively.

Dr. S.M. Akramuzzaman, Medical Officer, CRC, CSD, left to begin studies at the LSHTM, UK for a Masters degree in Community Health in developing countries.

Mr. Md. Zeaur Rahim, Assistant Scientist, LSD left to begin studies at the Institute of Pasteur, University of Pasteur, France for a Ph.D. in Molecular Genetics from the University of Paris VII, France.

Dr. R.N. Mazumder, Medical Officer, CRC, CSD, left to begin his studies at the INSERM, for a Ph.D. in Gastroenterology from the University of Paris, France.

Mr. Sentu B. Gomes, Project Office Manager, PSED, and **Mr. M.A. Jabbar**, Personnel Manager, Administration and Personnel, attended short courses in management in the Philippines, **Dr. Rashidul Haque**, Parasitologist, LSD, took a short course in Parasitologic Diseases in London, **Mr. Mizanur Rahman**, Senior Accounts Officer, Finance Division, also attended a short course in Management in Denmark, as did **Mr. Hasan Shareef Ahmed**, Publication Officer, DISC, in Editing and Publication in London.

IN COUNTRY TRAINING: During 1991, 18 staff members were sent to institutions within the country for short courses of training in the fields of accounting, materials management, English, fertility management, computers, library science, basic electronics, haematology, and microbiology. **Mr. Zeaur Rahim**, Assistant Scientist, LSD, gained an M.Phil degree in Microbiology from the University of Dhaka.

In addition, a number of staff attended conferences/workshops, including the first international conference of the College of Physicians and Surgeons, the 5th Bangladesh Nutrition Conference, and the annual Conference of Bangladesh Society of Microbiologists.

IN HOUSE TRAINING: During the year, 2 workshops, one on Research Methodology and the other on Statistical Analysis Software (SAS) were organised. These workshops, which provided extensive training in the field, were attended by 20 staff members.

Two courses on English, originally planned to begin in December (one for scientific staff and the other for non-scientific staff) were rescheduled by the British Council, Dhaka, for January 1992.

ADMINISTRATION AND PERSONNEL DIVISION

Associate Director. M. A. Mahbub

The Administration and Personnel Division is engaged in supporting the research and scientific activities of the Centre by providing the required logistic support. The Division consists of four branches, namely: Personnel, Supply, Engineering, and General Administration.

The **Personnel Branch** is responsible for ensuring that the Centre's human resources are organised and administered in a manner to maximise the Centre's potential as an international health research organisation.

Personnel Office
Chief Personnel Officer: Wahabuzzaman Ahmed

At the end of 1991, the Centre had 1,028 staff members plus 140 Community Health Workers and 112 Urban Volunteers. There were 28 International staff members, 14 of whom were on secondment, 142 held National Officers grade, and 858 were in the General Service category. The Centre successfully endeavoured to contain the payroll costs during the year, and a net total of 212 separations were made.

DEPARTURES

During the year, one Associate Director left the Centre. MR. JOHN F. WINKELMANN (Canada), Associate Director, Finance, who was seconded by the World University Service of Canada (WUSC), returned home in August after completing the three year term of his secondment assignment.

Mr. John Winkelmann

Another seconded staff member from WUSC, MS. MICHELLE MUNRO (Canada), left the Centre in June on completion of her secondment assignment as Nurse Health Educator in the Maternal and Child Health and Family Planning (MCH-FP) Extension Project.

DR. MICHAEL A. KOENIG (U.S.A.), Project Director, MCH-FP Extension Project, seconded by the Population Council, left the Centre in April after completing six years of his secondment assignment with the Centre.

Three Danish Nationals seconded by DANIDA left during the year. MS. CHARLOTTE BRUN, Associate International Research Fellow (Trainee), Child Health Programme (CHP), left in January for Denmark after a one year assignment. MS. NINA SORENSEN, Teaching Coordinator, CHP, and MS. CARIN C. NIELSON, Follow up Coordinator, CHP, left in March and June, respectively, on completion of their three year assignments in CHP.

DR. ANDREW HALL (U.K.), Visiting Scientist, Community Health Division, completed a seven year secondment assignment provided by the University of London and left the Centre in June to work in the Imperial College of Science, Technology and Medicine, London.

DR. CHARLES LERMAN (U.S.A), seconded by the Johns Hopkins University to work as Research Investigator in the Urban Volunteer Program (UVP), resigned from his assignment in July to join the USAID Dhaka.

Two International professional fixed term staff members, MR. M. IQBAL ALI (Bangladesh), Programme Officer, External Relations Division and MS. JUDITH A. CHOWDHURY (Australia), Executive Assistant, Director's Office, completed their six year terms in June. Ms. Chowdhury applied for and was reappointed to the same position.

International short-term staff member, DR. FAKIR CHARAN PATRA (India), Assistant Scientist, Clinical Sciences Divison, resigned in

August to pursue research training in the Karolinska Institute, Stockholm, Sweden.

MS. CHARAMONIE JAGDEO (Canada), a nurse midwife trainer and adviser to the MCH FP Project, left at the end of the year.

NEW STAFF

MR. KENNETH J.J. TIPPING (Australia), formerly working as Financial Manager of Solomon Taiyo Limited, Solomon Islands, joined the Centre in October as Chief Finance Officer (Associate Director), Finance Division, initially for three years.

DR. SUSHILA ZEITLYN (U.K.), an anthropologist and former Consultant to the Community Health Division (CHD), joined as an International short term member of the same division.

Eight other international staff members joined the Centre on secondment during 1991. Three of them were sponsored by the Johns Hopkins University. DR. R. BRADLEY SACK (U.S.A.), Professor, Johns Hopkins University School of Hygiene & Public Health, Department of International Health, joined in February on a two year assignment as Associate Director, CHD. DR. KIRK ALLEN DEARDEN (U.S.A.), from the National Center of Health Statistics, Hyattsville, M.D., joined in July as a Child Survival Fellow, CHD, for a term of two years. DR. KANTA ALVI (Bangladesh), a Teaching Assistant in Johns Hopkins University, joined the UVP in September as Project Demographer for one year.

Three seconded staff members from Belgium were deputed by the Belgian Administration for Development Cooperation (BADC). DR. ANN MARIA VANNESTE, DR. THERESE JUNCKER, and DR. MARTINUS DESMET joined in January, August, and September repectively as Visiting Scientists in the CHD for two years. Prior to coming to the Centre, Dr. Venneste completed a Masters in Tropical Biomedical Sciences from the Tropical Medical Institute, Belgium. Dr. Juncker was working as permanent consultant in the Ministry of Public Health, Niger, and Dr. Desmet had completed his M.Sc. in Community Health in Developing Countries from the London School of Hygiene & Tropical Medicine.

DR. JOHN HAAGA (U.S.A) joined the MCH - FP Extension Project as its Project Director for two years beginning in July. He was seconded by the Population Council. Prior to his assignment, Dr Haaga was Policy Analyst at the RAND Corporation Washington D.C. and adjunct Professor of Govt. of Georgetown University.

In October, the Swiss Development Corporation (SDC) seconded DR. SAMUEL ERNY (Switzerland) as a fellow in the CHD for 12 to 16 months. He was previously working in Childrens Hospital, Switzerland.

VISITORS AND CONSULTANTS

During the year, the following people were invited to provide consultancies in various projects/programmes:

MS. NANCY JAMIESON (USA), having provided administrative consultancy services to the Danish/Afganistan Committee in Pakistan, was hired by the MCH FP Extension Project in January for six months to assist the project in planning curriculum design, development of training materials, and evaluation of guidelines for the national implementation of injectable contraceptive delivery pilot project.

MS. DAWN HIGGINS (AUSTRALIA), National President of the Institute of Professional Secretaries, Australia, in January, conducted a two week training course for secretaries, and also assessed training needs and undertook an evaluation of the course and the progress of the participants.

MS. SHEILA RYAN HUSSAIN (IRELAND) joined in February for 11 months as Administrative Consultant for the MCH - FP Extension Project to assist the Project Director with financial, personnel, and administrative issues of the project and to prepare reports for the donor agency.

DR. NIMAL ATTANAYKE (SRI LANKA), from the Department of Economics, University of Colombo, Sri Lanka, came to the MCH - FP Matlab Project in March for two weeks to complete the collection and analysis of data related to the cost effectiveness study of the project.

DR. ANDREJ WEINTRAUB (SWEDEN), from the

Department of Clinical Bacteriology, Karolinska Institute, Huddinge University Hospital, Sweden, conducted a course on extraction, purification, and characterisation of Bacterial Lipopolysaccharides in the Laboratory Science Division (LSD) for three weeks in May.

MR. ROY MARSHALL (U.S.A.), Director, DRL Computer Centre, Philadelphia, PA, was invited to offer a one week consultancy in July on a thorough review and evaluation of the CIS main frame computing system and investigation of the relationship between the microcomputer and mainframe computer, and to provide a report on the above.

DR. CHRISTINE LORRAINE MOE (U.S.A.), from the Department of Environmental Sciences and Engineering, University of North Carolina, provided a consultancy in the Virology Laboratory for one month in the summer. She assisted in setting up a detection test for astrovirus and training virology laboratory staff to perform the test.

PROF. M.K. BHAN (INDIA), Additional Professor, Dept of Paediatrics, Division of Gastroenterology & Enteric Infections, All India Institute of Medical Sciences, New Delhi, and PROF. J. MULIYIL (INDIA), Professor of Community Health, Christian Medical College, were invited to act as faculty members for the Workshop on Research Methodology in October.

MR. DETLEF PIEPER & MR. ALAN SUNTER (CANADA), of ABS Research Design and Analysis Inc., Ottawa, were invited to provide consultancies in connection with the Urban Surveillance System (USS) in the Demographic Surveillance System (DSS) for six weeks beginning in October.

Dr. AGNES B. GUYON (FRANCE), a public health physician assisting UNICEF in the assessment of growth monitoring and promotion, came on a consultancy to the CHD for one week in November to evaluate the possibility of joining the Matlab MCH - FP programme.

DR. JACK MELLING (U.K.), Deputy Director & Head of the Division of Biologics PHLS Centre for Applied Microbiology and Research, London, rendered his consultancy to the Board of Trustees Meeting in November.

DR. KAZUNOBU AMAKO (JAPAN), Prof. of Bacteriology, Kyushu University, Fukuoka, spent two weeks in December investigating freshwater planktons for the LSD.

PROF. J.O. ALVAREZ (USA), Chairman, Dept. of Public Health Sciences, University of Alabama, came to collaborate with scientists in the LSD on a Vitamin A methodology.

MRS. SHARON HUTTLY (UK), Maternal and Child Epidemiology Unit, London School of Hygiene and Tropical Medicine, visited in November to discuss improving communications between the London School and ICDDR,B, as well as perhaps starting a fellowship program.

DR. DAVID SACK (USA), Johns Hopkins University and once an Associate Director of ICDDR,B, came for a week in June to assess the possibility of a feasibility study of cholera vaccine. DR. ANN MARI SVENNERHOLM (SWEDEN) joined him from Gothenberg, as did DR. JOHN CLEMENS (USA) from the NIH, Bethesda, MD.

DR. MASSEE BATEMAN, Associate Director for Environmental Health WASH Project, Washington D.C. and MS. CLAUDIA LIEBLER (Facilitator) both from the USA, spent a month in November assisting in a water and sanitation workshop for the CHD. Others involved with the workshop were DR BARRY DAVIS (CDC, USA) and DR. STEVEN ESREY (McGill University, Canada) Dr. Bateman was also here in April consulting with the Division and helping with the cyclone relief.

