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AN ASSESSMENT OF THE SCIENTIFIC  
ACHIEVEMENTS OF THE INTERNATIONAL  
CENTRE FOR DIARRHOEAL DISEASE RESEARCH,  
BANGLADESH AND THEIR RELEVANCE TO  
AID HEALTH SECTOR PRIORITIES

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## EXECUTIVE SUMMARY

This document reports the findings of an AID assessment of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) which examined the scientific work of the Center in relation to AID's health sector priorities. AID's Bureau of Science and Technology/Health has been providing core support to ICDDR,B but this grant terminates during F.Y. 1983. The multi-disciplinary assessment team was charged with making recommendations about the continuation of these funds and about any ways in which the ICDDR,B program might be modified to more closely respond to AID's concerns.

ICDDR,B's scientific research is of excellent quality and of great significance to the acquisition and spread of new knowledge about diarrheal diseases. There is every reason to believe that the work of scientists at ICDDR,B, which has in the past revolutionized thinking about these diseases, will continue to contribute to the search for ways to address this critical public health problem. AID should, therefore, continue to provide generous core support to ICDDR,B.

The nature and diversity of the global diarrheal disease problem, and the ecologically determined differences in the requirements of implementation of control programs, make it impossible for ICDDR,B to carry the burden of scientific investigation alone. While the Center should continue to play a focal role, AID is encouraged to identify and support institutions in other developing countries which could undertake scientific and operational research of diarrheal diseases. ICDDR,B could assist this global effort by providing guidance and specialized technical consultation and training as new research programs are being developed elsewhere.

The program of ICDDR,B is generally balanced and appropriate. However, the assessment team was concerned about the lack of expertise in epidemiology and immunology at the Center. This deficiency has been recognized by the Board of Trustees and the Director. Remedial action is likely to happen soon. There was concern also about the use of core funds to support operational research and health service provision, but bi-lateral and other categorical funding is expected to provide most of this support. ICDDR,B's role as a training institution is unique but the Center agrees with the AID team's view that practical, field-based and laboratory bench training should take precedence over more structured learning experiences. The contributions of ICDDR,B in the areas of disease surveillance and health services research have been significant but are constrained by computer hardware limitations and the lack of a senior epidemiologist. While not wanting to see the Center place too much emphasis on these activities, the assessment team agrees that the constraints should be removed.

## I. INTRODUCTION

The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) was established in December 1978 by an ordinance of the Government of People's Republic of Bangladesh. The ordinance was subsequently ratified in February 1979 at an Interim Internationalization Committee meeting held in Geneva and chaired by the United Nations Development Program. Thirty-four countries and international agencies are currently participating in the work of the Center.

The Center succeeds the former Cholera Research Laboratory which was established in 1961 by the Governments of the United States of America and Pakistan. The United Kingdom and Australia also participated. The scientific achievements of the former Cholera Research Laboratory are well recognized internationally. Significant scientific advances included pioneering breakthroughs in understanding the pathophysiology of cholera and closely related enterotoxigenic E. coli and the development of efficacious treatment of cholera and other diarrheas first with an intravenous replacement mixture, "Dhaka Solution", and later with an oral rehydration preparation. Five major vaccine field trials, undertaken at the Matlab field station, have demonstrated that the current cholera vaccine provides only limited protection of brief duration. Other epidemiologic field studies have delineated the transmission patterns of cholera and other diarrheal diseases and have highlighted the importance of asymptomatic infections. These field studies have resulted in major policy decisions by international organizations and national governments.

The aims and objectives of this Center are:

1. To undertake and promote study, research, and dissemination of knowledge of diarrheal diseases and directly related subjects of nutrition and fertility with a view to developing improved methods of health care and for the prevention and control of diarrheal diseases and improvement of public health programs with special relevance to developing countries.
2. To provide facilities for training Bangladeshi and other nationals in areas of the Center's competence in collaboration with national and international institutions.

Central funds of the Agency for International Development (AID) provide core support to ICDDR,B. When ICDDR,B succeeded the Cholera Research Laboratory a grant of \$10 million was made by what is now AID's Bureau of Science and Technology/Health, but this annual commitment of \$1.9 million will terminate in F.Y. 1983. This AID grant to ICDDR,B accounts for approximately 40 percent of the Center's core budget, or 27 percent of the total budget.

AID also funds specific projects of the ICDDR,B, but this support derives from the USAID mission in Bangladesh and is not the subject of this assessment.

The purpose of the assessment reported on in this document was to consider the past, future and potential contributions of the ICDDR,B to areas of relevance to AID's own objectives and strategy. The assessment was conducted in Bangladesh between November 29 and December 10, 1982 by a multi-disciplinary team of four people. The visit to Dhaka coincided with a program review by ICDDR,B's Board of Trustees. The AID team members participated in most aspects of the Board's review but were not invited to attend the formal Board meeting which followed. Members of the AID team, either during this assessment or previously, visited each of ICDDR,B's field stations in Bangladesh.

The charge to the assessment team was to make recommendations about what changes, if any, may be needed for the future program and plan of action of ICDDR,B as they relate to the aims and health policy of AID. The recommendations were also to address the global significance of the Center. Questions were posed by AID about the actual and potential contributions of ICDDR,B in assisting other countries to develop national programs, in disseminating new knowledge, advising on national demographic and disease surveillance systems, and building effective training programs. These questions and related issues are addressed in Chapter IV of this report.

The report is presented in four chapters. Following this introduction, Chapter II provides an overview of ICDDR,B and documents the resources and organization of the Center. Chapter III describes the achievements of ICDDR,B and its plans for the future and is organized into sections which address each of the Center's program areas. The relevance of these achievements and plans to AID is pointed out in this discussion. The final chapter, Chapter IV, documents the conclusions and recommendations of the assessment team.

## II. OVERVIEW OF ICDDR,B

The Dhaka headquarters of ICDDR,B contains a clinical research ward and laboratories in microbiology, immunology and biochemistry. In addition, the Dhaka station contains a treatment facility which serves over 100,000 patients, as well as a library and publications unit, animal facilities, statistical and data management resources, and administrative, logistical, and maintenance support systems.

In Matlab a study population of 160,000 has been under longitudinal demographic surveillance for 15 years and in Teknaf a study population of 40,000 has been under intensive observation for 6 years. These field stations include both an independent longitudinal data collection capacity as well as selective health services for diarrhea-related illnesses. Recently research activities have been extended to Noapara and Sirajgang at the request of the Government of Bangladesh. Figure 1 shows the location of these ICDDR,B activities.

### ICDDR,B Staff

The total number of people employed by ICDDR,B is at present 1,060. This staff complement is lower than last year and it is planned to reduce it further over the next 12 to 18 months. The distribution of these employees across locations and functional categories is shown in Table 1. Only three percent of Center employees earn an international salary (34 people) and more than half of these are scientists. Eighteen of the employees on local salaries are classified as scientists (2 percent).

The range of salaries is, of course, very great with the 34 international scale employees consuming a major proportion of the personnel budget and the lowest paid worker earning only \$640 a year. The personnel costs of the research program account for 49 percent of the total personnel costs, reflecting the concentration of people on international salaries in this budget category.

The organizational structure of ICDDR,B is currently undergoing revision. The main feature at present is that the Director is the focal point and is reported to by the Deputy Director, three Associate Directors, (Resources Development, Administration and Finance, and Training, Extension and Communications) and the Program Head of each of the five research programs.

## Budget

The operating budget for 1983 and the estimated budget for 1984 are shown in Table 2. The following table, Table 3, presents the distribution of the estimated budget for the years 1980 through 1983 across budget categories. Changes in accounting and budgeting procedures, and in the fiscal year make this comparison of limited value but the table does point out some trends.

