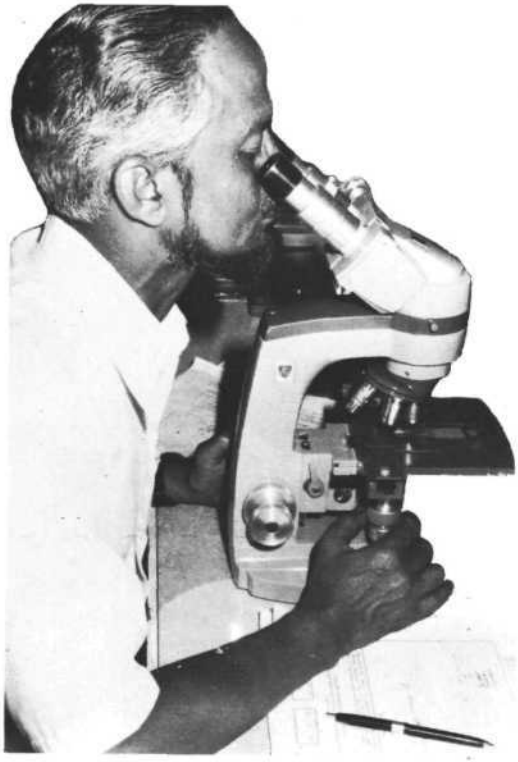

1983 ANNUAL REPORT

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

Editor: Naomi Rock Novak
Associate Editor: Shereen Rahman
Design & Photography: Asem Ansari

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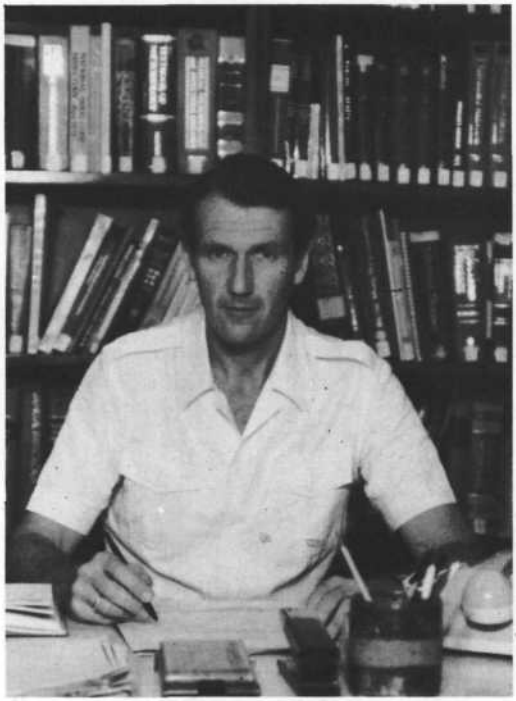


Dr. William B. Greenough III, DIRECTOR

Dear Friends,

The ICDDR,B's 1983 Annual Report seeks to highlight research activities and results. For it is on such research and results, by us and many colleagues worldwide, that a foundation is laid – one on which effective diarrhoeal disease control measures must rest. When development resources are spent without such a careful research base, failures and ineffective programs are more likely to occur. Thus, while at times the research process may appear to be frustratingly slow, the stakes are extraordinarily high.

The ORT story now has been told and retold. Still, one important point too often is overlooked. Thus as often occurs with scientific discoveries, there has been a tendency to forget that the development of a simple, safe, effective, low-cost home remedy for diarrhoeal diseases arose from the marriage of apparently esoteric basic physiology, on the one hand, with hands on treatment of a devastating group of related diseases. In this case, it took nearly 30 years for the necessary basic research to be translated into a highly effective health measure.

In general, it is difficult to predict which particular project will be the seed for the next breakthrough. Overall, where diarrhoeal diseases are concerned, we are confident that, as long as the research process insists on taking science to where the problem is greatest, the results will be worth the effort.

The year 1983 has been very fruitful. Our staff can well be proud of their achievements.

Aside from the other research which has not been described, as well as of discoveries that we have chosen to focus on at some length, the Centre is equally proud of its more immediate outreach efforts. Among these have been our extensive training of health workers, from Bangladesh and, for the most part, other developing countries; and our related information dissemination efforts – which gained an enormous boost when we began publishing the new "Journal of Diarrhoeal Diseases Research," the first international effort of its kind. Together, these efforts ensure that, as effective health measures are discovered, they are rapidly applied, where they are needed most.

Other signal achievements have been the initiation, in cooperation with the Bangladesh Government, of an effective cholera surveillance and control program and, in concert with the World Health Organization, our expanding assistance to other developing nations, seeking to acquire the basic skills and to implement their own diarrhoea control operations. Such a long-term project already is underway in Saudi Arabia, while shorter term ones have begun in Indonesia, Tanzania and Colombia.

Having briefly surveyed the Centre's accomplishments for 1983, let me turn now to the present and immediate future. For, as with any scientific endeavor, one major goal is to continually pinpoint the next set of critical questions, to set the stage for future research. From this perspective, several significant advancements were made.

Thus, thanks to a partnership thoughtfully developed in 1983 with the Bangladesh Government and the World Health Organization's Control Programme for Diarrhoeal Diseases, the Centre moved closer toward beginning, in late 1984, a large-scale field trial of an orally-administered cholera vaccine.

In other important work, ICDDR,B scientists began focussing increased efforts on testing cereals other than rice as a base for oral rehydration solution. For thanks to well-documented studies, we now know that when rice-ORS, as opposed to sugar-ORS, is used, diarrhoea fluid losses decrease significantly. However, before the full power of such "super ORS" can be realized on a large scale, basic studies are needed to further explore the potential and limits of new ORS formulae. Also needed is increased training and operational research to develop and speed application of improved solutions.