DR. ROGER GLASS (USA), from CDC, Atlanta, visited with the CHD and LSD in May to talk about collaboration on viral diarrhoeas

DR. KLAUS GYR (SWITZERLAND), University of Basle, was here in the summer to work on a collaborative project involving *Helicobacter pylori* with the CHD and LSD.

DR. ROBERT BLACK (USA), from Johns Hopkins University, visited UVP as a consultant on several projects.

The following experts were invited on special service agreements during the year from both home and abroad:

DR. ABDULLAH HEL HADI (BANGLADESH), Research Associate, University Research Corporation, Dhaka worked for the UVP from April to Septen.ber in analysing existing RCSS & USS data on family planning, nutrition, immunisation, and diarrhoeal diseases and wrote a report of the findings.

DR. A. MAJEED KHAN (BANGLADESH), a former senior official of the UNESCO and Education Minister of the Govt. of Bangladesh, reviewed, for a month in April, the DSS Project proposal submitted to UNFPA. He recommended ways and approaches on how bilateral sources of funds may be made available to support DSS activities and suggested ways of increasing the linkage of international agencies, such as UNFPA, UNICEF, UNDP and WHO, with ICDDR,B.

DR. BARKAT E KHUDA (Bangladesh), from the University Research Corporation, came for a week in November to review the activities of the Population Science and Extension Division (PSED) as a member of the ICDDR,B Board of Trustees Programme Committee Review of the PSED

DR. M. U. KHAN (Bangladesh), erstwhile Senior Scientist, CHD, assisted in organising a nation al conference on diarrhoeal disease from July til November. He also acted as a rappoteur for the conference and developed a paper on the Centre's contribution to Bangladesh.

Dr. S.C. BHATNAGAR (India), a management specialist, came on a special service agreement to the MCH FP Extension Project for three weeks in Sept to identify key management and service delivery tasks at the union, upazila, and district levels and to prepare a first draft of the outline of a manual for upazila and district managers.

DR. VINCENT A. FAUVEAU (France), the former MCH FP Physician, visited the PSED on a special service agreement for two weeks in June to review the ongoing measles surveillance project and to prepare a final report for a measles workshop.

MS. JOSEPHINE A. SACK (U.S.A) came as Editorial Advisor for one year in March to provide editorial assistance in preparation of publications, with special responsibility for the JDDR, Glimpse, and the Annual Report, and also to provide technical English skills to scientists in the writing of scientific papers.

DR MAXINE WHITTAKER (Australia), Opera tions Research Scientist, Australian National University, returned to the MCH FP Extension Project during the summer for three weeks on a Special Service Agreement to implement door step delivery of injectable contraception on a national basis, to design and implement injectable training, and to prepare a report on the quality of care operations research study.

DR. KATE STEWART (USA), the erstwhile Principal Investigator of the Matlab MCH FP Project seconded by JHU, was again on a special service agreement for about four weeks during April to evaluate the mortality impact of Matlab health interventions.

DR. SHAKUNTALA THILSTED (Denmark), re - turned on a brief contractual service agreement for three months beginning in June to finalise the scope and activities proposal for the next phase of the CHP.

DR. MICHAEL BENNISH (U.S.A), Associate Professor, Tufts and Harvard University, visited for three weeks in January on a collaborative agreement between ICDDR,B and the New England Medical Centre, Tufts University School of Medicine, Boston, to assist the short course ciprofloxacin study.

Vistors to the ICDDR,B in 1991 included among many others: H.E. Senator Robert Hill, Shadow Minister for Foreign Affairs and Trade, Australia; H.E. Mr. H. Gajentaan, Ambassador from The Netherlands and Mrs. Gajentaan; Dr. Immita Cornaz, Madame Peng Pei Yun, Minister of family planning in China; SDC, Switzerland; Mr. Bill Hausdorff, USAID, Washington; Mr. Binayak Ray, AIDAB, Australia; Mr. Jeff McMurdo, representative for WUSC; Mrs. Sheila Ward, representative for CIDA; Mrs. Margaret Hempel and Jose Berzelatto, Ford Foundation, New York; Mr. Duncan Peterson, IDRC, Ottawa; Dr. David Nabarro and Dr. M. Kapila, ODA, UK; Prof. H. Dumont and Dr. J. Mertens, BADC, Belgium; Mr. Beat Keller and Mr. Jutzi, SDC, Berne; Dr. I. Lejnev, WHO CDD/HQ, Geneva; Dr. Kevin Hansen, US Task Force; and Mr. Ranjan Poudyal, Save the Children (UK), Nepal, and senior MOHFW officials.

Among those who visited the field station in Matlab were: Mr. Albert Mehr, Swiss Charge d'Affairs to Bangladesh and family; Mrs. Shirley Imray, wife of the British High Commissioner to Bangldesh; Mr. James P. Blair, Staff Photographer, National Geographic Magazine, USA; Members of the Japanese Embassy; Members of the Board of Trustees and the Scientific Advisory Committee; A team from Switzerland filming a video; Members of a Canadian TV team; 38 participants from a BARD (Comilla) training course; and Representatives from USAID, UNDP, BRAC, ODA, CIDA, SDC, and SAREC.

OBITUARIES

With sorrow, we record the deaths of the following staff members who have given many years of service to the Centre: Mr. Mizanur Rahman, 53, Driver, Logistics & Field Support Branch (22yrs); Mr. Nur Hussain, 58, Assistant Staff Nurse, DTC Matlab (20yrs); Mr. Abdur Rab, 40, Attendant, Matlab MCH FP (almost 10yrs); Mr. Golak Behari Chakma, 36, Senior Staff Nurse, CRC (11yrs); Mr. Mangal, 32, Cleaner, CRC (7yrs); and Mr. M. A. Sattar Miah, 53, Senior Health Assistant, Matlab DSS (21yrs).

RETIREMENT

Five staff members retired from the Centre during the year: Mr. Asaddar Ali, Cook, Guest House; Dr. Ansaruddin Ahmed, Associate Scientist, LSD; Cdr. (Retd.) M.A.H. Miah, Manager, Security & Safety; Mr. Lorence D'Costa, Security Guard, General Services Unit; and Mr. Md. Shahabuddin, Special Assistant to the Associate Director, A&P.

LONG SERVICE

During 1991, three national officers and 24 general service staff members completed 25 years of service in the Centre and were awarded meritorious increases in pay: Mr. Md. Akbar Ali, Manager, Laboratory Services, LSD; Mr. Matloob Sobhani, Head, Bio medical Engineering Cell, LSD; Mr. Md. Sayeedur Rahman, Computer Operations Supervisor, CIS, PSED; Mr. Md. Sirajul Haque, Senior Health Assistant, Matlab DSS, PSED; Mr. Abdul Momin, Storeroom Attendant, Supply Branch, A&P; Mr. Md. Mahfuzul Islam, Field Research Officer, Matlab MCH-FP, CHD; Mr. Md. Younus Howlader, Senior Laboratory Attendant, LSD; Mr. K.M.A. Rouf, Procurement Officer, Supply Branch, A&P; Mr. Md. Jalaluddin Ahmed, Cabinet Maker, Maintenance Branch, A&P; Mr. Md. A. Latif Patwary, Senior Health Assistant, Matlab DSS, PSED, Mr. Ali Miah, Animal Attendant, Animal Resources Branch, LSD; Mr. Jiban Chandra Das, Laboratory Attendant, Clinical Pathology Section, LSD; Mr. Md. Delwar Hossain, Storeroom Attendant Supply Branch, A&P; Mr. Md. Kashem Ali, Senior Health Assistant, Matlab MCH-FP, CHD; Mr. Md. M. Rahman Khan, Senior Laboratory Technician, Clinical Microbiology Section, LSD; Mr. Md. Delwar Hossain, Senior Health Assistant, Matlab MCH FP, CHD; Mr. A.F.M. Aminul Islam Khan, Senior Health Assistant, Matlab DSS, PSED; Mr. Md. Osiur Rahman, Speedboat Driver, Matlab Administration; Mr. Abdul Majid, Pharmacy Incharge, CRC; Mr. Rajab Ali, Field Research Officer, Environmental & Child Survival Study, MH&RC; Mr. Md. Fazlur Rahman, Health Assistant, MH&RC; Mr. Md. Omar Ali Mian, Senior Laboratory Attendant, LSD; Mr Md. Abdul Latif, Senior Laboratory Attendant, LSD; Mr. Md. Abdus Samard, Security Guard, General Services Unit, A&P; Mr. Abdul Mannan, Cleaner, General Services Unit, A&P; and Mr. Azizul Haque Maintenance Supervisor, Maintennace Branch, A&P.

AWARDS

The following scientific staff members were granted special salary increases (two steps within their own grades) in recognition of sustained performance of exceptional merit: Dr. S.K. Roy, Associate Scientist, CSD, Dr. A.K.M. Iqbal Kabir, Associate Scientist, CSD; Dr. Syed M. Akramuzzaman, Medical Officer, CRC; Dr. Firdausi Qadri, Associate Scientist/Immunologist, LSD; Mr. A.K.M. Golam Kibriya, Senior Research Officer, LSD; Mr. Mujibur Rahman, Senior Research Officer, LSD; Mr. J. Chakraborty, Manager, Health Services, Matlab H&RC, CHD; Dr. Bilqis Amin Hoque, Environmental Engineer, CHD; Dr. M.M. Hoque Munshi, Assistant Scientist, PSED; Dr. Abbas Uddin Bhuiya, Associate Scientist, PSED; and Mr. Mian Bazle Hossain, Statistician-Demographer, PSED.

The **Supply Branch** is responsible for procuring all the supplies and materials necessary for research and support use from both overseas and local sources.

Supply Office
Chief Officer: M. Golam Morshed

During the year, the Supply Office procured materials worth approximately $1.75 million compared with $1.02 million in 1990. This included several capital items, such as a Wireless system for Dhaka Matlab communication, a PABX CUM INTERCOM for Dhaka Hospital, a Spectrophotometer, a DNA Thermal Cycler, vehicles, and others. The procurement costs have been minimised to a considerable extent due to direct purchase from the manufacturers/suppliers abroad instead of through agents. Also junk goods worth around Tk 250,000 was auctioned during the year. Some renovation was done to improve the physical facilities of the warehouse and Supply Office.

The **Engineering Branch** is responsible for developing and maintaining the plant physical facilities and equipment of the Centre.

Maintenance Office
Engineering Manager: Taqsem Ahmed Khan

In 1991 the Centre made several improvements in its physical facilities. A 40,00 gallon water reservoir along with a pump house and 10 over head water tanks were installed for the hospital to solve the water supply problem of the Clinical Research Centre. For better security, a gate house has been constructed near the west side, main entrance gate, and about 240 ft of new boundary wall was constructed on the south side.

The **General Administrative Branch** looks after travel, property, transportation, communications, security, sanitation, the canteen, mail, and other related jobs.

Travel Office
Manager: Kh. Shafiqul Hossain

During the year, the Travel Office provided travel assistance to staff members, trainees, and members of the Board of Trustees, and effectively handled the complex operation of obtaining visas, customs passbooks, and export/import of goods.