Table 4 presents the ICDDR,B estimate of donor support for 1983. About one-third of the anticipated resources derive from contributions which are to be used for specific project activities as distinct from core budget support.

## Physical Facilities and Scientific Equipment

The laboratory facilities in Dhaka are presently crowded and in need of repair and updating. The microbiology facilities are particularly weak. During the next few months some re-organization will occur as clinical facilities are transferred to a new building and space becomes available in the main structure.

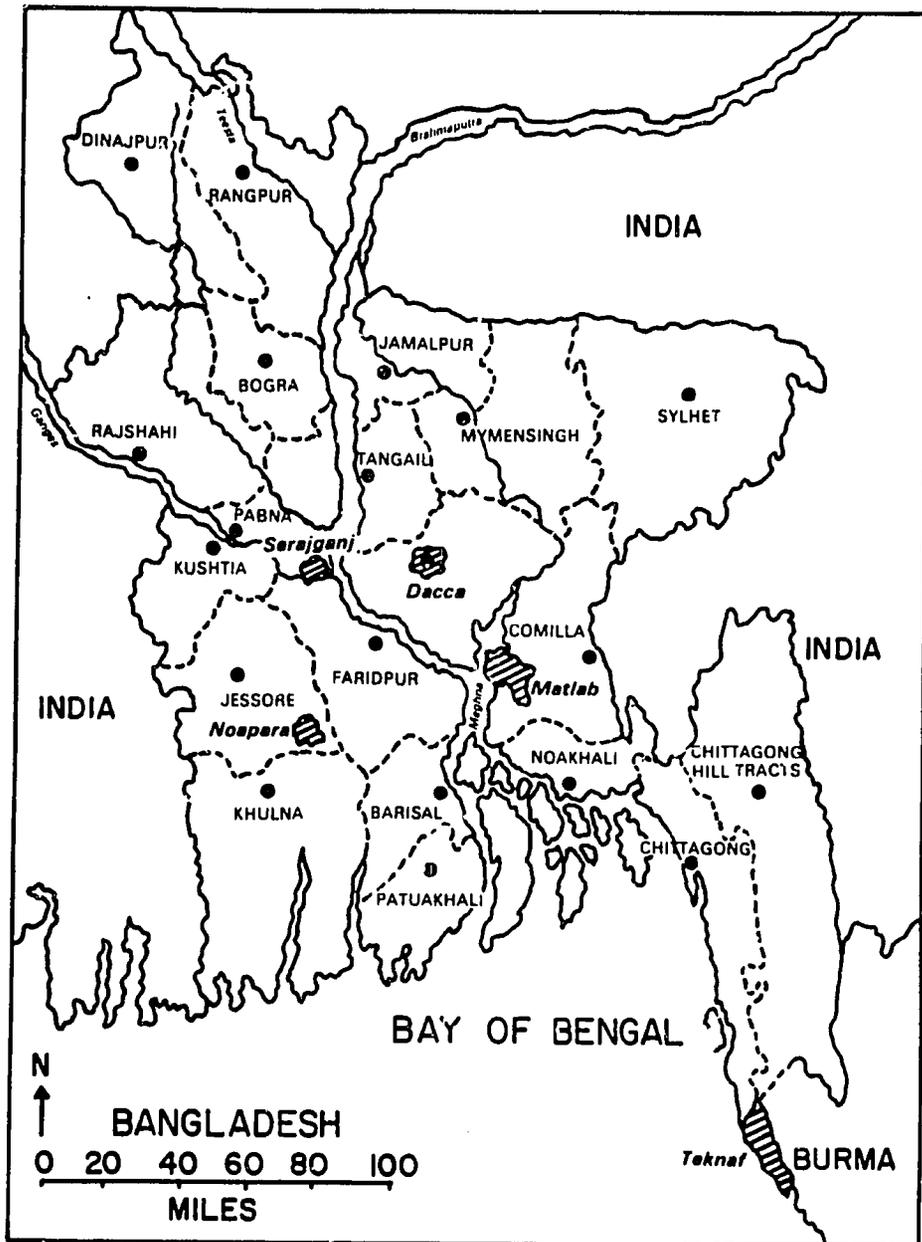
Scientific equipment at Dhaka is generally adequate though the scientists would welcome an amino acid analyser to accurately appraise intake and absorptive function in nutrition studies, and an electron microscope for morphological studies of Reyes Syndrome and other uses, including virologic studies. Other equipment items, such as refrigerators, freezers and centrifuges are in short supply and disposable items are often difficult to get promptly and in sufficient quantity.

The animal facility is an excellent resource. The physical plant of the facility is spacious and includes an ample operating theater and cages, pens and enclosed spaces for both small and large animals. Perhaps the most notable attraction of this facility is the relatively large numbers of trained assistants available to the investigator. With proper instructions beforehand and sufficient advance notice, these assistants prepare everything before the investigator arrives and investigative work in the animal facility proceeds in an admirably efficient way.

In Matlab, excellent basic facilities for simple clinical microbiology exist but are poorly and only sporadically utilized because of the lack of an M.D. epidemiologist. Routine cultures are conducted for Salmonella, Shigella, Vibrio and Campylobacter, and E. coli and stools are saved for further enterotoxin, virologic or parasitologic studies. The Matlab laboratories could usefully be upgraded and more effectively used once senior and junior epidemiologists team up with the able hospital and field staff there to expedite imaginative new protocols.

FIGURE 1

MAP OF BANGLADESH SHOWING ICDDR,B STUDY AREAS



Key:  study areas

TABLE 1

ICDDR,B STAFF AS OF DECEMBER 1, 1982a) Location of Local Pay Scale Employees:

	Core*	Project*	Total	Percent of All Local Staff
Dhaka	522	64	586	57
Matlab	152	137	289	28
Teknaf	42	14	56	5
Other Areas	<u>7</u>	<u>88</u>	<u>95</u>	9
	723	303	1026	

b) Categories of Local Pay Employees:

	No.	Percent of All Local Staff
Scientific	18	2
Scientific Support*	607	59
Administrative	<u>401</u>	39
	1026	

c) International Pay Employees:

	No.	Percent of All International Staff
Scientific	19	56
Administrative	6	18
Consultant	<u>9</u>	26
	34	

\*Definitions: Core staff are not on limited term contracts.  
 Project staff are on 3 year contracts with every expectation  
 of renewal.  
 Scientific support staff is a catch-all category for everyone  
 except scientists and administrative personnel.

TABLE 2  
1983 OPERATING BUDGET AND ESTIMATED BUDGET FOR 1984  
(In US \$)