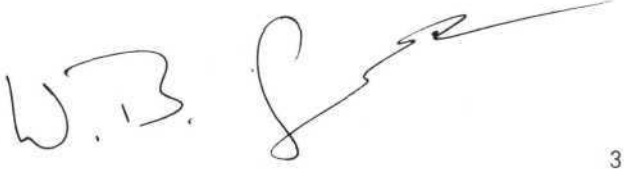
In related work, exploratory studies must be done to determine whether anti-secretory drugs combined with optimized ORS can achieve still more than the substantial diarrhoeal reduction effects already seen.

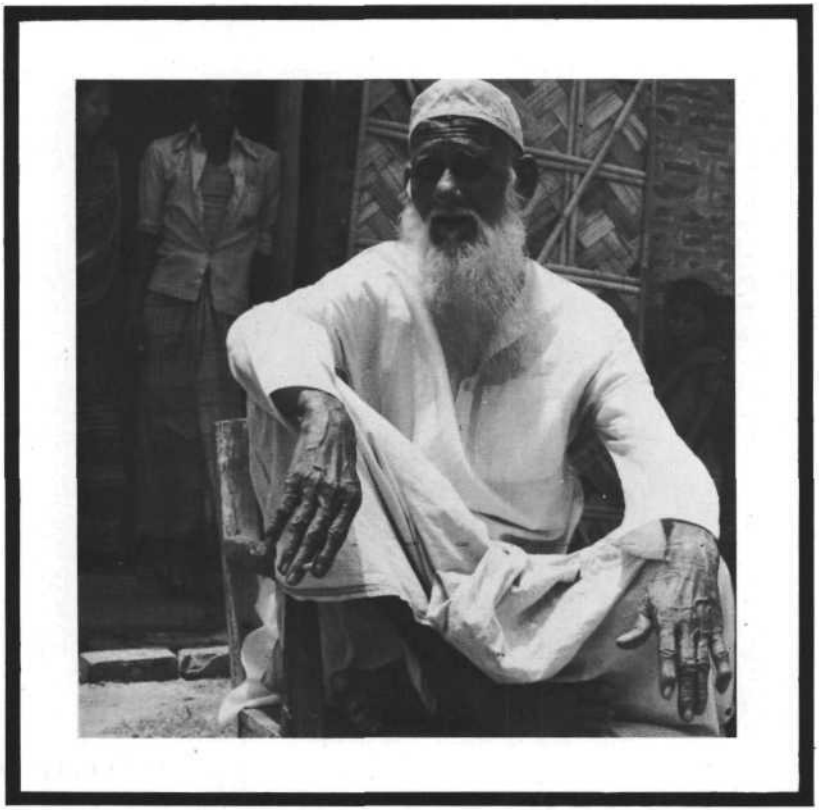
Likewise, building on earlier studies which showed that measles, often fatal in developing world children, is associated with higher attack rates of dysentery, it is apparent that more work on measles immunization is needed, as a possible diarrhoea preventive.

Speaking of often fatal diarrhoeal complications, more research also is needed into the relationships between diarrhoea and diverse respiratory infections. For it may be that, where such diarrhoea–respiratory combinations are concerned, control of respiratory illness may provide a long–term answer to controlling the high death rate — an answer akin to that found for measles, for example, at our Matlab field trial area.

As we constantly see at our Matlab Hospital, respiratory diseases are by far the most common complication and cause of fatality in diarrhoea patients we treat. So intertwined are diarrhoea and certain respiratory diseases, that, for example, for a serious respiratory disease such as pneumonia due to *legionella,* patients may be brought to a hospital not for a respiratory ailment, but because they are suffering from acute, watery diarrhoea.

Science knows a great deal about the causes of diverse respiratory diseases, but there is extraordinarily limited field data on this subject, from any developing country including Bangladesh. We at the Centre hope that steps can be taken to improve our knowledge about these critical diseases — so that sound, effective measures, based on adequate field studies, will become available soon. For although our focus is on diarrhoea, we are firmly committed to seeing such efforts as an integral part of our overall goal of improving health; and, thus we cannot and do not ignore easily preventable or remediable diseases when we work on diarrhoea.





"During the winter months when I was a boy," recalls the wizened man with the long white beard, "we practically lived at the cemetery with our spades, trying to keep up with the cholera victims.

"Cholera was so dreaded that a victim's family would be shunned, and no one even would walk near the house. It was believed an evil spirit had descended. Hundreds died in each epidemic. Few survived.

"Then, 20 years ago, they opened that cholera hospital, about 20 miles from here by boat. After that, cholera victims who reached the hospital alive, returned alive. Soon people stopped dreading the disease, and abandoned their superstitions.

"Last year when I turned 85 I thought about how good God had been to me. I'm not rich, but I own three acres. My family is well provided for. So, when that Cholera Hospital at Matlab wanted to help start a small, community-run treatment center here, I donated a bit of land here by the riverside, because most diarrhoea victims are brought by boat. Now I devote what time is left to me to supervising the Centre..."

His name: Ahmed Ali Sarder. His home: Kalir Bazaar, Bangladesh. His statement: far more than a "testimonial" for the Matlab Cholera Hospital, which is but a small, though critical part of the ICDDR,B's operations. For the implications of Mr. Sarder's words reverberate throughout the developing world.

CHOLERA

For 2,500 years that we know of cholera has plagued mankind. While rich nations have not been much threatened for a century, poor ones live in dread.

The Harsh Human Realities

* With a 30-50 percent death rate among untreated cases, cholera is the most deadly of the diarrhoeal diseases.

* In Asia, Africa and Latin America, these diseases are the 1st or 2nd biggest killer, vying with pneumonia, and other respiratory infections.