Further, this office successfully obtained permission from the Ministry of Home Affairs to incorporate six journeys instead of three into the yearly Bangladesh visa, and three-months entry visas for new staff members from Bangladesh Missions abroad pending clearances from the Ministry.

Estate Office
Senior Estate Officer: Mujibur Rahman

Apart from the routine functions of the Estate Office, i.e. maintenance of the telecommunication system, photocopying operation, billing of utility and rental equipment, and assisting expatriate staff members in respect to housing, major improvements were made in 1991 in the physical facilities of the Centre's Guest House.

Logistics & field support
Transport Officer : Md. Hamidullah

This Unit extended valuable and timely support to the Centre's research and other related activities by providing land and water transportation and related logistics activities. Sixteen vehicles were used and maintained, and 24 vehicles were rented to staff members. In addition, this branch maintained and operated throughhout the year a very effective wireless communication system between the Centre and the Matlab Health & Research Centre.

Staff Clinic
Physician Manager: Meena Chowdhury

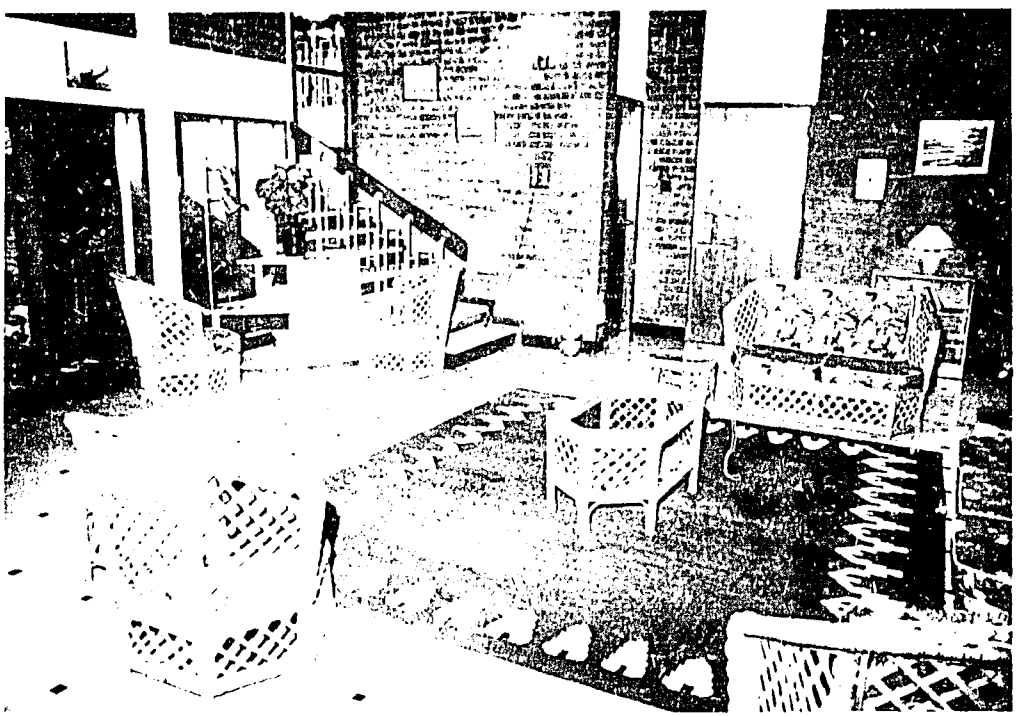
As usual, great effort was made to provide improved health care facilities to the staff members and their dependents during 1991 by the Staff Clinic; 21,532 patients were seen (Table). Over 700 of these were emergency cases, 177 were hospitalised, 418 required surgery, and 28 babies were delivered. Family planning services provided 60 persons with their choice of contraception; the pill was the most popular (44); only one vasectomy was performed.

General Services
Supervisor: Mujibur Rahman

The General Services Branch, throughout the year, looked after the security and cleanliness of the Centre very efficiently. Moreover, the staff smoothly carried out their various responsibilities in arranging the venues with catering facilities for all the seminars, workshops, meetings, conferences, and the Board of Trustees meetings.

Monthly attendance of patients at Dhaka Staff Clinic FY 1991

Patients	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Self	888	594	678	941	865	693	892	884	906	783	758	589	9411
Dependent	1013	921	1037	799	978	878	1176	1100	989	1131	1084	628	11734
Vaccine	22	37	31	38	24	17	27	26	32	28	25	20	327
Total	1923	1552	1746	1778	1807	1588	2095	2010	1927	1942	1867	1237	21472
Family Planning													60
Grand Total :													21532



Asem Ansari

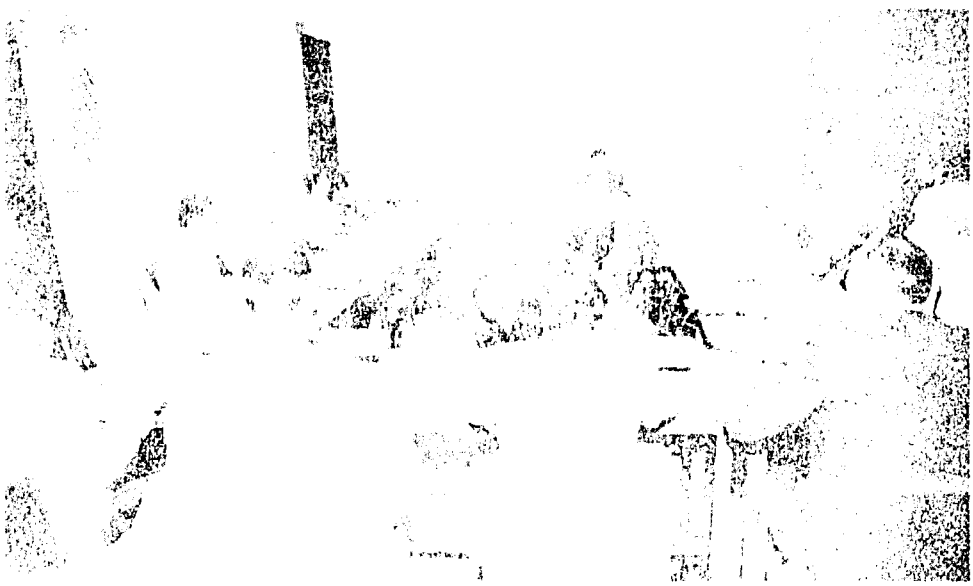
Early in 1991 the Centre's Guest House was redecorated by a committee of ICDDR,B women. The guest house provides a home away from home for visitors and consultants.

One of the Centre's many visitors, Dr. Bernard Kouchner, French State Minister for Humanitarian Action, Paris, is given a tour of the treatment wards by the director in June.

Asem Ansari

"Congratulations! As a gastroenterologist and a third world doctor I had the opportunity to appreciate your fantastic work." — Dr. B. Kouchner

Board of Trustees
Programme Coordination Committee
Research Review Committee
Ethical Review Committee
Council of Associate Directors
Consultative Management Committee



Asem Ansari

The Board of Trustees meeting in Dhaka in November.

COMMITTEES – 1991

The Board of Trustees provides general direction to the affairs of the Centre. The Board has 17 members: the Director of the Centre, three persons nominated by the Government of Bangladesh, one by the World Health Organization, one by the United Nations, and eleven members at large, of whom at least half must come from developing countries. Each June one third of the members complete their three year term unless re elected for another term, after which they must retire.

The Board meets twice a year (in 1991, they met in June in Jakarta and in November in Dhaka) and considers matters of science, finance, and management. The Director of the Centre is Secretary to the Board. The members of the Board in 1991 were:

Dr. Peter Sumbung (Indonesia), Chairman
Prof. Demissie Habte (Ethiopia), Secretary
Mr. M.K. Anwar (Bangladesh) to February
Dr. Y.Y. Al Mazrou (Saudi Arabia)
Dr. Deanna Ashley (Jamaica)
Mr. M.R. Bashir (Bangladesh) to February
Prof. John C. Caldwell (Australia)
Mr. E.A. Chaudhury (Bangladesh), from February
Prof. Dr. K.M. Fariduddin (Bangladesh), from February
Prof. J.R. Hamilton (Canada)
Mr. M. Mokammel Haque (Bangladesh), from August replacing Mr. K.A. Asaduzzaman (Bangladesh) from February to August
Dr. Ralph H. Henderson (WHO representative)
Dr. Maureen Law (Canada),from August replacing Prof. D.A. Henderson (USA)
Prof. A. Lindberg (Sweden)
Prof. V.I. Mathan (India)
Prof. Fred S. Mhalu (Tanzania)
Prof. A.S. Muller (The Netherlands)
Mr. Taslimur Rahman (Bangladesh) to February
Dr. Jon E. Rhode (UNICEF representative)
Dr. Takashi Wagatsuma (Japan)

The Programme Coordination Committee (PCC) is a mandatory committee of the Centre which coordinates research with the work of national institutes in Bangladesh. Its objectives are : (a) to ensure that the Centre offers fellowships and facilities for training and research to Bangladeshi scientists and health personnel, (b) to ensure that the Centre establishes and maintains contact with Bangladeshi institutes by means of collaborative research, seminars and exchange of visits, (c) to ensure that the Centre avoids actions prejudicial to the interest of research in similar fields carried out by other organisations in Bangladesh, (d) to assist in solving any controversy in relation to the involvement of the ICDDR,B in research and training.

The PCC has 50 members five from ICDDR,B and the remaining members from Government health departments/institutions, universities and non governmental organisations related to science, health, nutrition, development, education, and population studies. The present Committee will be in office until December 1992. The Chairman is Prof. M.A. Matin, Vice Chairman is Prof. Kamaluddin Ahmad, and the Member Secretary is Prof. Demissie Habte. The members of the PCC are:

Prof. M.A. Matin
Prof. Kamaluddin Ahmad
Prof. Nurul Islam
Maj. Gen. M.R. Chowdhury
Prof. K.A. Monsur
Prof. T.A. Chowdhury
Dr. Humayun KMA Hye
Brig (Retd.) M. Hedayetullah
Dr. Zafrullah Choudhury
Dr. A.K. Khan
Dr. Mobarak Hossain
Dr. Sultana Khanum
Vice Chancellors of Bangladesh Agricultural University, Dhaka University, Bangladesh University of Engg. & Technology, Chittagong University, Rajshahi University, Jahangir Nagar University, Islamic University, Shahjalal University of Science & Technology, and Khulna University,
Chairmen of Bangladesh Agricultural Research

Council and BCSIR Laboratories,
Research Director, Bangladesh Institute of Development Studies
Medical Director, Bangladesh Institute of Research & Rehabilitation in Diabetes, Endocrine & Metabolic Disorders
Directors - General of Health Services, Family Planning Implementation, and the National Institute of Population Research and Training
Directors of the Institute of Post Graduate Medicine & Research, Institute of Nutrition & Food Science, Dhaka Univ., Institute of Public Health, National Institute of Preventive & Social Medicine, Institute of Public Health Nutrition, and Bangladesh Fertility Research Programme,
Executive Director, Bangladesh Rural Advancement Committee
Director MIS Unit, Family Planning Directorate
Joint Director, Dhaka Shishu Hospital
Directors of the Institute of Bangladesh Studies, Rajshahi University; and Bangladesh Medical Research Council,
Project Director, CDD Programme, GOB
Directors of the Cancer Institute & Research Hospital and the Institute of Herbal Medicine
Prof. J.R. Hamilton, Member Board of Trustees
Dr. Deanna Ashley, Member, Board of Trustees
Director, ICDDR,B,
Associate Directors, CSD, CHD, LSD, PSED, (ICDDR,B)

The PCC met on two occasions (once with the Board of Trustees). The Scientific Review Committee of PCC also met on two occasions and considered six protocols originating from national institutions. During the year, the PCC generated interest among the scientists of national institutions in developing research proposals and in undertaking research in their own institutions. The scientists of the Centre provided technical assistance to them in developing proposals and gave necessary guidance during the research. As many as eight PCC - collaborative research proposals were provided with funds amounting to approximately US$60,000.00 by the Centre.