	Personnel Services	Travel & Transp. of Persons	Transp. of Things	Rent, Comm. & Utilities	Printing and Repro- duction	Other Cont. Servs.	Supplies and Material	Depre- ciation	1983 Total	1983	1984 Total	Percent Distri- bution
A. RESEARCH PROGRAM	2,273,900	43,500	1,600	23,000	17,800	31,800	248,200	25,300	2,665,200	41.0	3,280,000	41.0
1. Disease Transmission	586,500	6,200	500	6,400	2,600	5,900	48,700	6,500	663,300		816,300	
2. Pathogenesis & Therapy	349,700	7,300	200	4,900	1,400	4,200	55,400	2,200	426,300		524,600	
3. Host Defense	165,300	5,000	200	1,000	1,000	1,200	20,000	8,800	202,500		249,300	
4. Nutrition	403,000	8,200	200	3,700	2,200	7,000	34,100	1,200	459,600		565,600	
5. Community Services Research	769,400	16,800	500	7,000	10,600	13,500	90,000	5,600	913,400		124,200	(34.3)
B. TRAINING PROGRAM	209,800	26,600	500	3,300	8,300	9,000	38,800	9,100	305,400	4.7	377,400	4.7
C. PROJECT DEVELOPMENT	363,100	36,500	100	1,300	37,900	30,200	34,500	1,500	505,100	7.8	621,500	7.8
D. STAFF DEVELOPMENT	45,000	6,000		500	500	20,000	8,000		80,000	1.2	98,400	1.2
E. RESEARCH & TRAINING SUPPORT FACILITY	537,700	4,100	19,300	17,700	27,100	600	296,100	163,200	1,065,800	16.4	1,311,600	16.4
F. MAINTENANCE & LOGISTICS	283,200	7,300	40,200	21,500	800	3,700	30,800	60,600	448,200	6.9	551,400	6.9
G. MANAGEMENT	784,800	54,300	1,400	28,400	8,900	49,700	100,300	12,000	1,039,800	16.0	1,279,600	16.0
H. RESOURCES DEVELOPMENT	137,900	45,200	400	3,200	2,300	3,900	5,800	2,500	201,200	3.1	247,400	3.1
I. MANDATORY COMMITTEE	30,000	89,600	600	600	500	900	1,000		123,200	1.9	151,400	1.9
J. EMPLOYEE BENEFIT	19,400	200	200	300	700	18,300	26,400	700	66,200	1.0	81,300	1.0
TOTAL	4,684,900	313,300	64,300	99,800	104,800	168,100	789,900	274,900	6,509,000		8,000,000	100.0
PERCENT	72.1	4.8	1.0	1.5	1.6	2.6	12.2	4.2	=100	100		

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TABLE 3  
DISTRIBUTION OF ICDDR,B BUDGET 1980-1983

	1983	1982	1981	1980
TOTAL	\$6,500,000 Percent	\$6,500,000 Percent	\$4,065,300 Percent	\$4,216,250 Percent
A. RESEARCH PROGRAM	41	35	37	34
1. Disease Transmission	10	7	9	7
2. Pathogenesis & Therapy	7	6	5	4
3. Host Defense	3	4	5	4
4. Nutrition	7	6	6	4
5. Community Services Research	14	12	13	15
B. TRAINING PROGRAM	5	15	9	6
C. PROJECT DEVELOPMENT	8	NA	NA	NA
D. STAFF DEVELOPMENT	1	NA	NA	NA
E. RESEARCH AND TRAINING SUPPORT FACILITY	16	18	25	19
F. MAINTENANCE AND LOGISTICS	7	7	10	19
G. MANAGEMENT	16	10	16	22
H. RESOURCES DEVELOPMENT	3	5	2	NA
I. MANDATORY COMMITTEE	2	2	2	NA
J. EMPLOYEE BENEFIT	1	4	NA	NA

Notes: 1) The 1983 budget figures are those presented at the meeting of the Board of Trustees in December 1982.  
2) The amount spent in 1982 was approximately \$4.5 million, rather than the estimated \$6.5 million.  
3) During 1982 accounting and budgeting procedures underwent major modifications.  
4) The fiscal year was changed from July-June to the calendar year as of January 1, 1981. Figures for 1980 are approximate, being derived from the July 79-June 80 and the July 80-June 81 budgets.

TABLE 4

STATEMENT OF ESTIMATED DONOR SUPPORT - 1983  
(In U.S. Dollars)

A. CORE BUDGET

		PERCENT	
		(A. Subtotal)	(Total)
Australia/ADAB	225,000	4.8	3.2
Bangladesh	37,000	.8	0.5
Ford Foundation	200,000	4.3	2.8
France	80,000	1.7	1.2
Japan	625,000	13.3	8.8
Saudi Arabia	100,000	2.1	1.4
Sweden/SAREC	72,000	1.5	1.0
Switzerland	270,000	5.7	3.8
United Kingdom	200,000	4.3	2.8
USA/USAID	1,900,000	40.3	26.8
UNICEF/AGFUND	<u>1,000,000</u>	<u>21.2</u>	<u>14.2</u>
	4,709,000	100.0	66.5

B. EARMARKED CONTRIBUTIONS

		(B. Subtotal)	
Aga Khan Foundation	25,000	1.1	0.4
Belgium	75,000	3.2	1.1
GTZ-Munshiganj	56,000	2.4	0.8
IDRC - DISC	66,000	2.8	0.9
IDRC - Sanitation Impact	26,000	1.1	0.4
IDRC/UNICEF - Water Sanitation Conference	60,000	2.5	0.8
Kuwait	100,000	4.2	1.4
SAREC - Immunity & Vaccine	76,000	3.2	1.1
Saudia Arabia	250,000	10.5	3.5
UNDP/WHO - Clinical Research	350,000	14.7	4.9
UNDP/WHO - Regional Training	75,000	3.2	1.1
UNFPA - DSS	426,000	18.0	6.0
UNFPA - MCH	66,000	2.8	0.9
UNICEF - Water & Sanitation	20,000	.8	0.3
USAID - MCH-FP Extension	595,000	25.1	8.4
USAID - Population Council	83,000	3.5	1.2
USAID - Clinical Nutrition	<u>24,000</u>	<u>1.0</u>	<u>0.3</u>
	<u>2,373,000</u>	100.1	<u>33.5</u>
TOTAL	7,082,000		100.0

C. EARMARKED CONTRIBUTIONS

As Percent of the Total 1983 Budget: 33.5 percent

### Data Processing Facilities

Until recently data processing was being carried on by using computer facilities at the Bureau of Statistics (Dhaka), Engineering University (Dhaka), Johns Hopkins University (Baltimore), and the Asian Institute of Technology (Bangkok). The Center installed its own computer, an IBM System/34, in mid 1980. Soon after its installation, several scientific projects and administrative and financial management systems of the Center were computerized. By mid-1982 the System/34 has reached almost its saturation point and it has become more difficult to take on any further computer applications. Sophisticated analytical work is being impaired owing to the limitations of the System/34 for analytical computing.

A serious problem of computerization in Bangladesh is the lack of trained personnel. Initially, the position of Computer Manager had to be filled by several acting computer managers who were only partially conversant with computer management in a Third World setting. In 1981 they were replaced by the present Computer Manager, who returned home to Bangladesh after training and working abroad. ICDDR,B has also been fortunate to attract computer science graduates who returned home after their studies. However, their stay was brief due to higher paying jobs in the Middle East. The branch then introduced its own in-house training program and, today, the computer at ICDDR,B is fully run by Bangladesh nationals and is one of the best utilized System/34 installations in the developing countries.

The data processing staff have overcome many of the problems of capacity and personnel training as well as the constraints of the S/34 in terms of computer language and consequent unsuitability of standard statistical packages. During 1982 some 72 million characters were entered for punching, verification and updating, but more hardware will be needed within the near future if ICDDR,B is to remain self-sufficient in data processing.

### Organizational Units Within ICDDR,B

The scientific research of ICDDR,B is organized into five areas, each of which is addressed by a working group. In addition, the organizational structure identifies a division with responsibility for training and activities concerned with extending the Center's work to other areas of Bangladesh. The following chapter discusses the achievements and plans of these organizational units in detail. An overview of the purpose and scope of each scientific working group is presented in the paragraphs below.

The Disease Transmission program has three goals: to identify causative agents of diarrhea and to define and identify their cycles of occurrence and

modes of transmission; to delineate how these agents interact with human beings and how they are transmitted in different communities; and to develop effective means to interrupt the spread of causative agents.