* In children under age five, the primary victims, diarrhoeal diseases account for an estimated one-third of all deaths— perhaps 4-6 million children annually.

* Another 750 million or so children survive diarrhoeal bouts, paying a heavy price — as repeated attacks aggravate malnutrition, growth retardation and blindness, while sapping strength and vitality.

* Even in rich countries, diarrhoeas cause sporadic, often violent outbreaks, that are the leading cause of young children's hospitalization in North America, Europe and Japan.

The Scientific Realities

* The killer is not diarrhoea, which is the body's defense trying to expel the invading disease organisms. The killer is dehydration — the swift drainage from the body of essential water and salts.

* Cholera and related diarrhoeas spread swiftly, often with terrifying results, because the disease pathogens are transmitted readily in infected feces, from person-to-person, as well as via contaminated water, food and soil, especially in overcrowded, unsanitary environments.

Unfortunately, in developing countries it's impossible to institute rapidly on a large scale needed changes in water quality, sewage facilities and sanitary habits.

* There are dozens of diarrhoea-causing pathogens (bacteria, viruses and parasites) which are not equally harmful, and do diverse levels and types of damage.

Thus, there are "invasive" organisms, such as *Shigella* and *Campylobacter,* which penetrate the intestinal lining, doing much damage leading to dysentery diarrhoea with blood and mucus in the stool; and "non-invasive" pathogens, such as *Vibrio cholerae* and *E. coli,* which do not injure the intestines, but produce toxins which trigger fluid production, leading to watery diarrhoea minus blood and mucus.

* Different pathogens have diverse transmission modes, need varying environments to survive, often cause auxilliary illnesses, and require different drugs to treat the severest cases and contain epidemics.

* While enormous knowledge has been amassed, many crucial things remain a mystery. Cholera is the best example. Thus, it is unknown "Where and how, in cholera-endemic areas, the bacteria remain dormant for 6-8 months a year, before suddenly resurfacing with a vengeance," and, "What environmental conditions trigger this."

For these and other reasons, science has been unable to eradicate, or even to contain, diarrhoeal diseases.

The only current option: to fight them, as vigorously as possible; and to use oral rehydration therapy to prevent death and malnutrition.

Meeting the Challenge

Until 1960, there was no concerted scientific effort to study diarrhoeal diseases located in a developing country, where they are endemic and cause frequent epidemics. Then, the United States began to finance, in cooperation with the U.N., Australia and Pakistan, the Pakistan-SEATO Cholera Research Laboratory, established in Dacca, East Pakistan (now Dhaka, Bangladesh).

Over the next 18 years, the pioneering CRL made outstanding contributions to understanding the cholera bacteria's nature, the factors controlling its presence or absence, and the prospects for treatment and vaccine development.

In 1979, thanks to an initiative by the Bangladesh Government and the United States' A.I.D. Program, the CRL was "internationalized," becoming the ICDDR,B.

Why the change: to make diarrhoeal disease research an international priority, thus attracting enough funds and expertise to have an impact that would begin to match the challenge.

THE ICDDR,B

* The only international institution solely devoted to studying the causes, preventives, treatments and cures for diarrhoeal diseases.
* Supported, with substantial funds and/or diverse services, by 39 countries and agencies.
* Researchers from many countries: in 1983, 18 expatriate and 40 Bangladeshi scientists; as well as about 500 scientific support and 435 logistic support staff.
* Not per se a Bangladeshi, Third World or Developed World institution; nor primarily a hospital or developmental health service. First and foremost, an international health research and training center — the largest, most comprehensive one of its kind.
* While mandated to do basic research, the Centre also serves, and returns to health, patients suffering from the specific diarrhoeas being studied. Moreover, since such diseases do not exist in a health vacuum, research also is focussed on the related subjects of nutrition and fertility; and the attack on diarrhoea is placed in the overall context of primary health care.
* Two other goals: to improve health care methods and public health practices, especially in developing countries; and to share its knowledge as widely as possible.

In four short years, the Centre, building on the CRL's work, has played a key role in defining the international focus of diarrhoeal disease research, treatment and training. Furthermore, ICDDR,B scientists have significantly broadened scientific knowledge of diarrhoeal diseases — in a series of insights that are influencing diagnosis, treatment and prevention; and that have set the stage for further Centre research — research to answer fundamental questions without which future breakthroughs, such as oral rehydration therapy, are less likely to occur.

From this perspective, 1983 was a very successful year.

THE ACHIEVEMENTS

As with progress in any field, along the way there have been keystone discoveries. One was made in 1968/9 by two American scientists — one of whom, Dr. William B. Greenough III, since 1979 has been the ICDDR,B's Director. The discovery is pertinent to this report.

Cholera Research: the Groundwork

First, it resulted from research done in Dacca, at the erstwhile CRL, from 1962-5, that led in 1968 to critical experiments in Baltimore and Boston. Second, in recognition of this breakthrough, Dr. Greenough, in February 1984, received the 1983 King Faisal International Prize in Medicine, presented in Riyadh, by Saudi Arabia's King Fahd. Finally, the finding is universally acknowledged as a research cornerstone, on which has been built much subsequent knowledge about cholera and the other diarrhoeas.

The discovery — about precisely how cholera bacteria toxin sparks rapid, often deadly bodily fluid loss — has had enormous impact on diarrhoeal diagnosis and treatment. Moreover, it precipitated a research explosion, so that today cholera perhaps is better understood than any other infectious disease.

Finally, it helped explain basic hormonal and cell secretion processes — information with enormous implications beyond cholera. Such information helps explain how bodily cells work, the specific ways they react to hormones and drugs, and how cells interact.