In nine ongoing ICDDR,B research protocols, investigators from five national institutions participated with the scientists of the Centre. This collaboration is viewed as most rewarding for ICDDR,B researchers.

The Centre also assisted Dhaka University departments and other medical research institutions with installation and maintenance of their scientific instruments and equipment, and by providing animals and animal blood.

The Research Review Committee (RRC) evaluates all research proposals of the Centre in terms of their scientific value, competence of the investigators, significance and feasibility in view of the Centre's objectives, priorities, and financial resources. The RRC is composed of scientists and physicians from the ICDDR,B and external organisations*, and representatives from the PCC Standing Committee. During 1991, the RRC met ten times and considered 21 protocols: 18 were approved, one disapproved, and consideration of the remaining two were deferred. The members of RRC in 1991 were :

Prof. Demissie Habte, Chairman
Prof. Kamaluddin Ahmad*
Maj. Gen. M.R. Choudhury*
Dr. Dilip Mahalanabis
Prof. R. Bradley Sack
Dr. Michael A. Strong
Dr. M. Moyenul Islam
Dr. M.J. Albert
Dr. P.K. Bardhan
Dr. Sajida Amin*

The Ethical Review Committee (ERC) is also a Mandatory Committee of the Centre, and this Committee meets regularly to examine the ethical issues of approved research protocols involving human subjects. It has fifteen members : four from the Centre, one each from the PCC Standing Committee, the Bangladesh Medical Research Council, and the WHO in Bangladesh, and eight persons representing other disciplines.

The ERC has a five - member Sub - Committee to undertake periodic inspection and audit of research projects on behalf of the Committee to ensure that studies are being conducted ethically and according to the approved proposal. The Committee ensures privacy to the study patients and equal treatment even if they wish to withdraw from the study.

In 1991, the ERC met nine times and considered 22 protocols including six PCC - collaborative studies. Twenty - one protocols

were approved and consideration of one protocol was deferred. In 1991 the members of ERC were:

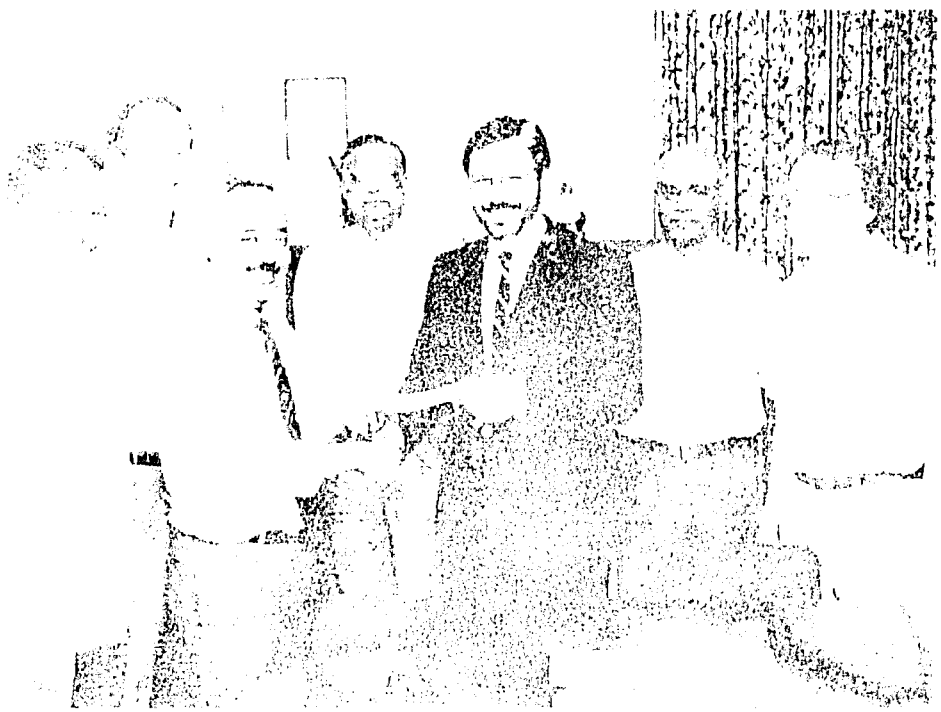
Prof. Kamaluddin Ahmad (PCC Standing Committee)
Dr. Humayun KMA Hye (Pharmacologist, Chairman)
Prof. T.A.Chowdhury (Bangladesh Medical Research Council)
Prof. K.A. Monsur (Scientist)
Dr. Shafiqur Rahman (Community Scientist)
Dr. Rafiqur Rahman (Lawyer)
Mrs. Taherunnessa Abdullah (Behavioural Scientist)
Mrs. Husnara Kamal (Behavioural Scientist)
Mr. Md. Mofazzal Hossain Khan (religious representative)
Dr. Jamal Ara Rahman (non scientific member)
Dr. Samira Aboubaker (WHO, Dhaka)
Dr. D Mahalanabis (ICDDR,B)
Dr. A.N. Alam (ICDDR,B)
Dr. K.M.A. Aziz (ICDD,B)
Ms Husna Ara Begum (ICDDR,B)

The Council of Associate Directors is a consultative management body comprising the Associate Directors of the Divisions. They meet each week to advise and assist the Director, and discuss matters of mutual interest, and make policy decisions. The members of the Council in 1991 were:

Prof. Demissie Habte, Director
Dr. Dilip Mahalanabis, CSD
Dr. Moyenul Islam, LSD (acting)
Prof. R. Bradley Sack, CHD
Dr. Michael Strong, PSED
Mr. John Winkelmann, Finance (to October)
Mr. Kenneth J.J. Tipping, Finance (from October)
Mr. M.A. Mahbub, Administration and Personnel
Mrs. Judith Chowdhury, Minutes Secretary

The Consultative Management Committee includes members of the Council of Associate Directors, other senior members of the Centre's administration, a representative of each Division, and the President of the Staff Welfare Association. It meets as an informal platform for a wider discussion of the management of the ICDDR,B. During 1991, the Committee met twice, once after each Board of Trustees meeting to get an up date of the meeting and discuss action to be taken. The members, in addition to the Council of Associate Directors, were:

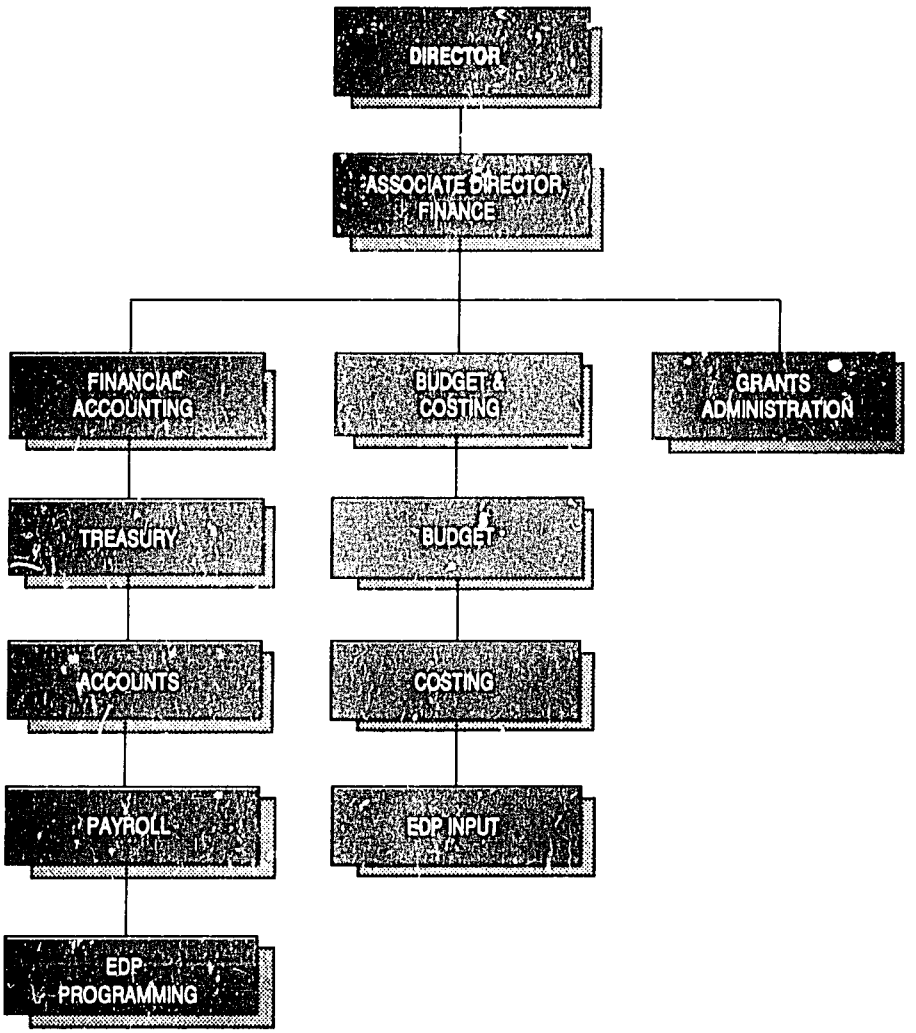
Mr. M.S.I. Khan (DISC), Dr. R.L. Akbar (Training Branch), and Dr. A.S.M. Rahman (President, SWA); Administration and Personnel reps: Mr. W. Ahmed, Mr. M.G. Morshed, and T.A. Khan; CHD reps: Dr. K.M.A. Aziz, Dr. A.K.M. Siddique, Dr. Md Yunus, and Mr N. Paljor, CSD reps. Dr. A.N. Alam, Dr I. Kabir, Dr. Aminul Islam, and Mrs. A. Stephen; Finance Division Reps: Mr. M.R. Khalili, Mr. M.M. Hassan; LSD Reps: Mr. M.A. Wahed, and Dr J. Albert; and PSED Reps: Dr. R. Maru, Dr. John Haaga.



Asim Ansari

Dr. Urs Heierli, Head, Swiss Development Cooperation, Dhaka, presents the annual SDC contribution to Prof. Habte while members of the Council of Associate Directors look on.

ORGANOGRAM : FINANCE



FINANCE DIVISION

Associate Director: Kenneth J.J. Tipping

The basic functions and purposes of the Finance Division are:

** to ensure that financial transactions and commitments are within approved budgets and authorisation limits,

** to ensure that adequate internal control and division of duties exist so that we can confidently rely on the accuracy and integri - ty of transactions and records,

** to ensure that procedures and controls comply with statutory and donor regulations, and

** to record financial transactions and commitments in such a manner that accurate and timely financial reports (monthly, Board of Trustees, annual and donor) can be prepared.

Mr. Tipping took over his duties as Associate Director in October from the departing Finance director, Mr. John Winkelmann. The Division has four senior staff members, including one international member. A new position of Grants Administration Officer has been created and filled, and other changes are being made to fill vacant offices and eliminate unnecessary ones.