The Pathogenesis and Therapy program seeks to understand the causes and mechanisms by which micro-organisms and parasites produce diarrhea, and to develop simple, effective and inexpensive methods for treating and preventing diarrheal diseases. The Pathogenesis and Therapy program is responsible for the Dhaka hospital and out-patient treatment center, where in 1981 it treated 96,586 patients; 66,016 of these were treated as outpatients with oral rehydration solution.

The broad goals of the Host Defense program are to determine how the body defends itself against infecting agents which produce diarrhea and to develop interventions by strengthening these immune mechanisms.

The Nutrition group is working to discover ways to interrupt the diarrhea-malnutrition cycle effectively and appropriately, including the study of nutrient loss during diarrhea, the effect of diarrheal control on nutrition status, traditional feeding practices which may contribute to the cycle, and the nutrititional/disease impact of such interventions as hand pumps and water-sealed latrines. Teknaf field station is under the administrative control of this program.

The Community Services Research program carries out and evaluates interventions and large-scale field studies directed at preventing or treating diarrhea and related health problems in the context of overall community health. This program oversees the Matlab field station and its longitudinal demographic surveillance system. The data system has provided a unique resource for study of the efficacy of maternal-child health and family planning interventions in rural Bangladesh.

The primary objective of ICDDR,B's Training Division is to help Bangladesh and other developing countries to improve the planning and delivery of diarrheal and related health services and to develop their research capacity. Technical and applied training is given for health workers from Bangladesh and other countries in the region, ranging from short formal courses to individually-designed fellowships.

### III. THE ACHIEVEMENT AND PLANS OF ICDDR,B

The AID assessment of ICDDR,B took place at the same time as the Board of Trustees of the Center were undertaking a major program review for their own purposes. In preparing for the Board's review, the staff of ICDDR,B had documented their plans for the future and, during the review process, staff members presented these plans along with summaries of recent achievements. The AID assessment team members were invited to participate in these discussions but did not attend the formal Board meeting which followed. This chapter presents the findings of the AID team and is based on their participation in the Board's review and on discussions with ICDDR,B staff members which took place outside the Center's own review process. It should be pointed out that the minutes of the Board's deliberations are not yet available and, although some decisions of the Board were communicated informally to the AID team, the team's findings do not take into account all aspects of the Board's review and subsequent deliberations.

This chapter is organized into eight sections. These describe the work of each of ICDDR,B's scientific working groups, the division responsible for training and communications and the activities of the Project Development Committee. Within each section the presentation highlights achievements and plans of particular relevance to AID's health sectors priorities. The chapter which follows synthesizes the assessment team's conclusions and recommendations to AID.

#### Disease Transmission Working Group

The Disease Transmission Working Group has made many important contributions to scientific understanding of diarrheal diseases. Among the most important are those listed below:

- 1) Identification of the etiology of diarrheal disease in 70-80 percent of the patients treated at Matlab over a two-year period.
- 2) The demonstration that two agents, enterotoxigenic Escherichia coli and rotavirus, account for approximately two-thirds of the cases of dehydrating diarrhea in infants in Matlab. This finding reinforces the importance of developing vaccines against these agents.
- 3) A village-based longitudinal study of infants in Matlab which showed that in the first two years of life each Bangladeshi infant suffers an average of seven distinct episodes of diarrhea per year. This finding is similar to those from Guatemala and Gambia.

Enterotoxigenic E. coli were the most frequent pathogens identified in Matlab, accounting for two episodes per child per year. These findings provide guidance as to the magnitude and nature of the diarrheal disease problem.

- 4) Epidemiologic studies in Matlab which showed that Enterotoxigenic E. coli infections had a striking age-specific incidence with peak infection occurring in the first few years of life and with low incidence rates in older children and adults. These observations lend strong credence to the notion that acquired immunity is responsible for the decreased incidence rate for E. coli diarrhea found in adults.
- 5) Environmental bacteriologic studies of infant weaning foods showing heavy contamination with coliform bacteria. Levels of contamination are worst in the hot season and increase with hours of storage after preparation of the food. These studies incriminate weaning foods as an important vehicle of transmission of enteric pathogens and thus reinforce the importance of breast-feeding.
- 6) The demonstration in a longitudinal village-based study that diarrhea due to enterotoxigenic E. coli is significantly correlated with subsequent development of malnutrition. This fact reinforces the need to address the problems of diarrheal diseases and malnutrition in a concerted fashion.
- 7) Identification of Campylobacter jejuni as a common enteric pathogen in Bangladesh and also recognition of a high rate of asymptomatic infection.
- 8) Recognition of shigellosis and other dysenteric invasive bacterial enteric infections as significant causes of mortality in areas (Matlab) where deaths from diarrheal dehydration are controlled, thus supporting the desirability of developing a vaccine against Shigella.
- 9) Demonstration of the efficacy of hand washing as a means of significantly diminishing the transmission of Shigella infections, suggesting that a relatively simple behavior change could have major impact.
- 10) Identification of the transient appearance of multiple antibiotic resistant V. cholerae in Bangladesh.
- 11) The first studies in man of the safety, immunogenicity and efficacy of purified cholera B subunit vaccine.

- 12) Establishment of a model hospital-based diarrheal disease surveillance system which can be used to monitor etiology in relation to patient load and seasonality.

The future plans of the Disease Transmission scientific working group emphasize the following:

- Development of techniques for studies of the invasiveness of *Shigella* and the pathogenic mechanism of *Campylobacter*.
- Studies on the epidemiology and transmission of rotavirus infections including identification of serotypes.
- Epidemiological, immunological and bacteriological studies on classical and El Tor biotypes *V. cholerae* infection.
- Collaborative studies toward development of an oral vaccine against cholera.

The first of these priorities would appear to fall more logically within the parameters of the Pathogenesis working group, reflecting the somewhat confused allocation of investigations among the working groups. However, the development of a method to screen large numbers of strains is certainly an important area of study, allowing comparisons of the relative virulence of *Shigella* strains and perhaps explaining differences in rates of infection and clinical characteristics.

Rotavirus is the single most important cause of dehydrating diarrhea in children less than two years old in Matlab. Information about the relative importance of the various serotypes of rotavirus is critical for field trials of the new vaccines being developed in several laboratories.

Studies on cholera are also urgent and important, especially since large-scale epidemic due to classical type *V. cholerae* occurred in Bangladesh during October-December 1982. It is encouraging that this working group includes these studies among their priorities, although the present exceptional circumstances suggest that intensive epidemiological studies of cholera might well be accorded overriding priority. Collaboration with Dr. John Murphy of Harvard on a vaccine against cholera is placed fourth among the Disease Transmission Working Group priorities. While this is valuable, other investigators in the U.S. and the U.K. are undertaking similar work and two groups have vaccine candidate strains.

The lack of an experienced epidemiologist is a serious constraint of ICDDR,B's Disease Transmission Working Group, In particular the statistics

from the Matlab Demographic Surveillance System, which are a unique and valuable data base, could be improved and better used if an epidemiologist were a member of the team.

#### Pathogenesis and Therapy Working Group

The recent achievements of the Pathogenesis and Therapy Working Group include the discovery that citrate and acetate are effective substitutes for bicarbonate in the ORS formula in order to correct the acidosis with diarrhea. These non-reactive bases considerably improve the shelf life of packaged ORS salts. Recent work with rice powder and labon gur formulations of ORS is demonstrating that such preparations provide an excellent (perhaps even better) oral therapy solution. This work has great potential impact as it suggests that a culturally adapted formulation using ingredients already in village households might be an alternative to pre-packaged ORS.

Work on the pharmacologic reversal of the intestinal secretory processes has been led by studies involving chlorpromazine, which has been tested in clinical cholera at the Center and found to significantly reduce stool volume, intravenous fluid requirements, vomiting and the duration of diarrhea in clinical cholera. However, one side effect is sedation, which may interfere with oral rehydration. Studies of other agents, such as nicotinic acid, indomethacin, salicylates, and chloroquine are currently underway or planned.