Dr. Greenough, then at Johns Hopkins University, collaborated with Dr. Michael Field (co-recipient of the Faisal Prize), then at Harvard University. Basically, they proved that fluid loss in cholera is caused by the toxin stimulating a specific bodily secretion mechanism. Second, they showed that this secretion mechanism does not interfere with simultaneous fluid absorption in the presence of glucose, a sugar. Finally, generalizing, they proved that a bacterial product interfered with normal hormonal bodily control processes.

Thanks to this discovery .

- It has been possible to successfully predict, develop and test anti-secretory drugs that inhibit or reverse cholera-caused fluid losses.
- The scientific foundation was laid for the life-saving Oral Rehydration Solution (ORS) — which also was developed at the old CRL. For ORS works by using a salt/sugar/water mix to replace the liquids and salts lost to diarrhoea. Without a sugar-mediated chemical reaction, the critically needed salt and water cannot cross the intestinal membrane barrier in cholera patients.
- It was learned that many other toxin-producing bacteria, which cause much more common diarrhoeas than cholera, operate like cholera in the intestines.
- A series of insights were gained into the operation of hormones.

The stage now has been set for the research highlights of 1983.

Perhaps these best are viewed in categories, beginning with what is being discovered about the disease-causing pathogens themselves.

THE DIARRHOEAL PATHOGENS

* New Cholera Toxin

In a discovery[1] with vital implications for human health, vaccine development and environmental contamination, ICDDR,B scientists, led by Dr. Suhas C. Sanyal, an Indian microbiologist on loan from Banaras Hindu University, Varanasi, India, isolated a new, potent cholera toxin.

Though unlike known cholera toxin in most respects, the substance produces cholera-like effects in laboratory tests and test animals — suggesting it may do likewise in man.

It is manufactured by water-living mutant cholera bacteria strains — that had been widely considered unable to cause cholera, because they lack the gene for the previously recognized toxin.

Consequently, in recent years, these strains, as well as similar, genetically engineered varieties, have been considered prime candidates as the base for a new, effective cholera vaccine. (The vaccine still widely used, though no longer required for international travel thanks to CRL/ICDDR,B research, is mostly ineffective).

Now, thanks to the Sanyal finding, vaccine researchers are looking anew at these mutant cholera strains. One reason: they may be doubly dangerous. For tests show that each time these strains are passed through an animal's system, they produce a more potent toxin, and more of it. Thus, the mutants are a potential ever increasing hazard, were they to become a widespread human affliction.

This is possible. For over the past decade, perhaps 80 such strains have been found, in the U.S. Gulf Coast, Great Britain, the U.S.S.R., Guam, Brazil, Japan, India and Australia. These strains have been isolated from such marine sources as sewage, oysters, and brackish water, as well as from intestinal and other human infections.

Dr. Suhas C. Sanyal

Until the ICDDR,B discovery, the strains had not been recognized as a possible cholera cause — although, for almost a decade, numerous cholera cases had been attributed to unexplainable contamination of the very marine environments where the mutant varieties were known to exist.

Especially in Western Europe and the U.S., free of cholera epidemics for decades, minor outbreaks were thought to have been caused by bacteria somehow imported into the area. Until the 1983 discovery, few believed the disease-causing bacteria to be indigenous, or connected the outbreaks with the mutant strains.

Now, new vaccines will need to take this new toxin into account, to be sure it is inactivated; and immunity to these strains may be important to achieve.

1. Sanyal SC, Alam K, Neogi PKB, Huq MI, Al-Mahmud KA. A new cholera toxin. *Lancet* (letter) 1983 Jun 11:1337.

* *Campylobacter:* A Newly-Proven Human Pathogen

About a decade ago, a new, "suspicious" bacteria, *Campylobacter jejuni,* first was detected in rich countries, in the feces of patients suffering from severe bloody dysentery-type diarrhoea. Then, five years ago or so, researchers in developing countries, especially at the CRL/ICDDR,B, began searching for the suspected pathogen.

Soon were found more than 30 strains or serotypes (members of the same species) that had significant differences and caused diverse levels of disease. In Dhaka, *Campylobacter* was seen in many children, most, though not all of them, sick with bloody diarrhoea.

An important question thus arose: were all *Campylobacter* strains capable of causing disease, and/or the same levels of disease?

In 1983, this question was answered,[2] once again by researchers led by Dr. Suhas Sanyal. The scientists sought to develop an animal "model," in which could be shown whether or not specific *Campylobacter* strains caused diarrhoeal disease.

Such a successful model turned out to be newly-hatched chicks — in which some, but not all, *Campylobacter* strains caused fluid accumulation in the small intestines (such fluid accumulation is a standard test for diarrhoeal pathogens). The fluid-causing strains had been isolated from human diarrhoea patients. Other strains, that did not cause disease, had been found in healthy humans and animals, and in the environment.

The conclusion and significance: the chick animal model apparently provides the first means of proving that some *Campylobacter* strains can cause severe diarrhoeal disease in man and animals; and shows that, within strains, some *Campylobacter* organisms are pathogenic, while others may not be.

2. Sanyal SC, Islam KMN, Neogi PKB, Islam M, Speelman P, Huq MI. Development of a *Campylobacter jejuni* diarrhoea model in infant chicks and studies on pathogenic mechanisms. *Infect Immun* (in press)

* *Campylobacter* and Travellers' Diarrhoea

As any voyager from a developed to a developing country (with poor sanitation) knows too well, an attack of "Montezuma's Revenge" or "Delhi Belly" is hard to avoid. Known to scientists as "travellers' diarrhoea," the affliction, according to previously published studies, is due mostly to a pathogenic type of *E. coli,* a ubiquitous bacteria which, in the non-harmful variety, is a normal, important inhabitant of the human intestine or gut.