ICDDR,B had a significant change in both revenues and expenditure in 1991. Contribu tions from donors after deducting contributions for fixed asset expenditure of US$629,768 (1990 US$ 309,777) increased by 12.9% from US$8,611,886 to US$9,719,152. Net expenditure after deducting miscellaneous receipts of US$662,130 (1990 US$453,645), but excluding depreciation, increased by 7.0% from US$8,131,170 to US$8,703,158. Before provid ing for depreciation the surplus increased by 111.4% from US$480,716 to US$1,015,994 which after charging depreciation of US$568,772 (1990 US$865,041) resulted in a net surplus for the year of US$447,222 compared with a net deficit of US$384,325 for 1990. Net current assets increased by US$1,482,907 due to the surplus before depreciation and interest income on non-operating fund bank deposits.

The increase in revenue resulted mainly from additional commitments to core funds, prior years overhead rate adjustment, and contributions to disaster relief activities.

The continuing hiring freeze and strict control of expenditure coupled with the receipt of prior years overhead adjustment and devaluation of the Bagladesh Taka by 7.6% gave the Centre its first net operating surplus since 1987. Additionally the stronger financial position obviated the need to access the Centre's bank overdraft facilities.

Contributions received from donors to the work of the Centre over the past six years are shown in the table.

EXTERNAL RELATIONS

The table shows an analysis of the contributions made to ICDDR,B in 1991 by funding category (central/core, project and capital) and donor. The year saw a 10% increase in the central/core contributions but there was a 9% reduction in the total amount of money made available to the Centre. This reduction occurred despite the renewed donor confidence in ICDDR,B and its work and the $ 320,000 increase in capital contributions.

The **Government of Bangladesh (GoB)** representatives at the Donor Support Group meeting in November stressed the excellent relations that the host country is now enjoying with the Centre. Both the Minister and Secretary for Health and Family Welfare expressed the government's full, unconditional, and unequivocal support for ICDDR,B.

Central/Core Funds: The increased level of central/core funding reflects donors' moves

Contributions to ICDDR,B during the last 6 years on the basis of cash received in US$.
(see note 5: Auditors Report).

	1991	1990	1989	1988	1987	1986
Central Funds:						
Australia - AIDAB	214,803	185,711	191,845	216,893	126,325	123,237
Belgium - BADC	50,074	105,906	22,851	-	-	-
Bangladesh	26,458	21,042	37,288	38,071	-	59,311
Canada - CIDA	862,790	-	-	-	-	-
China	-	-	-	-	-	10,000
ICHF	5,000	-	-	2,649	1,217	-
Norway - NORAD	-	35,730	-	-	-	-
Saudia Arabia	57,275	-	-	70,000	-	70,000
Sweden - SAREC	491,836	93,007	-	-	-	117,810
Switzerland - SDC	856,571	836,533	709,212	792,931	-	780,309
UNICEF	250,000	250,000	250,000	250,000	250,000	500,000
United Kingdom - ODA	259,664	520,290	253,410	-	230,302	206,448
United States - AID	300,000	1,000,000	300,000	275,000	250,000	500,000
Total Central Funds	3,374,471	3,048,219	1,764,606	1,645,544	857,844	2,367,115
Project Funds:						
Aga Khan Foundation	-	-	< 69,582 >	155,983	45,585	17,951
Australia - AIDAB	-	14,566	46,180	-	-	7,997
Arab Gulf Fund	-	-	235,440	-	250,000	-
BAYER AG	30,000	-	122,000	-	-	-
Belgium - BADC	236,065	500,121	137,104	193,880	243,045	114,739
BOSTID	-	-	19,337	23,221	28,425	22,170
Canada - CIDA	-	452,932	1,153,661	599,143	953,979	1,021,677
Case Western Reserve University	-	-	-	-	12,160	12,782
Denmark - DANIDA	83,773	131,830	662,957	511,989	509,589	-
FAO	-	-	-	-	-	37,987
Ford Foundation	59,475	79,574	39,226	319,498	-	68,349
France	17,752	15,698	11,445	-	55,568	-
ICHF	-	10,000	-	6,675	2,890	-
IDRC	66,357	38,332	68,082	-	53,864	93,796
IBM	-	-	-	-	30,916	-
IBRD	-	-	25,110	184,000	174,753	78,863
Japan	-	380,000	380,000	310,000	295,176	320,000
Kanton Hospital, Switzerland	-	-	9,880	-	-	-
Medecins Sans Frontieres	-	-	-	-	-	24,063
Miles Pharmaceuticals	-	-	-	-	107,822	47,399
Nestle	-	-	-	3,704	2,793	9,205
Netherlands	162,005	875,748	37,817	50,000	7,335	-
Norway - NORAD	110,158	164,014	395,913	308,291	459,364	427,827
Norwich Eaton Pharmaceuticals	-	-	-	-	12,086	22,500
OPEC	-	-	-	-	-	30,000
Population Council	-	-	-	-	13,438	5,352
Saudi Arabia	-	-	406,333	-	530,708	536,596
Sweden - SAREC	255,560	86,795	-	-	1,000	-
SKF	40,141	33,189	-	-	-	-
Searle France	-	-	15,000	15,000	-	-

continued....

continued....

	1991	1990	1989	1988	1987	1986
Switzerland - SDC	306,872	779,805	446,696	-	138,920	-
UK - ODA	20,554	5,889	-	-	-	-
UNDP/UNROB	-	-	-	-	-	43,571
UNDP - UVP	-	-	-	-	-	103,154
UNDP/WHO	455,218	300,000	312,138	-	300,000	388,000
UNICEF	86,811	37,401	6,000	57,580	193,665	335,480
United States - AID	2,629,969	2,420,006	4,653,2[illegible]	3,786,737	3,189,544	3,167,627
WHO	40,100	271,290	175,814	201,563	195,040	88,104
Welcome Trust	-	-	17,228	28,658	29,019	-
WUSC/CIDA	875,548	690,105	689,662	571,879	-	-
Disaster Relief Funds	278,314	-	354,474	464,494	-	-
Others	20,440	5,324	8,238	648	922	10,664
Total Project Funds	5,775,112	7,292,619	10,359,367	7,792,943	7,837,626	7,035,853
Capital Funds:						
Sasakawa Foundation	300,000		-	-	-	-
UNCDF	50,568	28,788	272,159	526,420	-	-
Total Capital Funds	350,568	28,788	272,159	526,420		-
GRAND TOTAL US$	9,500,151	10,369,626	12,396,132	9,964,907	8,695,470	9,402,968

towards addressing the long standing need to recognise the value and necessity of supporting the institution and the infrastructure that allows ICDDR,B to conduct research. In addition, because of their satisfaction with the Centre and its work, many donors have commenced long term, multi year grant agreements, thus addressing the need to create financial stability to allow effective planning of the organisation's activities.

Major donors who have taken these steps and signed new agreements in 1991 include.

CIDA (Canada) which has committed Canadian $ 3,000,000 over 4 years. **USAID/Washington** (USA) which has committed $ 6,500,000 over 5 years. **SAREC** (Sweden) which has committed SEK 2,000,000 over 2 years, an increase of 50% over the contributions made under the previous agreement.

The **Government of Bangladesh** increased its cash and in kind support for the Centre by over 25% over the previous year. **BADC** (Belgium) increased its contributions to the central/core by 15% over the previous year.

Project Funds: Significant increases in the amount of project funding during the year include:

SAREC which is assisting the Centre through three institution collaboration agreements with universities in Sweden.

USAID/Washington which committed $ 500,000 for vital Vitamin A research work.

USAID/Dhaka which entered into a new two year agreement to further develop the Urban Volunteer Program now the Urban Health Extension Project (UHEP).

UNICEF which has begun to use the ICDDR,B as a resource centre; this is reflected in the increased level of project funding.

WUSC/CIDA which added an additional component to their on going activities.

Nonetheless, the total project funding fell by over 20% from its 1990 level. As was noted at the Donor Support Group meeting in November, the maintenance of the Centre's excellence and productivity in 1991, despite the decrease in project and overall funding, is a considerable achievement.

Capital Funds: The increase in capital contributions was largely due to the generous donation of $ 300,000 by the **Sasakawa Foundation** (Japan) for the construction of training facilities.

Total funds: As is clear from the Figure, the overall funding of ICDDR,B slumped to its 1986 level. This is despite cumulative inflation well in excess of 100%, and thus a doubling of costs in the intervening period. The Centre will require assistance in broadening its portfolio of donors, and in raising additional funds from existing donors.

To carry out the focal work that has been endorsed by the Support Group and the Board of Trustees, contributions must increase to sustain progress, especially in the light of inflation. The imbalance between core and project contributions needs close examination, and a fair degree of stability in funding is essential. Mr. Timothy Rothermel, Director of Global and Inter Regional Projects, UNDP. (Chairman of the November 1991 Donor Support Group meeting).

ICDDR,B thanks all its current donors for their continued contributions and the optimism and support offered at the Support Group meeting where the Chairman of the Finance Committee of the Board of Trustees, posed five challenges to the assembled participants:

** Ensuring the appropriateness of the capital and physical plant available to the institution.

** Shifting contributions from project to core, to maintain a structure that is able to respond flexibly to research and challenges produced by essential health service research needs here and in other countries. This would also be assisted through the development of the ICDDR,B Reserve Fund established to provide interest to cover any deficiencies in core contributions. Currently, it stands at only $ 1.7 million, little more than 10% of the $ 15 million target.

** Ensuring the stability of funding to the Cen tre to allow effective forward planning of its activities.

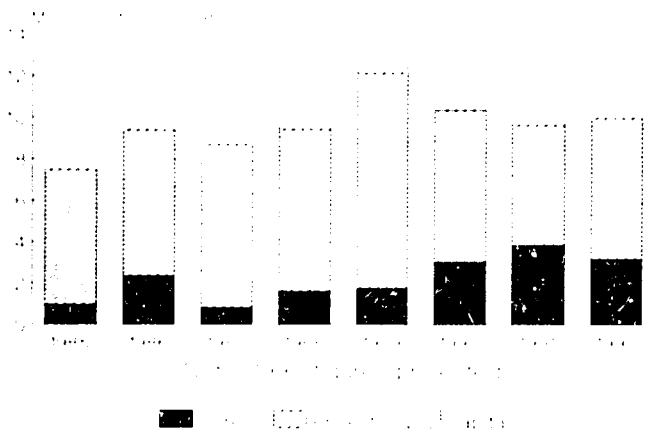
** Making special funds available for the further rationalisation and development, to allow ICDDR,B to realise its potential.