Studies of travelers' diarrhea in Dhaka reveal that 25 percent are dysenteric - have blood and mucus in their diarrheal stools - of which 26 percent have Shigella, 18 percent Campylobacter, and 6 percent amebic infections. However, an important finding that 50 percent remain unknown has led to additional interest in exploring invasive diarrheas.

Current activities on pathogenesis and therapy are now being extended in several areas. In investigating the pathogenesis of invasive diarrhea, colonoscopic findings in several patients with shigellosis, amebiasis, and Vibrio parahemolyticus infections have been examined. In acute shigellosis, pathological findings range from 100 percent in the recto-sigmoid area to 13 percent in the ascending proximal colon. Of considerable interest is the description of "aphthous" ulcers in a number of patients with Shigella infections that have extended beyond ten days. Studies of amebiasis shows the smaller, deeper ulcers more confined in the recto-sigmoid area. In contrast, the V. parahemolyticus infections result in no colonic lesions but a terminal ileitis. Other-hospital based studies of severe shigellosis and its complications are currently underway. In another study, the investigators have addressed the kidney lesions in a hemolytic-uremic syndrome that complicates Shigella infections and the work now includes the demonstration of an animal model with which to study this complication.

From a series of autopsy studies, members of the Pathogenesis and Therapy Working Group are describing several newly recognized syndromes for Bangladesh. These include severe Yersinia infections, necrotizing enterocolitis, as well as the pneumonic complications of diarrhea. Some very interesting theories on the possible pathogenesis of rotavirus diarrhea have been developed by an investigator who is finding elevated stool cyclic-AMP concentrations in patients with rotaviral diarrhea. These studies lead to new and important hypotheses that require further study.

These scientific findings are highly relevant contributions to increased knowledge of how diarrheal illnesses occur and have potential application to the development of improved management of these illnesses both in the hospital and in the field. They also identify several areas where further work is needed. Confirmation and extension of such concepts as the rice powder ORS preparations and their field testing in village households has great relevance to improved primary health care for diarrheal diseases and for preventing the severe dehydration which requires hospitalization.

Several new, innovative studies are planned by this working group. Regarding the pathogenesis of invasive diarrheal diseases, studies are already underway of the colonic function of shigellosis. Whole bowel and total colon perfusion studies have been started using the colonoscope to define the site and extent of interference with absorptive function.

Extension of autopsy studies will include electron microscopic studies if new facilities are donated, as hoped in 1983. Further studies of the hemolytic-uremic syndrome following shigellosis are planned, using the experimental rabbit model. Also studies are planned to examine the mechanism of diarrhea seen in the few cases of typhoid fever admitted to the Center's hospital with diarrhea each month.

The roles of new etiologic agents and newly recognized syndromes will be studied with measles diarrhea, with possible synergistic measles virus and other enteric infections. Studies are also planned of Chlamydia and Yersinia as agents of acute diarrhea, as are studies of possible causes and mechanisms of chronic diarrhea.

Metabolic studies to be undertaken include those of the anion gap in cholera, intracellular pH and potassium concentrations in acute cholera, and potential renal effects of prolonged acidosis. Planned studies of the treatment of diarrheal diseases include investigations of rice powder ORS to determine the optimal concentration of rice powder for rehydration and nutritional benefit. Further studies will investigate citrate salt substitutes for bicarbonate and newer antibiotics, as well as single dose sulfa-trimethoprim, in the antibiotic of management of shigellosis. Other issues to be studied include antisecretory drug treatment including nicotinic acid, new calcium blockers, and loperamide.

As discussed under the Disease Transmission Working Group, there are some overlaps and inconsistencies in the allocation of research protocols among the ICDDR,B scientific departments. Better communication among scientists and stronger scientific leadership would encourage closer coordination and foster synergy. The Center hopes to recruit a senior immunologist and it can be hoped that this person will assist in resolving these problems, as well as contributing to the scientific work.

#### Host Defense Working Group

Work on host defenses has been somewhat limited by the need for a permanent program head. However, new scientific findings in this area have included the demonstration of a slight effect of a ganglioside-charcoal preparation on diminishing the volume of diarrhea if given early in the course of clinical cholera. Other work has involved the study of a major outer membrane protein that is common in both El Tor and classical biotypes of Vibrio cholerae; this protein has potential significant implications for vaccine development.

Considerable work with the cholera toxin B subunit has been done with Swedish collaborators. This includes the demonstration of both secretory and serum antibody responses to oral B subunit administration. In family studies in which B subunit was given to contacts of documented cholera cases, a slight decrease in attack rates among contacts appeared to be present, but no change in the severity of clinical cholera was noted. Measurement of local antibody responses in breast milk, saliva, and intestinal secretions has been done, and a correlation has been found between intestinal secretory antibody and salivary antibody responses to the B subunit.

Studies of Giardia lamblia infections have been initiated. To date, findings suggest that breast milk is protective against symptomatic Giardia infections and that mothers of young infants excrete Giardia cysts in over 50 percent of instances.

The future plans of the Host Defense Working Group include studies of specific antibodies that are responsible for the natural termination of cholera diarrhea and infection. The specificities of these antibodies have important implications for effective vaccine development.

Similar studies of local, intestinal immunity in acute shigellosis are planned. The site of Shigella antibody protection will also be studied. Regarding vaccine development, atoxigenic transductants of V. cholerae and other potential vaccine strains will be studied in animal models, volunteers, and it is hoped in patients.

A newly developed magnesium-breath hydrogen test for gastric acidity is expected to facilitate possible field studies of achlorhydria as a predisposing factor to sporadic cholera and other enteric infections. Studies of passively given antitoxic antibodies in bovine colostrum will also be conducted by giving this material to cholera patients in an attempt to inactivate the toxin. The success of this work will determine its relevance to future developments for treatment and prevention of infectious diarrhea. Because of the known effect of endotoxin to stimulate leukocyte mediators of inflammation, the Host Defense Working Group will examine the endotoxin of Shigella with human leukocytes for the production of possible mediators of diarrhea or fever in experimental animals.

#### Nutrition Working Group

The objectives and research priorities of the Nutrition Working Group have focused on three major questions:

- How does diarrhea lead to malnutrition?
- How does undernutrition influence the course, severity, and outcome of diarrhea?
- How can the diarrhea - undernutrition cycle be interrupted?

The significant investigations of this group include the following studies dealing with the complex interaction of diarrhea, undernutrition, Vitamin A deficiency and eye lesions (xerophthalmia, keratomalacia, night blindness, etc.); investigations of serum and liver Vitamin A levels following oral application of retinol in children with acute diarrhea; protein losses in measles diarrhea, shigellosis, ETEC,; and a longitudinal study of the growth and weight of children between birth to age 10 in relation to common childhood diseases, diarrheal episodes, seasonal undernutrition, breast-feeding, teething and intercurrent diseases. A significant, on-going study has examined the intake and utilization of calories from rice starch electrolyte therapy in acute diarrhea due to cholera, ETEC, Rotavirus and Shigella. The Nutrition Working Group is also concerned with studies of culturally rooted behavioral aspects of child nutrition, disease concepts, sanitation and health education.

The Nutrition Working Group differs from the three working groups discussed previously in that about one-half of its operating research budget comes from contributions which are restricted for certain investigations only. The largest of the bi-lateral projects with restricted funds is a new study on the impact of safe water and sanitation in the Teknaf field station. This important investigation is being carried out jointly with the Community

Services Research Working Group and is discussed further in the following section.