In this significant study,[3] ICDDR,B scientists, led by Dutch gastroenterologist Dr. Peter Speelman, sought the disease culprit in 269 travellers' diarrhoea patients who came to Bangladesh during one year.

They found that a surprisingly high 15 percent of patients were infected with *Campylobacter,* and an equal number with *Shigella* — both "invasive" organisms that damage the intestinal wall or mucosa, causing dysentery-type diarrhoea with blood and fluid in the stool (see page 5). Moreover, other bacteria, not usually associated with travellers' diarrhoea, also were detected.

Patients with *Campylobacter*-caused diarrhoea got sick sooner than those infected with other diarrhoeal organisms. Also, fever and dysentery were more common in *Campylobacter* and *Shigella* victims, though the former caused less severe illness.

The conclusion: *Campylobacter* appears to be an important cause of travellers' diarrhoea among visitors to at least one and perhaps most developing countries.

3. Speelman P, Struelens MJ, Sanyal SC, Glass RI. Detection of *Campylobacter jejuni* and other potential pathogens in travellers' diarrhoea in Bangladesh. *Scand J Gastroenterol* 1983;18(Suppl 84):19-23.

PATHOGENIC PROPERTIES AND HUMAN IMMUNITY

One way to successfully combat diarrhoeal organisms is to analyze their structural components and how each one interacts with humans — to find ways to establish or strengthen human immunity. In 1983, ICDDR,B scientists made several significant discoveries.

* Breast Milk Immunity and Cholera

For the first time in humans, it was found that breast milk containing antibodies against a specific disease offers nursing babies some protection against getting the disease — but not against becoming disease carriers. While the finding[4] was made for cholera, it has important immunization implications for a host of diseases. For it may be possible to increase in lactating women levels of antibodies they already have — thereby protecting their infants from severe illness or death.

The discovery resulted from collaborative work done at the ICDDR,B by scientists from the Centre and from the University of Göteborg, Sweden. Leading the work was Dr. Roger I. Glass, an American epidemiologist then on loan to the ICDDR,B from the Centers for Disease Control, Atlanta, Ga., USA.

The research was done against a background of findings that showed two phenomena: that, compared to those bottle-fed, nursing babies get fewer and less severe attacks of cholera and other diarrhoeal diseases; and that, in developing countries, many mothers have demonstrable breast milk antibodies against common diarrhoeal agents.

Previously, no one had been able to prove that these antibodies could protect babies from diarrhoea — though more than 10 breast milk components had been found and shown to have anti-infective activity, in test tubes and test animals.

Also, two different cholera antibodies had been identified in human breast milk. These had been shown to protect against experimentally-induced cholera in animals; and to provide synergistic protection in an animal's gut.

Dr. Glass' team sought to learn whether the antibodies could protect breast-fed babies. They chose 93 mothers who lived with a cholera victim, but had not gotten diarrhoea for at least a week. For 10 days they watched the mothers and their breast-fed babies. Breast milk antibodies measured at the outset were correlated with whether the infants developed cholera-caused diarrhoea or became cholera carriers.

While there had been no differences in breast milk antibody levels fed to babies who eventually showed no signs of harboring cholera bacteria versus those who did, 30 babies became colonized, and of these, 19 got diarrhoea. Compared to the 11 (out of 30) who became colonized but not ill, the 19 who got sick had drunk breast milk with significantly lower levels of both antibodies. Also, the two antibodies were seen to work synergistically: babies with high levels of both were less likely to get ill.

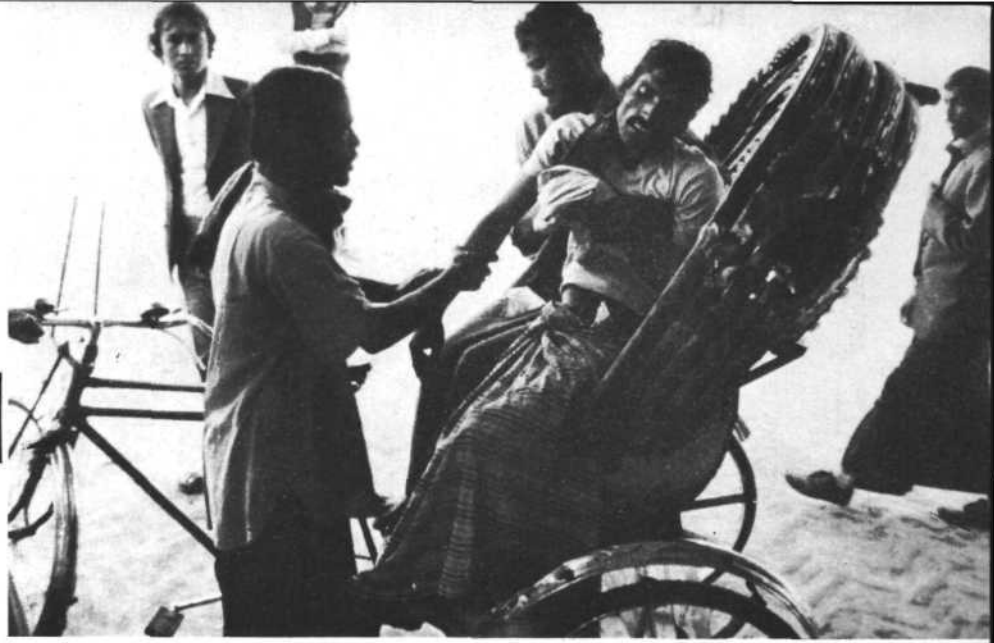
4. Glass RI, Svennerholm A-M, Stoll BJ, Khan MR, Hossain KMB, Huq MI, Holmgren J. Protection against cholera in breast-fed children by antibodies in breast milk. *N Engl J Med* 1983 Jun 9;308:1389-92.