** Contributing as individuals and as donor agencies to the Hospital Endowment Fund.

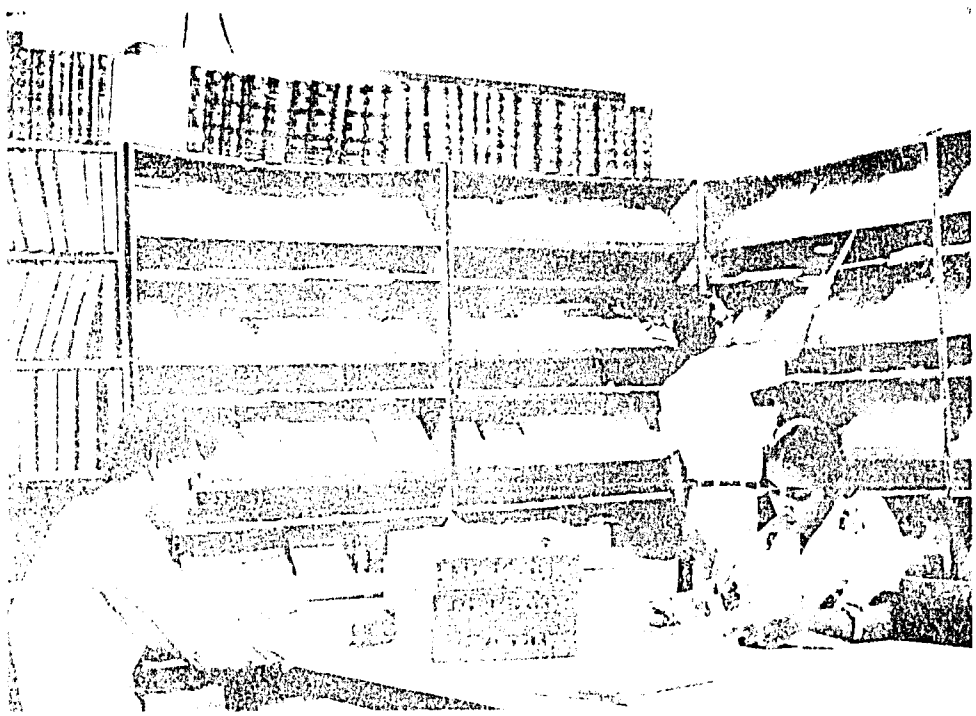
Prof. V.I. Mathan (India)

ICDDR,B hopes that its well - wishers will rise to these challenges and enable the Centre to realise its huge potential to meet the continu - ing global challenges posed by diarrhoeal disease and related health problems.

Contributions received 1985 1992



Internal publication series
Original scientific papers
Review articles
Proceedings, monographs, book chapters
Abstracts, letters, editorials, annotations



Asem Ansari

Students perusing scientific journals in the ICDDR,B library.

SCIENTIFIC PUBLICATIONS - 1991

A INTERNAL PUBLICATION SERIES:

A1 ICDDR,B Annual report, 1990. June 1991. 99 p.

Specialized Bibliography Series

A2 Annotated bibliography on laboratory diagnosis of diarrhoeal diseases, 1985 - 1991, compiled by M Shamsul Islam Khan, Farhad Hossain, and M Motasem Ali. Editor in Chief: M John Albert. Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh, 1991. ix, 133 p. (Specialized bibliography series, 16)

Special Publication

A3 Annual scientific conference of International Centre for Diarrhoeal Disease Research, Bangladesh, Dhaka, 26 - 28 October 1991; programme & abstracts. Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh, 1991. iii, 82 p.

A4 Demographic Surveillance System - Matlab. V. 15. Registration of demographic events - 1984. Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh, 1991. vi, 74 p. (Scientific report, 67)

A5 Scientific achievements of the ICDDR,B, 1979 - 1990. Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh, 1991. 99 p. (Special publication, 27)

Monograph

A6 Aziz KMA, Islam MS. Community participation in the management of diarrhoeal diseases: a review. Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh, 1991. 64 p. (Monograph, 4)

Journal and Newsletter

A7 Journal of Diarrhoeal Diseases Research (also includes: Bibliography on Diarrhoeal Diseases). V. 9, nos. 1 - 4, 1991.

A8 Glimpse. V. 12, no. 6, 1990 and v. 13, nos. 1 - 5, 1991.

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D2 Albert MJ, Haider K, Nahar S, Kibriya AKMG, Hossain MA. Multiresistant *Salmonella typhi* in Bangladesh [letter]. J Antimicrob Chemother 1991 Apr;27(4): 554 - 5

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* Abstracts published in conference proceedings/brochures are not included in this list. The complete list of abstracts is available from the ICDDR,B library.

APPENDIX A

AUDITORS' REPORT
TO THE BOARD OF TRUSTEES OF
INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

We have examined the Balance Sheet of International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) as of December 31, 1991 and the related Statement of Income and Expenditure (Operating Fund) for the year then ended which are in agreement with the books of account maintained by the Centre and produced to us. Our examination was made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion and to the best of our information and according to the explanations given to us, the annexed Balance Sheet and the annexed Statement of Income and Expenditure together with the notes attached thereto, present respectively a true and fair view of the state of affairs of the Centre as at December 31, 1991 and the results of its operations for the year then ended.

HODA VASI CHOWDHURY & CO
Chartered Accountants

DELOITTE HASKINS & SELLS
Chartered Accountants

Dhaka, March 18, 1992

Asem Ansari

The auditors signing the annual accounts in the office of Mr. Enam A. Chowdhury, Secretary, Economic Relations Division, Ministry of Finance, Government of Bangladesh, and a Member of the ICDDR,B Board of Trustees.

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

BALANCE SHEET AS AT DECEMBER 31, 1991

	Notes		1991	1990
FIXED ASSETS:				
Cost	(3)		9,212,484	8,586,534
Less: Accumulated Depreciation	(3)		5,617,504	5,082,493
			3,594,980	3,504,041
CURRENT ASSETS:				
Stock of stores and spares	(4)		350,726	410,201
Contributions receivable from Donors	(5)		825,652	597,582
Advances, deposits and other receivables	(6)		607,800	341,464
Deposits with Banks against Fixed Asset Replacement Fund	(7)		569,000	200,000
Deposits with Banks against Reserve Fund	(8)		2,109,695	1,978,248
Deposits with Banks against Hospital Endowment Fund	(9)		5,851	-
Cash and bank balances	(10)		2,445,115	2,859,984
			6,913,839	6,387,479
LESS: CURRENT LIABILITIES:				
Interest free loan	(11)		1,186,080	1,186,080
Contributions paid in advance by Donors	(5)		1,206,680	2,157,947
Other current liabilities	(12)		1,613,380	1,618,660
			4,006,140	4,962,687
NET CURRENT ASSETS			2,907,699	1,424,792
		US$	6,502,679	4,928,833

THE ATTACHED NOTES 1 TO 21 CONSTITUTE AN INTEGRAL PART OF THESE ACCOUNTS

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

BALANCE SHEET AS AT DECEMBER 31, 1991

(...Continued)

	Notes		1991	1990
FINANCED BY:				
Fixed Asset Fund	(13)		9,512,484	8,770,216
Fixed Asset Replacement Fund	(14)		757,944	288,429
Reserve Fund	(15)		2,109,695	1,978,248
Hospital Endowment Fund	(16)		15,577	-
Operating Fund	(17)		(5,893,021)	(6,108,060)
		US$	6,502,679	4,928,833

THE ATTACHED NOTES 1 TO 21 CONSTITUTE AN INTEGRAL PART OF THESE ACCOUNTS

Director
ICDDR,B

Member
Board of Trustees

This is the Balance Sheet referred to in our report of same date.

HODA VASI CHOWDHURY & CO.
Chartered Accountants

DELOITTE HASKINS & SELLS
Chartered Accountants

Dhaka, March 18, 1992

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

STATEMENT OF INCOME AND EXPENDITURE (OPERATING FUND) FOR THE YEAR ENDED DECEMBER 31, 1991

	Notes		1991	1990
INCOME				
Contributions	(5)		10,348,920	8,921,663
LESS: Transferred to Fixed Asset Fund to the extent of capital expenditure	(13)		629,768	309,777
			9,719,152	8,611,886
ADD: Exchange gains			23,479	135,153
Other receipts			638,701	318,492
			10,381,332	9,065,531
EXPENDITURE				
Personnel salaries and benefits - local			4,966,779	5,144,707
Personnel salaries and benefits - international			1,078,425	1,108,329
Consultancy local and international			211,051	106,488
Mandatory Committee Meetings	(19)		137,353	94,928
Travel			183,712	177,014
Supplies and materials			1,347,413	801,265
Repairs and maintenance			93,637	78,027
Rent, communication and public utilities			315,480	305,277
Printing and publications			204,520	108,265
Other items			826,768	660,515
			9,365,338	8,584,815
Surplus before depreciation			1,015,994	480,716
LESS: Provision for depreciation	(3)		568,772	865,041
SURPLUS/(DEFICIT) OF INCOME OVER EXPENDITURE FOR THE YEAR		US$	447,222	(384,325)

THE ATTACHED NOTES 1 TO 21 CONSTITUTE AN INTEGRAL PART OF THESE ACCOUNTS

Director
ICDDR,B

Member
Board of Trustees

This is the Statement of Income and Expenditure referred to in our report of same date.

HODA VASI CHOWDHURY & CO.
Chartered Accountants

DELOITTE HASKINS & SELLS
Chartered Accountants

Dhaka, March 18, 1992

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INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

STATEMENT OF SOURCES AND APPLICATIONS OF FUNDS FOR THE YEAR ENDED DECEMBER 31, 1991

		1991	1990
SOURCES			
* Net Operating Surplus/(Deficit)		1,013,591	509,464
Increase in Fixed Asset Fund			
Donors' contributions utilised for capital expenditure		629,768	309,777
Donors' restricted funds for construction of a hospital at Matlab and training centre at Dhaka:			
Cash		329,517	48,788
In kind		1,051	
		960,336	358,565
Increase in Fixed Asset Replacement Fund			
Interest received on time deposits		19,264	--
Increase in Reserve Fund			
Interest received on time deposits		131,447	80,596
Interest accrued on time deposits			78,579
		131,447	159,175
Increase in Hospital Endowment Fund			
Donations received		15,577	--
Proceeds from sale of fixed assets		3,028	2,958
	US$	2,143,243	1,030,162
APPLICATIONS			
Additions to fixed assets		1,380,994	260,738
(Decrease)/Increase in capital work in progress		(720,658)	72,901
Increase in net current assets		1,482,907	696,523
	US$	2,143,243	1,030,162

* CALCULATION OF NET OPERATING SURPLUS/(DEFICIT)

Surplus/(Deficit) appearing in the Statement of Income and Expenditure (Operating Fund)		447,222	(384,325)
Add: Depreciation charge for the year		568,772	865,041
(Profit)/Loss on sale of fixed assets		(2,403)	28,748
	US$	1,013,591	509,464

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED DECEMBER 31, 1991

1. NATURE OF ACTIVITIES

The International Centre for Diarrhoeal Disease Research, Bangladesh (here in after referred to as the Centre) was established in 1978 by an Ordinance of the Government of The People's Republic of Bangladesh to provide for the establishment of an international centre in Bangladesh with multinational scientific collaboration and financial contribution to conduct research in diarrhoeal diseases and the directly related subjects of nutrition and fertility with special relevance to developing countries and for matters ancillary thereto. The activities of the Centre are mainly funded by various Governments and international organisations.

2. SIGNIFICANT ACCOUNTING POLICIES

i) These accounts have been prepared on a going concern basis and in accordance with generally accepted accounting principles on the historical cost convention.

ii) The Statement of Income and Expenditure and the Balance Sheet of the Centre are prepared in the manner as prescribed and approved by the Board of Trustees.

iii) Income and Expenditure of the Centre for the year have been accounted for on an accrual basis except other receipts which are accounted for on a cash receipt basis in conformity with the past practice.

iv) Contributions have been considered as income on the following bases.

(a) Core Funds have been accrued to the extent they relate to the current period and those pertaining to future periods have been carried forward.