Anemia of undetermined etiology is one of the most frequently made diagnoses in the primary health care services of Bangladesh. Little is known as yet about its prevalence, distribution, severity and causes. It is assumed that iron deficiency and undernutrition (folic acid) are the major determinants in a complex picture. The Nutrition Working Group in cooperation with the Institute of Public Health and Nutrition and assisted by Dr. Paul Goff, a hematologist of the U.S. Embassy, has written two research protocols for epidemiologic investigations of anemia and its causes in Bangladesh. These studies will use on-going demographic population studies in Matlab, Teknaf, peri-urban Dhaka, and in the new extension areas to obtain results from ecologically different parts of Bangladesh.

Almost all of the ongoing and new studies being undertaken by the Nutrition Working Group are concerned with MCH and especially with child nutrition and health at the primary health care level. The relationships among health education, water and sanitation, and nutrition are given emphasis in the approach of ICDDR,B's Nutrition Working Group in order to fill gaps in knowledge and to develop new methods for improved diarrheal disease control and prevention at the community level through focused research.

#### Community Services Research Working Group (CSRWG)

The CSRWG is the largest of the five research programs of the ICDDR,B, its budget representing 34.3 percent of the Center's total research budget (\$769,000 in 1982 and a projected budget of \$913,000 in 1983).

CSRWG undertakes two major types of studies:

- 1) Population based investigations of behavioral and environmental aspects of diarrhea, including demographic and social determinants of morbidity, mortality and fertility; and
- 2) field trials of new methods for diseases control and prevention in rural communities.

The important scientific contributions of the CSRWG include the following: Evaluation of ORS packages prepared from locally available, cheap ingredients against the WHO standard; evaluation of the impact of tetanus immunization of pregnant women on the incidence of tetanus neonatorum; studies of the effects of systematic, service-intensive family planning on fertility and infant mortality; and measurements of time trends of morbidity and mortality in longitudinal observations.

In addition to the research into diarrheal diseases, the working group has been responsible for the establishment and maintenance of a demographic surveillance system (DSS) in the river delta area of Matlab. This system was begun in 1963 when it included about 280,000 rural people. In 1978, after refinement of the procedures and methods needed for longitudinal follow-up of a large population using multiple parameters, the number under surveillance was reduced to 160,000.

The DSS is the largest component of the CSRWG. Over the years, it has become a major source of demographic information and research and is probably the largest continuous system of accurate vital registration for any sizeable population in a developing country. Vital records are now updated routinely by regular household visits and all of the information is computerized. The system permits the creation of printouts for different types of sample populations, such as field trials, epidemiologic inquiries and health service research.

The DSS has been used in family planning and health intervention experiments which investigate relationships between mortality, primary health care and family planning acceptance. It has also been used to evaluate tetanus immunization of pregnant mothers as a means of reducing neonatal tetanus. Further a major field trial has been carried out with locally prepared ORS as compared with ORS packages supplied by WHO, which noted that there was no difference between the two treatment groups. Updating of this large demographic surveillance system has continued and offers unique opportunities for conducting scientifically sound field trials of new vaccines, treatment schedules and of alternative methods of diarrheal disease control and other major public health problems.

A second major area for population studies was initiated in 1974 in the Teknaf area after a serious outbreak of dysentery. Because of the close association between diarrheal disease and nutrition in children, the Teknaf project has been carried out jointly with the Nutrition Working Group. The Teknaf area is also the site for a major investigation of the impact of water and sanitation on the incidence of diarrhea and on morbidity in general. This bilateral project between the People's Republic of Bangladesh and Canada is funded by IDRC. The study was started in July 1980 and has involved the installation of hand pumps (tubewells), water-sealed latrines for each family in the sample, combined with systematic health education. The population selected for this type of intervention is approximately 2,000 comprising 300 families. This population sample has been compared for nutritional parameters and diarrhea frequency with ten control villages in which no intervention projects have been carried out.

After a review of the Matlab project in 1981, the UNFPA requested ICDDR,B to extend Matlab-like services to three other areas of Bangladesh. In response, plans were made to conduct MCH-FP extension projects in Sirajgang,

Noapara, and Teknaf. These studies have started or are in the implementation stage but so far, no results have become available. The new extension projects will study the transferability of the experiences in Matlab to the health services provided by the Ministry of Health and Population Control (MOHPC). Technical components to be studied will include oral rehydration therapy, tetanus immunization and comprehensive family planning. For evaluation and training, three research teams were created, one for a sample registration system of vital event assessment, another survey team for special studies of simple population sampling methods, and functional analysis team for operational research of health services.

The CSRWG suffers from two major problems. Data collected through the DSS and from other survey populations are not processed and analyzed in a timely fashion, leading to long delays in generating the results which are needed in Bangladesh and elsewhere. This problem stems from limitations of ICDDR,B's computer facilities which, although efficiently run and operating on a 24-hour schedule, are not able to keep up with the various demands. The second problem centers around the lack of epidemiological and clinical expertise in the planning, execution, analysis and evaluation of the population data. The addition of one or more epidemiologists would bring focus to the currently fragmented and somewhat duplicative CSRWG program and would also identify further ways in which the existing data collection system could contribute to scientific knowledge.

### Training

Under Title 5(1)(b) of the ICDDR,B ordinance, the Center is required to: "Provide facilities for the training of Bangladeshi and other nationals in areas of the Center's competence in collaboration with national and international institutions, but not to include the conferring of academic degrees." In responding to this requirement, the Center has developed a training program staffed by an Associate Director and a technical staff of three.

The training program undertakes a variety of formal and informal training activities. For Bangladeshi scientists and students, ICDDR,B provides an exceptional opportunity to learn scientific and medical techniques through observation and individual instruction on an unstructured basis. In a more structured way, ICDDR,B assists in the development of Bangladesh's scientists by offering six research fellowships each year and by organizing a three-week course in research methodology.

Bangladeshi health care workers of all kinds participate in orientation tours and brief courses describing diarrheal diseases management, and several hundred health care workers and medical students visit ICDDR,B each year for

this purpose. To assist in the national oral rehydration therapy effort, ICDDR,B, has developed a manual on the treatment and prevention of diarrheal diseases and complementary flip-chart and trainer's guide. These draft materials have been used to train trainers and are now undergoing evaluation. ICDDR,B is also taking a leading role in the development of course materials on diarrheal diseases management to be used in Bangladesh's medical colleges. This activity follows coordinating workshops with broad participation, and a further workshop will be held next year to introduce the materials to medical college teachers in Bangladesh.

The ICDDR,B training program also includes an international component. Fellowships, usually sponsored by other organizations, provide the opportunity for pre- and post-doctoral students from other countries to learn from ICDDR,B scientists for periods ranging from a few days to several months. The Center has also served as the site for several international workshops and conferences concerned with topics relevant to the work of ICDDR,B.

During the past two years, ICDDR,B has become increasingly involved in offering inter-regional training courses in collaboration with WHO. Three two-week courses - one each on laboratory, clinical and epidemiological aspects of diarrheal diseases - are now developed. Participants have come mainly from developing countries in Asia and the Middle East and faculty have been recruited from among the Center's staff and from outside consultants.

Continuing education for the Center's own staff also falls within the scope of the training division and ICDDR,B encourages staff members to take advantage of training opportunities, both within Bangladesh and overseas. While most long-term international training is sponsored by external funds, the Center does have some fellowships available for this purpose.

The facilities for training at ICDDR,B are somewhat limited. One room is designated the lecture room, but it is also needed for other purposes. Similarly, one laboratory with limited bench space can be used for training but must also serve other needs. Audio-visual equipment includes a slide projector and an overhead projector. Further space for training may become available shortly as a result of reorganization.