* Breast Milk Immunity and Worms

When rural people in developing countries move to cities, the traditional heavy dependence on breast feeding declines, and large numbers of children no longer are breast-fed.

In this study,[5] ICDDR,B epidemiologist M.U. Khan of Bangladesh demonstrated that exclusive breast feeding is a powerful, inexpensive protective against acquisition of two highly prevalent intestinal parasites: roundworm and hookworm.

5. Khan MU, Shahidullah MM, Begum T. Role of breast feeding in preventing aquisition of roundworm and hookworm in Dhaka Slum children. *Indian J Ped* 1983;50:493-5.



A CHOLERA VICTIM arrives at the Centre's Dhaka Hospital.

* Cholera Bacteria : Surface Properties

In three landmark studies[6] believed to be the most detailed ones of their kind, ICDDR,B immunologist Shajahan Kabir, a Bangladeshi, described many important surface properties of cholera bacteria's outer membrane, basically a protein. Such knowledge is critical to development of new approaches to disease prevention and treatment. For, to a great degree, surface properties determine the bacteria's ability to cause disease.

The first study targeted on the properties thought to determine whether and how cholera bacteria adhere to human intestinal tissue. Such basic studies may lead to development of drugs that prevent such binding.

Basically, Dr. Kabir sought to determine whether cholera bacteria adhere to intestinal cells, either because they have a chemical affinity for water, or the opposite — a "hydrophobicity," meaning they do not mix with water, but seek out fatty substances.

Studying a number of cholera bacteria serotypes, he found that of all the diverse surface components examined, the outer membrane proteins were conspicuously hydrophobic, with some more so than others; that this affinity was accentuated or unaffected by various environmental conditions; that the strains adhered strongly to an ion-exchange matrix, and agglutinated red blood cells (caused a clumping); and that their adherence ability was affected by interaction with small sugar molecules.

The other two studies defined, apparently for the first time, the properties of the cholera bacteria's major outer membrane protein itself.

This study is critical to successful immunization efforts. For to immunize against an infecting organism, scientists seek an antigen (a component of that organism) that is common to all types of that organism. Since such antigens often are proteins, Dr. Kabir's research is invaluable.

In an important part of these studies it was found that antibodies (the substance that fights the invading organism) could be prepared against the cholera bacteria surface protein — indicating that this protein may become an important component of future cholera vaccines.

6. Kabir S, Ali S. Characterization of surface properties of *Vibrio cholerae*. *Infect Immun* 1983 Mar;39(3):1045-58.
Kabir S. Immunochemical properties of the major outer membrane protein of *Vibrio cholerae*. *Infect Immun* 1983 Jan;39(1):452-5.
Kabir S. The serological properties of the cell surface protein of *Vibrio cholerae*. *J Gen Microbiol* 1983;129:2199-2206.

* Cholera Vaccine Studies

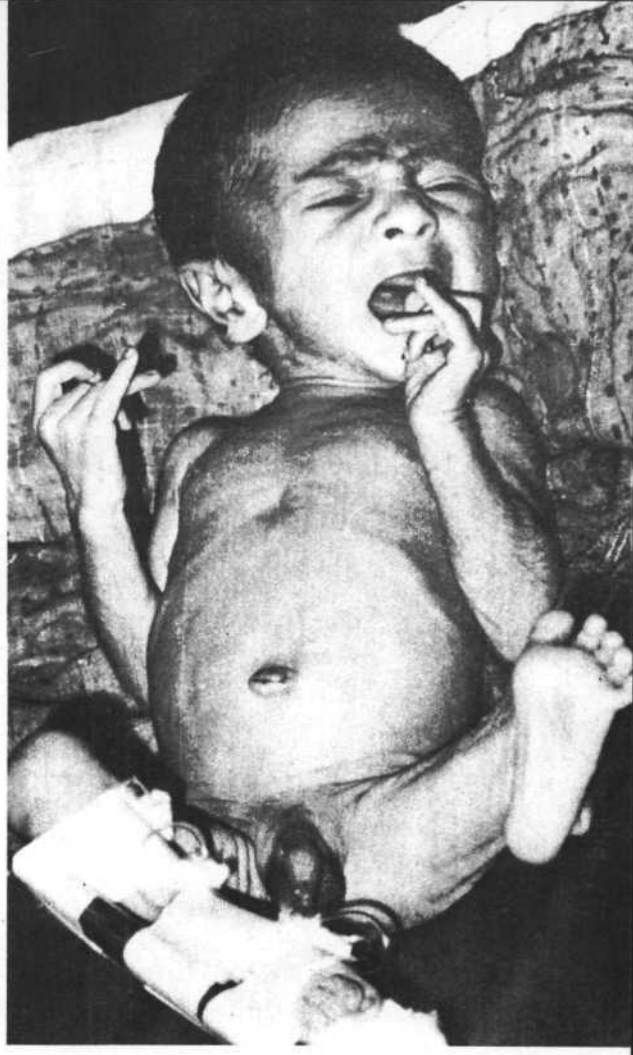
The prospects for developing an effective cholera vaccine, which also may offer some protection against the commonest diarrhoeal organism, *E. coli*, were heightened significantly by two basic studies[7] reported on in 1983. The work was done jointly by scientists in Sweden and Bangladesh — led by University of Göteborg immunologists Ann-Mari Svennerholm and Jan Holmgren.

Essentially, they studied a previously developed portion of cholera toxin (the bacterial poison that causes the disease.) Called "B-subunit," it is a non-toxic molecule, that can bind to intestinal cells without doing harm, while itself being "immunogenic" — meaning antibodies can be raised against it, making it a potential vaccine candidate.