(b) Project Funds received during the year but not expended have been carried forward as contributions received in advance. Correspondingly, amounts equal to the expenses incurred but not yet reimbursed by donors have been treated as contributions receivable. Project funds include overhead recoveries at the rate provided for in the various Donor agreements.

v) Other receipts mainly include interest and fees and charges for services provided to staff and third parties.

vi) Grants by way of various services rendered by the various Donor agencies and those directly paid by Donor(s) to other organisation(s) and those directly paid to other institutions have not been considered in these accounts.

vii) Fixed assets acquired up to August 1981 have been brought to account at material cost only. Subsequent to that date incidental expenses such as labour, freight, insurance, etc. (excluding clearing charges) have also been taken into consideration in arriving at the cost of fixed assets. Depreciation on fixed assets has been charged on the 'Straight Line' method based on the estimated useful lives of such assets.

viii) Stores and spares are valued at invoice price less a provision to cover obsolete and slow moving items. Stores and spares issued to Service Centres other than those issued to Matlab Health Complex are expensed when issued and as the stock of such items remaining unconsumed at the year end is considered immaterial it is not included in the closing stock.

ix) Currency conversion of non - US currencies to US Dollars:

a) Advances, liabilities (except interest free loan), cash and bank balances are translated into US Dollar at the prevailing year end exchange rates.

b) All items other than those stated under (a) above are translated into US Dollar at the rates of exchange prevailing at the beginning of that month.

x) All assets costing US$50 or below have been depreciated in full by way of a one time depreciation charge.

3. FIXED ASSETS

PARTICULARS		COST				DEPRECIATION				
		At January 1 1991	Additions during the year	Disposals/ adjustments during the year	At December 31, 1991	At January 1 1991	Charge for the year	Adjustments during the year	At December 31, 1991	Net Book value as at December 31, 1991
Land		71,362			71,362					71,362
Buildings		1,953,433	940,783		2,894,216	535,620	106,534		642,154	2,252,062
Vehicles		639,478	14,521	5,439	648,560	505,494	58,199	5,437	558,256	90,304
Furniture		418,116	31,705	26,513	423,308	374,099	23,463	26,137	371,425	51,883
Equipment		4,601,038	393,985	2,434	4,992,589	3,667,260	380,576	2,187	4,045,669	946,920
Capital Work in progress		903,107	216,843	937,501	182,449					182,449
1991	US$	8,586,534	1,597,837	971,887	9,212,484	5,082,493	568,772	33,761	5,617,504	3,594,980
1990	US$	8,311,350	421,126	145,942	8,586,534	4,244,201	865,041	26,749	5,082,493	3,504,041

i) Two plots of land measuring 4.10 and 0.51 acres situated at Mohakhali (Dhaka) and Matlab (Chandpur), received as donations from the Government of the People's Republic of Bangladesh and a private individual respectively, have not been valued and therefore not incorporated in these accounts.

ii) Cost of buildings includes an amount of US$103,488 spent by the Centre on the extension of the Institute of Public Health building, owned by the Government of the People's Republic of Bangladesh and which is at present partly accommodating the Centre.

iii) No provision for depreciation on fixed assets has been made up to December 31, 1982.

4. STOCK OF STORES AND SPARES

		1991	1990
Supply stores		240,361	283,268
Maintenance stores		98,077	126,933
		338,438	410,201
Stores in transit		28,811	-
		367,249	410,201
Less: Provision for obsolete and slow moving stock		16,523	-
	US$	350,726	410,201

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5. CONTRIBUTIONS

Donor	Advances/ (Receivable) as at 1.1.91	1991				1990
		Received during the Year	Receivable as at 31.12.91	Advances Carried to 1992	Income for the Year	Income
1	2	3	4	5	6	7
Core Funds:						
Australia - AIDAB		214,803			214,803	185,711
Bangladesh	(6,653)	26,458	6,365		26,170	27,695
Belgium - BADC		50,074			50,074	55,976
Canada - CIDA		862,790			862,790	
ICHF		5,000			5,000	
Norway - NORAD						35,731
Saudi Arabia		57,275			57,275	
Sweden - SAREC	(84,607)	491,836		173,307	233,922	87,854
Switzerland - SDC		856,571			856,571	836,533
United States - AID		300,000	100,000		400,000	1,000,000
United Kingdom - ODA	134,078	259,664		129,832	263,910	386,212
UNICEF		250,000			250,000	250,000
Total Core Funds (A)	42,818	3,374,471	106,365	303,139	3,220,515	2,865,712
Project Funds:						
Aga Khan Foundation						
- Kenya Project	10,000			10,000		2,338
Australia - AIDAB						
- HBC study & training	17,012			3,209	13,803	26,556
- Consultant to LSD	10,693			7,238	3,455	3,872
BRAC						18
Belgium - BADC	287,340	236,065		163,575	359,830	233,016
Bayer Ag	12,759	30,000		19,541	23,218	74,760
Canada - CIDA						
- DSS	5,081				5,081	198,717
- Training	13,555		1,269		14,824	7,323
- External review	2,438		810		3,248	6,982
Denmark - DANIDA - CHP	187,763	83,773		65,640	205,896	169,641
Ford Foundation	(8,057)	59,475	297		51,715	113,227
France	27,033	17,752		16,545	29,000	4,043
HKI - Nutritional Surveillance	(3,134)	8,440	3,340		8,646	4,690
ICHF						5,000
IDRC - Environment & Child Survival		55,791		12,702	43,089	
- ICDDR,B Fellowship	(4,016)	9,329			5,313	8,184
- DISC	20,535	1,237			21,772	43,547
Japan - CSD, LSD & TRN	143,170		291,637		434,807	387,000
Kanton Hospital, Switzerland	7,393				7,393	2,487
Norway - NORAD - MCH/FP Matlab	162,104	110,158	38,300		310,562	290,910
Norwich Eaton - Furazolidone	4,030				4,030	900

continued....

5. CONTRIBUTIONS (...continued)

Donor	Advances/ (Receivable) as at 1.1.91	1991				1990 Income
		Received during the Year	Receivable as at 31.12.91	Advances Carried to 1992	Income for the Year	
1	2	3	4	5	6	7
Netherlands - ARI Projects	(105,261)	162,005	5,813		62,557	113,898
- DSS Activities	171,496		100,000		271,496	647,647
- X-ray machine	2,185				2,185	3,245
Rand Corporation		8,000			8,000	
Sandoz Ltd.	(547)	4,000			3,453	
Searle - France	(20,299)		15,000		(5,299)	
Switzerland - SDC						
- DISC, Research HD & SD	524,782	306,872	97,117		928,771	309,100
Sweden - SAREC						
- Goteborg University	53,158	255,560		202,475	106,243	33,637
SKF - Albendazole	5,025	40,141		10,663	34,503	28,164
UNDP - DSS activities			19,062		19,062	
UNDP/WHO - Projects	(154,542)	450,000	42,385		337,843	16 752
- GOPP Workshop	(5,217)	5,218			1	
UNICEF - Research	37,401	76,300		45,845	67,856	
- Training	(2,538)	10,511			7,973	2,538
United Kingdom - ODA						
- Ascaris Comparison	(6,930)	20,554			13,624	11,222
United States - AID						
- Training	(1,300)	26,300			25,000	20,050
- Coop. Agreement		756,052		11,980	744,072	499,937
- Child Health/UVP	76,990	546,759		34,628	589,121	657,460
- MCH/FP Extension	64,996	1,300,858		119,210	1,246,644	1,073,748
WUSC - MCH/FP & Matlab	(131,579)	875,548	57,704		801,673	741,914
WHO	133,268	40,100		81,980	88,388	166,428
Disaster Relief Activities		278,314	46,553	95,310	229,557	
Total Project Funds (B)	1,537,547	5,775,112	719,287	903,541	7,128,405	6,055,951
Total Contributions (A + B)	1,580,365	9,149,583	825,652	1,206,680	10,348,920	8,921,663
Fixed Asset Fund						
UNCDF - Matlab Hospital	(20,000)	50,568			30,568	48,788
Sasakawa Foundation						
- Dhaka Training Centre		300,000			300,000	
Total Fixed Assets Funds (C)	(20,000)	350,568			330,568	48,788
Grand Total (A + B + C) US$	1,560,365	9,500,151	825,652	1,206,680	10,679,488	8,970,451

Note: The contribution to project funds from Switzerland - SDC includes:

a) irrevocable letters of credit for the supply of capital equipment and

b) non refundable sponsored and committed project expenditure rolling over to the subsequent year.

6. ADVANCES, DEPOSITS AND OTHER RECEIVABLES

		1991	1990
Advances to employees:			
- Official		73,391	33,489
- Personal		364,281	61,945
- Other		-	(120)
		437,672	95,314
Operating advances to Projects (including cash and bank balances of the projects US$ 5,652, 1990: US$ 9,343)		20,069	23,859
Advances to Suppliers & Others		103,619	148,665
Deposits		2,927	3,263
Other receivables		43,513	70,363
	US$	607,800	341,464

7. DEPOSITS WITH BANKS AGAINST FIXED ASSET REPLACEMENT FUND

American Express Bank Ltd., Dhaka			
- Time Deposit	US$	569,000	200,000

8. DEPOSITS WITH BANKS AGAINST RESERVE FUND

American Express Bank Ltd. -			
New York			
- Time Deposit		500,000	500,000
- Current Account		8,091	1,448
Dhaka			
- Time Deposit (includes accrued interest US$Nil, 1990: US$78,579)		1,601,000	1,471,579
- Current Account		604	5,221
	US$	2,109,695	1,978,248

9. DEPOSITS WITH BANKS AGAINST HOSPITAL ENDOWMENT FUND

Agrani Bank, Dhaka			
- Time Deposit		5,240	-
- Savings Bank Account		611	-
	US$	5,851	-

10. CASH AND BANK BALANCES

		1991	1990
Cash in hand			
(Taka converted to US Dollar)		434	1,128
Cash at banks:			
(including remittances in transit US$14,416 and cheques in hand US$210,484)			
Taka Account			
American Express Bank Ltd., Dhaka			
- Current Account (Convertible - NORAD)		16	21,725
- Time Deposit - NORAD		-	141,659
- Current Account (Convertible)		21,897	28,963
- Current Account (UNCDF Fund)		-	39,222
- Current Account		275	110
- Time Deposit		1,033,968	404,318
Agrani Bank, Dhaka			
- Current Account		25,988	63,989
		1,082,144	699,986
US$ Accounts			
American Express Bank Ltd.			
New York			
- Current Account		61,066	49,235
Dhaka			
- Current Account		29,718	424,781
- Current Account (USAID - MCH) - 2nd cont.		194,277	143,136
- Current Account (USAID - MCH)		-	38
- Current Account (USAID - UVP)		220,205	128,501
- Time Deposit		850,000	1,400,000
		1,355,266	2,145,691
UK£ Account			
American Express Bank Ltd., London			
- Current Account		7,271	13,179
	US$	2,445,115	2,859,984

11. INTEREST FREE LOAN

In May 1983, the Centre was provided by the Government of the People's Republic of Bangladesh with an interest free loan of Tk. 28,928,775 (US$1,186,080 converted at the then exchange rate) initially for a period of one year. After several extensions by the Government the repayment date expired on June 30, 1986. In terms of the loan, the Centre is liable to pay interest at the prevailing commercial lending rate if the loan remained unpaid beyond the

expiry of the period of repayment which at the option of the Centre can be effected either in Taka or in foreign currency. No provision for interest has been made in these accounts in this regard as the Centre holds the view that the loan should be converted into a grant since it was originally intended to be a grant to the Centre by UNROB and was utilised for providing free medical treatment to patients in Bangladesh as well as to provide free training to Bangladeshis.