The staff of the training program consist of four professionals, none of whom has had any formal training in training methodologies or techniques. The Associate Director in charge of training has a number of other major responsibilities within the Center. The Training Coordinator was a senior official in the Ministry of Health but is new to the field of training. The Training Physician conducts most of the routine training with little back up or assistance, while the Senior Research Officer coordinates the practical experience in the laboratory. Other staff members at ICDDR,B, as well as other resource persons in Bangladesh and abroad, participate in the training activities on an as-needed basis.

The shortage of staff time and experience has limited ICDDR,B's ability to develop training materials. Assistance from outside consultants has been needed to develop the Trainer's Guide, and will be needed in developing the teaching materials for the medical schools as well as any other lengthy materials. The Center does, however, have an excellent graphics department that could probably support such activities if given sufficient guidance.

Issues of concern to AID include the actual and potential role of ICDDR,B in the transfer of knowledge through training at the Center and through the development of training materials which could be used elsewhere. This concern stems from a recognition of the urgent need to diffuse information about the recent innovations in diarrheal disease control to as broad an audience as possible, and particularly to decision-makers, administrators and health workers in the developing countries.

A wide range of training activities are taking place at the Center and it is important to recognize that ICDDR,B must provide training to Bangladeshis as part of its overall commitment to the Government and its people. While this aspect of the training program may at times be burdensome and distracting to the research responsibilities of the Center, every attempt is made to keep this to a minimum. The present staff of the training program are adequate to provide this service, especially since, over time, more and more Bangladeshi trainers will be trained in diarrheal diseases management.

The ICDDR,B is a unique site for training in certain aspects of diarrheal diseases and provides a valuable opportunity for exposure to realities in the hospital and the field. The inter-regional courses in collaboration with WHO are a reflection of this opportunity. However, this kind of training challenges the capacity of the Center's facilities and any increase in the number or scope of these courses is probably unwise without a significant expansion of the training program. Adding staff or facilities in training to respond to what may well be a short-term demand for international training is a lower priority than meeting the needs of ICDDR,B in other areas. Similarly, the Center can serve as a site for international conferences and workshops but these kinds of activities could consume a considerable amount of staff time and energy and should be kept to a minimum.

The one area where training activities could usefully be increased is at the field stations. The work underway at Matlab and the other newer stations is directly relevant to the design and implementation of surveillance systems in other developing countries, as well as to many aspects of the health services research which is so urgently needed. The opportunity to spend time learning about the methodologies and techniques being used at these field stations would be very useful to technicians charged with such responsibilities in other developing countries. To facilitate coordination between the central training program and those responsible for the work in the field, consideration might be given to designating an existing field-based

staff member as the person responsible for this kind of training and assigning this person to the training program.

As experience is gained in training of various kinds, ICDDR,B could develop training materials for use in other places. To date, Bangladeshi materials for primary health care workers have been developed and medical college modules are underway. However, these materials are less than useful in other settings without adaptation. Given the limited expertise and resources at the Center it seems inappropriate for ICDDR,B to become actively involved in developing materials other than those it needs for its own purposes. Rather, the ICDDR,B materials should be widely available to others and, along with other efforts, can form the basis of materials developed for a specific purpose by country-specific or international organizations.

### Publications

ICDDR,B publishes Annual Reports, Working Papers, Scientific Reports, Monographs, and occasionally, conference reports and books. The Center also publishes the newsletter Glimpse which is now bi-monthly. Up to now these publications have been available without charge and they are distributed to a mailing list, visitors to ICDDR,B and upon written request. In the future, it is planned that charges will be made for the publications other than the newsletter.

During 1981, 32 new publications became available and a total of 11,766 ICDDR,B publications were mailed out and a further 2,222 were distributed by hand. A total of 43,521 copies of the newsletter were either mailed or distributed in 1981. Between January and October 1982 ten papers were added to the list of publications. Altogether 4,102 copies of ICDDR,B's publications were distributed by mail, and a further 7,136 by hand. A total of 38,454 copies of the newsletter were also distributed during this period.

A list of ICDDR,B publications to date and a copy of the newsletter, Glimpse, may be found in Appendix A.

### Project Development Committee Activities

In April 1982, ICDDR,B established a Project Development Committee (PDC) to coordinate the development of proposals and the early stages of projects, especially those which do not clearly fall within the areas of responsibility of an existing working group. The Director of ICDDR,B was given full executive authority over PDC projects and the Center's Management Committee was to be kept informed and given the opportunity to comment on PDC's

recommendations. The PDC was established as a result of the need to proceed quickly and efficiently once a project suitable for external funding had been identified and approved.

As of December 1982, PDC is responsible for 11 projects within Bangladesh. Seven of these projects are funded by donors, one by ICDDR,B and three are not yet funded. The projects with funds include the major research activities in MCH-FP at Sirajgang, Noapara, Matlab and Teknaf, the diarrheal diseases interventions at Chandpur and other urban and rural treatment centers, assistance to the BRAC oral rehydration therapy program, an investigation into cereal-based oral rehydration solution, a monograph on growth in relation to diarrhea, and an evaluation of ICDDR,B's training in diarrheal diseases treatment and prevention. The PDC projects in Bangladesh for which funds are being sought are concerned with the embankment at Matlab, the uses of duckweed and collaboration with the Medical Research Council.

The responsibilities of PDC include the development of relationships with other countries interested in collaboration. To this end exploratory discussions have been held with Saudi Arabia, Kuwait, N. Yemen, Egypt and China. These discussions have been concerned with training and technical consultation in diarrheal diseases research and training. No commitments have been made as of November 1982.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

In assessing ICDDR,B in relation to AID's health sector priorities, it was concluded that the Center undertakes excellent scientific investigations which provide new and important knowledge. This knowledge has revolutionized the understanding of diarrheal diseases and led to much improved techniques to prevent, control and manage these diseases. There is every reason to believe that the future work of ICDDR,B will be of equal or even greater importance to the fight against this enormous public health problem. It is recommended, therefore, that AID continue to provide generous core support to ICDDR,B.

It must be recognized that ICDDR,B cannot address all the issues of diarrheal diseases in each country where the problems exist. The Center can, and should, continue to serve as a global focal point but some needed scientific research can be better done elsewhere, and problems of national program implementation should be tackled in the geographic regions where they occur. Training, also, is often more effective if conducted on a regional or country-specific basis. Therefore, AID should also support other organizations which are engaged in activities relevant to diarrheal diseases.

The scope of work for the assessment included six specific questions which were to be answered. These questions and the team's responses are presented below. Following this, some recommendations are made about ways in which the ICDDR,B might be improved.

How successful has ICDDR,B been in rapidly and effectively disseminating the research findings through scientific publications, scientific meetings, the mass media and training courses?

1) Scientists at ICDDR,B place very high value on scientific publications, and the list of publications in Appendix A attests to their productivity. However, the increasing proportion of scientists whose native language is not English has led to some problems in generating well-written, scientifically sound articles which pass the scrutiny of peer review and appear in high quality international journals. These problems could be redressed through improved scientific and editorial review within the Center. The alternative approach of dissemination through publications produced by ICDDR,B might be reviewed in light of their cost and limited usefulness as reference materials.

2) Dissemination through scientific meetings has been successful, on the whole, but could be improved if more travel funding were available. The Center has also served as host to several important scientific meetings.

3) Mass media could be better and more carefully used to promote the Center and to disseminate research findings which have important implications for all developing countries.

4) Training courses at ICDDR,B are a useful and well-run means of disseminating research findings but training resources are limited and any expansion of the program would be difficult.

Utilizing their research findings, to what extent has ICDDR,B been able to develop new, simple and economic tools for routine-use at peripheral hospitals and health centers? Are there shelf items from which new tool for disease control could be developed through extended field research?