These studies showed that B-subunit, either injected or given orally, sparked the formation of antibodies against cholera in Bangladeshi women; and that the oral dose provided longer protection.

Further work showed that when B-subunit was combined with the conventional whole bacterial cell cholera vaccine that still is used widely but is basically ineffective, an even stronger immune response was seen. Thus, volunteers' intestines produced antibodies to both components, at levels equal to those seen in patients who have just recovered from cholera. Since such people have a high resistance to cholera for more than three years, the results suggest that a harmless whole cell B-subunit vaccine may provide long–lasting immunity against cholera.

The scientists also compared antitoxin (immune) responses in volunteers infected with *Vibrio cholerae versus E. coli.*, since other studies have shown that the two toxins' diarrhoea-producing pathogens are very similar. While the antibody response to cholera toxin was much stronger, the results suggest some cross-immunity may be possible via a single vaccine.



While these results in relatively small numbers of volunteers are encouraging, it is unknown whether any of the prospective vaccine candidates can offer effective, long-term protection to large numbers of people in a "field" situation in a developing country. To learn the answer, the ICDDR,B, cooperating with the Bangladesh Government at the request of the World Health Organization, is getting ready to begin, in late 1984, a large-scale, long–term "field trial" in rural Bangladesh — a subject for a later annual report.

7. Svennerholm A-M, Holmgren J, Black R, Levine M, Merson M. Serologic differentiation between antitoxin responses to infection with *Vibrio cholerae* and enterotoxin-producing *Escherichia coli*. *J Infect Dis* 1983 Mar;147(3):514-22.
Svennerholm A-M, Jertborn M, Gothefors L, Karim A, Sack DA, Holmgren J. Current status of an oral B-subunit whole cell cholera vaccine. In: Enteric infections in man and animals: Hillary IB, Hennessen W, eds. Standardization of Immunological Procedures. Baul: Karger, 1983: 73-80 (Developments in biological standardization. v. 53).

THE PATHOGENS: ENVIRONMENT AND SPREAD

To successfully combat, and eventually eradicate, diarrhoeal disease pathogens, it is critical to know how they survive, thrive and spread in nature and in human hosts.

* Classical *versus* El Tor: Partial Explanation

Last year, we reported a fascinating discovery, with worldwide implications. In autumn 1982, ICDDR,B scientists detected a unique phenomenon during a 3-month cholera outbreak. Nearly 10 years after it had been replaced by another strain and had totally disappeared from Bangladesh, a virulent type of cholera bacteria suddenly resurfaced with a vengeance.

Within three months, the emergent "classical" strain caused a major epidemic in five separate areas; and replaced its predecessor strain, El Tor, as the main cholera cause.

The phenomenon caused a scientific stir. For while El Tor had replaced classical in many countries, the reverse never had occurred.

While both cholera types are dangerous, the new classical causes more severe illness. For many reasons, the phenomenon raised vital questions — especially about whether the classical strain had changed, acquiring new, crucial, advantageous characteristics. This issue is critical. For if classical could adapt and change once, it might do so again, elsewhere. Moreover, knowledge of the change mechanism might be a key to winning the worldwide battle against cholera.

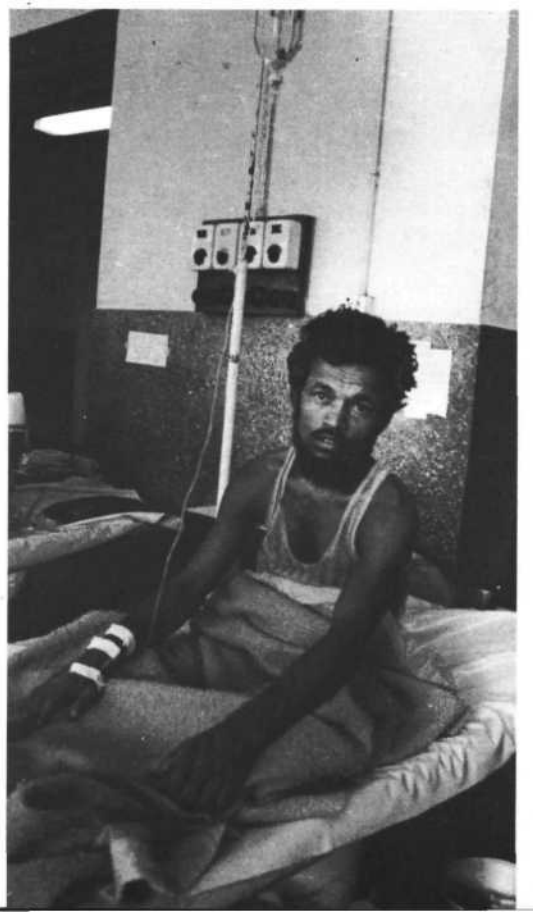
In 1983, ICDDR,B scientists, led by Bangladeshi microbiologist M. Imdadul Huq, sought to explain the unique occurrence. They found[8] a crucial difference between previously known classical strains and the new variety.

Old-type classical strains, when grown together with El Tor in laboratory cultures, were killed within 12 hours. Under similar conditions, the new classical survived for up to 50 days, though it did not overgrow and dominate the El Tor.

Concurrent epidemiological studies (results in press) showed that, for unknown reasons, the new classical spread more efficiently than did El Tor, within households and via close personal contact.

The conclusion: the new classical's undefined spreading advantage, coupled with its improved survivability in nature, begins to provide an explanation for its resurgence.