12. OTHER CURRENT LIABILITIES

		1991	1990
For supplies and materials		397,947	171,876
For expenses (includes advance lease rentals US$44,802, 1990: US$61,240)		1,145,408	1,385,645
Security and other deposits		70,025	61,139
	US$	1,613,380	1,618,660

13. FIXED ASSET FUND

Balance as at January 1		8,770,216	8,411,651
Add: Capital contributions received			
- in cash		329,517	48,788
- in kind		1,051	-
Transferred from the Statement of Income and Expenditure to the extent of capital expenditure incurred during the year (net of capital contribution received during the year)		629,768	309,777
		9,730,552	8,770,216
Less: Transferred to Operating Fund			
- Cost of fixed assets sold		34,386	58,455
- Prior years adjustment		183,682	(58,455)
	US$	9,512,484	8,770,216

The fixed asset fund reflects contributions from Donors and Centre expenditure for fixed assets. It is equal to the gross book value of fixed assets except where contributions have been received but not fully expended in the year of receipt. At the end of 1991 the amount not expended was US$300,000.

14. FIXED ASSET REPLACEMENT FUND

Balance as at January 1		288,429	-
Add: Net interest earned on deposits		19,264	-
Transfer from Operating Fund		507,997	288,429
		815,690	288,429
Less: Funds utilised for replacement of fixed assets		57,746	-
	US$	757,944	288,429

The fixed asset replacement fund was created to provide for the acquisition or replacement of fixed assets. It is the intention to build the fund up to an amount equal to the provision for depreciation by annual transfers of a percentage of the cash surplus, before providing for depreciation, and by income earned on investment of the fund.

15. RESERVE FUND

		1991	1990
Balance as at January 1		1,978,248	1,819,073
Add: Net interest earned on deposits (including accrued interest of US$Nil, 1990: US$78,579)		131,447	159,175
	US$	2,109,695	1,978,248

The reserve fund was created to enable the Centre to attain better financial stability and to enable it to retain a satisfactory level of work in case of uneven flow of resources beyond its control. The fund comprises donations, transfers from operating account and income earned on investment of the fund.

16. HOSPITAL ENDOWMENT FUND

Balance as at January 1		–	–
Add: Donations received		15,577	–
	US$	15,577	–

This Fund, which has been created this year at the directive of the Board of Trustees at their meeting held in June 1991, is to receive donations which are to be invested in a secure manner so as to generate maximum return.

The income from such investments, after deducting any administrative costs is to be utilised for patient care in the Centre's hospitals.

17. OPERATING FUND

Balance as at January 1		(6,108,060)	(5,435,306)
Less: Surplus/(Deficit) for the year		447,222	(384,325)
Transfer from Fixed Asset Fund		218,068	–
Transfer from Fixed Asset Replacement Fund		57,746	–
		(5,385,024)	(5,819,631)
Add: 50%, (1990: 60%) of cash surplus (before depreciation) for the year transferred to Fixed Asset Replacement Fund		507,997	288,429
	US$	(5,893,021)	(6,108,060)

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18. EMPLOYEES RETIREMENT FUND

i) The Centre operates a retirement fund called "**ICDDR,B Employees Separation Payment Fund**" for all National employees with GENERALI GROUP of UK under an agreement between ICDDR,B and Institute of International Education (IIE), USA. During the year the Centre and staff members contributed 14.8% and 7.4% of the base pay respectively to the fund. The amounts so accumulated are remitted to GENERALI GROUP through IIE on a quarterly basis by the Centre. The GENERALI GROUP is empowered to invest the fund available with them as considered profitable by them and at the end of each calendar year the profits earned from these investments are distributed among the staff members' accounts. This accumulated fund which at December 31, 1991 was estimated at US$6,561,560, (1990: US$5,607,839) is not reflected in the books of account as it is not considered a part of the Centre's assets.

ii) The Centre operates a fund called "ICDDR,B Severance Pay Fund" for Community Health Workers since July 01, 1987 which fund is not reflected in these accounts. The balance of this fund stands at US$67,728, (1990: US$52,655) as at December 31, 1991.

19. HONORARIUM

The expenses under Mandatory committee meetings" include an amount of US$20,709, (1990: US$17,552) paid as honorarium to the members of the Board of Trustees.

20. CURRENCY TRANSLATION

Currency	Average monthly exchange rates	Year - end exchange rate
	US$	US$
Tk. 1.00	0.0276	0.0262
UK £ 1.00	1.7758	1.8756

21. OTHERS

The previous year's figures have been rearranged and regrouped, wherever considered necessary, to conform to the current year's presentation.

Figures appearing in these Accounts have been rounded off to the nearest US dollar.

Director
ICDDR,B

Member
Board of Trustees

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APPENDIX B

ACRONYMS AND ABBREVIATIONS

A&PD	Administration & Personnel Division
ARI	Acute respiratory infections
BADC	Belgian Administration for Development Cooperation
BBS	Bangladesh Bureau of Statistics
BRAC	Bangladesh Rural Advancement Committee
CDC	Centers for Diseases Control
CHD	Community Health Division
CHP	Child Health Programme
CHW	Community Health Worker
CIDA	Canadian International Development Agency
CIS	Computer Information Services
COTC	Community operated Treatment Centres
CPU	Central processing unit
CRC	Clinical Research Centre
CSD	Clinical Sciences Division
DANIDA	Danish International Development Agency
DISC	Diarrhoeal Diseases Information Services Centre
DSS	Demographic Surveillance System
EAggEC	Enteroaggregative *E coli*
ECPP	Epidemic Control Preparedness Programme
EHEC	Enterohaemorrhagic *E.coli*
EIEC	Enteroinvasive *E.coli*
ELISA	Enzyme linked immunosorbent assay
EPEC	Enteropathogenic *E.coli*
EPI	Expanded Programme of Immunization
ERC	Ethical Review Committee
ETEC	Enterotoxigenic *E.coli*
FWV	Family Welfare Visitors
IBM	International Business Machines
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh
ICHF	International Child Health Foundation
IDRC	International Development Research Centre (Canada)
IPGM&R	Institute of Post graduate Medicine and Research
IPH	Institute of Public Health
JDDR	Journal of Diarrhoeal Diseases Research
LFPV	Lady Family Planning Visitors
LSD	Laboratory Sciences Division
LT	Heat - labile toxin
MCH/FP	Maternal and Child Health - Family Planning
MOHFW	Ministry of Health and Family Welfare
MUAC	Mid - upper - arm circumference
NGO	Non - governmental organisation
NIPSOM	National Institute of Preventive and Social Medicine
NORAD	Norwegian Agency for Development
ODA	Overseas Development Administration (UK)
ORS	Oral rehydration salts; oral rehydration solution
ORT	Oral rehydration therapy
PCC	Programme Coordination Committee
PCR	Polymerase Chain Reaction
PSED	Population Science and Extension Division
RKS	Record Keeping System
SAARC	South Asian Association for Regional Cooperation
SAREC	Swedish Agency for Research Cooperation with Developing Countries
SDC	Swiss Development Cooperation
SRS	Sample Registration System
ST	Heat stable toxin
SWA	Staff Welfare Association
TBA	Traditional Birth Attendant
TMP - SMX	Trimethoprim sulphamethoxazole
UHEP	Urban Health Extention Project
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNFPA	United Nations Fund for Population Activities
UNICEF	United Nations Childrens' Fund
UNROB	United Nations Relief Organisation in Bangladesh
US AID	United States Agency for International Development
USS	Urban Surveillance System
UVP	Urban Volunteers Programme
WHO	World Health Organization
WUSC	World University Service of Canada

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ICDDR,B PUBLICATIONS

PROCEEDINGS OF THE NATIONAL WORKSHOP ON ORAL REHYDRATION
Editors: K.M.S. Aziz and J.L. Beckett
October 1980. 23 pages. ICDDR,B Special publication no. 9
Price: US$ 4.00

BELIEFS AND FERTILITY IN BANGLADESH
By C Maloney, K.M.A. Aziz and P.C. Sarker
December 1931 xv, 366 pages. ICDDR,B Monograph no. 2
Price: US$ 30.00

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Editor Shereen Rahman
November 1981 155 pages. ICDDR,B Special publication no. 15
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ANNOTATED BIBLIOGRAPHY ON NUTRIENT ABSORPTION AND DIARRHOEA MALNUTRITION CYCLE
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December 1991. vol. 15, 74 pages
Scientific Report no. 67
Price: US$ 9.00

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AN APPEAL

ICDDR,B
Endowment Fund

Each year, ICDDR,B treats over 70,000 patients attending its two hospitals, one in urban Dhaka,the other in rural Matlab. Though they are planted in Bangladeshi soil, they grow because of the dedication of thousands of concerned people throughout the world. The patients are mostly children with diarrhoea and associated illnesses and the services are offered free to the poorer section of the community.

Since these services are entirely dependent on financial support from a number of donors, now we at the ICDDR,B are establishing an entirely new endeavour: an ENDOWMENT FUND. We feel that, given securely implanted roots, the future of the hospitals can confidently depend upon the harvest of fruit from perpetually bearing vines.

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Dr. Dilip Mahalanabis
Chairman, Hospital Endowment Fund Committee
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Thank you. Signature

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RESEARCH FACILITIES AT THE ICDDR,B

Bangladesh has many major health problems in common with other developing countries, such as diarrhoeal diseases and malnutrition. It too has widespread poverty and illiteracy, an increasing population, and a health system poorly equipped to respond to these challenges. The Centre is therefore in an exceptional position to conduct research in a natural setting on the problems of diarrhoea, nutrition, fertility, and public health.

Clinical facilities

A large number of patients with diarrhoeal diseases attend the Centre's two hospitals each year, one in urban Dhaka, the other in rural Matlab. The Clinical Research Centre in Dhaka has a 25 bed research ward, a 10 bed metabolic ward, specific wards for persistent and invasive diarrhoea, a nutrition rehabilitation ward for children who have become severely malnourished from diarrhoeal diseases, and a laboratory to provide a wide range of biochemical and microbiological tests. In Matlab, the new two storey hospital complex also provides facilities for medical and maternity care, training, and research.

Research laboratories

There are well equipped and well staffed laboratories for research in bacteriology, bacterial genetics, histopathology, immunology, molecular biology, environmental microbiology, nutritional biochemistry, parasitology, and virology. The Centre has a walk in cold room and freezer, facilities for growing and isolating pathogens, a large animal house, and many items of test equipment including an atomic absorption spectrophotometer, a cobas bio analyser, a gas liquid chromatograph, a high performance liquid chromatograph, a centrifugal analyser, and a polymerase chain reaction machine.

Demographic surveillance

Information collected on vital events concerning 200,000 people in the Centre's Matlab field area over the last 26 years currently provides an unrivalled opportunity to study demographic trends, to investigate the epidemiology of ill health, and to examine the effect of providing new health services on morbidity and mortality. These data allow a multidisciplinary approach, integrating insights from the social and behavioural sciences with those gained from biomedical research.

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Staff

The Centre currently has over 200 scientific researchers and medical staff from more than nine countries doing research and providing expertise in the many disciplines related to the Centre's areas of research. ■