1) The safe and effective use of household items to make oral rehydration solution has been an outstanding contribution of ICDDR,B.

2) Findings about the proven importance of handwashing in relation to transmission of shigella in a rural, endemic area have shown that this simple intervention is valuable in reducing disease.

3) The development of diagnostic tools for diarrheal diseases for use at the periphery has been largely unproductive so far and therefore should be a priority for future research.

4) Shelf items include the use of ORS packages, soap, Vitamin A additives and appropriate tubewell maintenance systems.

How successfully has the Center "exported" its research findings to other LDCs? How could the methods developed in Bangladesh be adapted to meet the conditions in different ecological settings?

1) ICDDR,B's role is to undertake research and to publish high quality research findings and scientific information. The application of these findings and their dissemination to others is the responsibility of other, more appropriate, organizations. Close collaboration exists between ICDDR,B and WHO, as well as with other organizations, and such organizations are better suited than the Center to "export" findings.

2) ICDDR,B is a valuable resource for other countries and the Center's senior staff have a potential role to play as consultants to governments wanting to establish diarrheal disease research centers.

3) However, the adaptation of methods developed at ICDDR,B must be done within the context of the different cultural, ecological and physiological environments around the world. The magnitude of the diarrheal diseases problem and the extent of diversity are beyond the scope of ICDDR,B and require investigations in other regions. Other Centers are needed and existing institutes should be funded to strengthen their work in diarrheal diseases. In addition, protocols to compare findings from the different regions should be developed and supported. ICDDR,B is an appropriate institution to serve Asia and to play an important role in the guiding and coordinating of such efforts.

To what extent has the Center's training programs, training facilities, audio visual aids, research protocols and demographic surveillance systems been used for: the development of training courses in primary health care; the development of training manuals aimed at different levels of health workers; inclusion in the curricula of medical and nursing schools; the continuing education of AID's own staff?

1) The training program at ICDDR,B meets many needs in Bangladesh and internationally, both in training of trainers and in training scientists. The unique opportunity to learn from seeing and doing at the various Center facilities is of great value, but any major increase in more structured training activities is beyond the existing resources.

2) Training materials developed at ICDDR,B require adaptation if they are to be used outside Bangladesh. This work is better done by the country wishing to develop materials or by another international organization.

3) ICDDR,B is currently developing teaching modules on diarrheal diseases for use in medical colleges in Bangladesh. These are likely to be adaptable to other country situations.

4) The Center provides the opportunity for AID's staff to observe the work of the Center and to read about it in the newsletter, Glimpse. Apart from this, no special attempts have been made to meet the continuing education needs of AID.

Many research projects in Bangladesh have included the rendering of medical services to patients and to the general population. Are there service activities that should become part of the general health service of Bangladesh? Could these services be better supported under a bilateral agreement between the U.S. and the Bangladesh government?

1) The provision of medical services is a necessary and integral part of

ICDDR,B's work and the Center has to meet the demands for service which result from the needs of Bangladeshis.

2) The volume of medical services provided exceeds that needed for research alone. It would benefit the research program if separate provision could be made for the capital and recurrent costs of this service delivery component over and above those directly related to research.

How effectively have new scientific findings in the different areas of diarrheal disease, nutrition and fertility and family planning been applied to a comprehensive analysis of all available data to identify major determinants of health and disease in the community?

1) Better coordination among scientists at ICDDR,B and closer cooperation with other research institutions in Bangladesh would go far towards answering important questions about aspects of community health.

2) The addition to the staff of a senior epidemiologist would greatly strengthen this area of applied research.

3) The Center should be cautious about diverting too many resources into such investigations without support for this kind of activity. However, relevant data have been collected by ICDDR,B in different parts of Bangladesh and a critical analysis of these data under the direction of an epidemiologist might yield useful conclusions without incurring the costs of additional surveys.

### Recommendations

The following recommendations result from the assessment of ICDDR,B made by the team and are included here as guidance to ICDDR,B and to AID. It should be stated again here that the assessment team was very much impressed by the work being done at ICDDR,B and by the dedication of its staff. The recommendations for change should be considered in this context.

#### A. Staffing

1) The ICDDR,B would benefit greatly from the rapid recruitment of the following staff members:

- One senior and one or two more junior epidemiologists

- One senior immunologist to head the Host Defenses Working Group
- One microbiologist trained in the most modern techniques.

The suggestions of adding a health economist and a training specialist are seen as lower priorities.

2) In addition to permanent staff members, the Center should have funding to support senior scientists in related fields who could visit Bangladesh for periods of a few weeks to several months. This would not only provide special technical expertise when needed, but would also increase the potential for collaboration with other research institutions.

### B. Organization

1) The Director of ICDDR,B should be relieved of many of the administrative tasks that might better be performed by a trained administrator. The present Director is particularly suitable to provide the scientific leadership and direction of ICDDR,B and to inspire the highest standards in research and he should be encouraged to make this his primary activity.

2) Consideration should be given to reorganizing the scientific staff in order to avoid the overlaps and gaps which now occur, and to foster closer coordination and collaboration.

3) The exchange of ideas among ICDDR,B's scientists is inadequate. Open discussions should take place on a regular, structured basis.

4) The Director and senior staff of ICDDR,B should develop a long-term overall strategy for scientific investigation which relates their present and future work to the efforts of other scientists at the Center and to clearly stated goals and areas of concern. This should be submitted for approval by the Board and should become an important criterion against which funding decisions are made about proposed protocols.

### C. Program Priorities

1) ICDDR,B should give priority to epidemiological studies supported by, and in conjunction with, research in the laboratory. Of particular importance are longitudinal studies of the etiology and transmission of diarrheal diseases, the relationships between diarrheal diseases and nutrition, investigation into the most fruitful points of intervention, and intervention trials.

- 2) Emphasis should be placed on research into diarrheal diseases which are major problems in Bangladesh (cholera) and those which do occur in Bangladesh and are also of great importance to other developing countries (Enterotoxigenic E. coli, rotavirus and Shigella).
- 3) Epidemiological and etiological studies of diarrheal disease and their control should be encouraged as a research emphasis of the Center.
- 4) Because of limited funds, studies of viral diarrheal disease should at present be limited to epidemiology and control, rather than basic studies of virology for which additional facilities and scientists would be needed. Rather, the present close collaboration with international institutes specializing in basic research of rotavirus and other enteric viral pathogens should be encouraged.
- 5) Health services research should not be emphasized at ICDDR,B, but rather the Center should encourage donors wishing to support such research to collaborate with other organizations in Bangladesh. ICDDR,B should assist in the conduct of health services research by other organizations by providing limited guidance when requested and by making data available, but this should not be to the detriment of other Center activities.
- 6) Better use should be made of the field and animal facilities at ICDDR,B so that they may more fully support the Center's research priorities, especially in studies in pathogenesis and pathology.
- 7) The emphasis of the training program should be on participation in the various specific on-going laboratory and field activities of ICDDR,B. Training activities should not distract from research activities and therefore probably should not be expanded beyond their present level.

APPENDIX A

LIST OF PERSONS CONTACTED

ICDDR,B Staff Members

Dr. W. B. Greenough III, Director  
Ms. R. L. Akbar  
Dr. K. M. S. Aziz  
Mr. M. R. Bashir  
Dr. T. Butler  
Mr. Chakraborty  
Ms. M. K. Chowdhury  
Dr. S. D'Souza  
Dr. R. Glass  
Mr. M. Goon  
Dr. M. I. Huq  
Dr. A. Molla  
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Dr. J. Phillips  
Dr. M. M. Rahaman  
Dr. A. R. Samadi  
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