8. Huq MI, Sanyal SC, Samadi AR, Monsur KA. Comparative behavior of El Tor and classical biotypes of *Vibrio cholerae* 01 isolated in Bangladesh during 1982. *J Diar Dis Res* 1983 Mar;1(1):5-9.



CHOLERA: it respects no age (right and facing)

* Cholera Bacteria: Ecological Relationships

Crucial changes in cholera types, such as noted above, seem to be related to the waxing and waning of cholera epidemics over centuries. Outside man, the only place the disease occurs, there live in aquatic environments diverse cholera bacteria or "vibrios," related to the pathogenic varieties, but harmless to humans.

Little is known about where, whether and how such aquatic strains may interact with their toxic human cousins, exchanging important genetic information. Moreover, as noted earlier, one of the critical unknowns about cholera bacteria, is where and how do they survive and hide for long periods between their sudden, dramatic re-emergences.

It is widely believed that human cholera epidemics spring *de novo* from aquatic environments — which would explain why each year in Bangladesh and other developing countries cholera epidemics surface simultaneously in many places. Given this fact and the vital unknown about the bacteria's off-season habitat, urgently needed is knowledge of the ecological relationships between the major human cholera pathogen and other aquatic life forms?

A collaborative study[9] was done between ICDDR,B and University of Maryland (USA) researchers. It was led by a Bangladeshi scientist, Anwarul Huq, working in the laboratory of Prof. Rita Colwell, a laboratory equipped with advanced techniques for ecological studies.

It was found that both human disease-causing and closely related *Vibrio cholerae* strains live in nature attached to tiny marine crustaceans called "copepods" (of the lobster, shrimp, shellfish family). This critical association was discovered by isolating, grinding up and specially culturing these small marine animals.

It was shown too that the copepods' egg sacs and oral regions were the areas most heavily colonized with cholera vibrios; and that living copepods sustained the lives of *V. cholerae* better and longer than did dead copepods.

The conclusion: the attachment is significant, since strains of other diarrhoea producing bacteria did not adhere to live or dead copepods. The study clearly shows the existence of a unique, specific ecological niche, shared by a virulent human pathogen and its close bacterial relations. This finding may provide a key to unlocking many of the mysteries surrounding the survival and spread of virulent, human disease-causing *Vibrio cholerae*.

9. Huq A, Small FB, West PA, Huq MI, Rahman R, Colwell RR. Ecological relationships between *Vibrio cholerae* and planktonic crustacean copepods. *Appl Environ Microbiol* 1983 Jan;45(1):275-83.

ECOLOGICAL realities and mysteries lie at the heart of diarrhoeal diseases' spread. Significantly, scientists are trying to learn how diarrhoeal pathogens survive, thrive and are transmitted in nature. Unfortunately, contaminated water is a major transmittal means – among poor, rural peoples who drink, bathe and, sometimes, defecate in a single water source. One result: intestinal parasites, such as worms, the cause of this boy's swollen belly.

Giardia lamblia : Dynamics of Spread

Studies on illness causes in developing countries often focus on a single point in time. While valuable insights thus are gained, no answers are provided to most of the major questions — about when a particular disease is acquired, its duration, damage and spread.

A cooperative study[10] was done between scientists at the ICDDR,B and the National Bacteriological Laboratory, Stockholm, Sweden. Led by community medicine research physician Asma Islam of Bangladesh, it followed for a year 33 urban mothers and their nursing infants. During the babies' first year, 42 percent acquired a major parasitic cause of diarrhoea, *Giardia lamblia*. Many infants were infected by age three months; and almost all had diarrhoea — indicating that the first exposure results in significant illness. As to the mothers, 82 percent excreted the parasite at least once during the year, but only one had diarrhoea at the time she was infected.

The results suggest that, with repeated exposure to *G. lamblia*, adults acquire good immunity, which protects them against getting ill, but not against getting the parasite.

In other findings, no relationship was seen between a mother's colonization and her infant's disease. Breast milk protected infants under six months, but no clear-cut relationship was seen between breast milk antibody levels and such protection. Another explanation for the lower infection rate in young children might be that they are too young to crawl around and pick up the parasite.

The study's significance: clearly shown is the disease's dynamics. Thus, though *Giardia* is very common, the disease may be important only in children, not adults, in a *Giardia*-endemic area.

10. Islam A, Stoll BJ, Ljungstrom I, Biswas J, Nazrul H, Huldt G. *Giardia lamblia* infections in a cohort of Bangladeshi mothers and infants followed for one year. *J Pediatr* 1983 Dec;103(6):996-1000.

* Sophisticated Science Simplifies Field Diagnosis

The world-over, the commonest diarrhoea causes among travellers to and residents of developing countries are pathogenic strains of *E. coli* bacteria. Unfortunately, the standard methods of proving that specific *E. coli* cause disease require a sophisticated laboratory. Thus, field studies aimed at learning how this important pathogen spreads have been difficult or impossible.

However, in 1983, scientists from the ICDDR,B, California's Stanford University, the U.S. Armed Forces Research Institute for Medical Sciences, Bangkok, and the U.S. Naval Medical Research Units, Manila and Jakarta, were responsible for two critical studies[11]

The first used a highly sophisticated genetic research technique as a very effective field tool for identifying pathogenic *E. coli*. The second proved that the tool works well in the field among a large rural population. Leading the respective studies were Stanford's Steve L. Moseley and Jitvimol Seriwatana, a scientist at the Research Institute in Bangkok.

First, the bacterial genes which encode for production of specific *E. coli* diarrhoea-causing toxin were isolated. Then DNA, the chemical base of the genes, was made into single strands; and the strands were "labeled" with a radioactive isotope, becoming a "probe." When it exists as a single strand, DNA seeks its mate, a replica of itself; and sticks to this replica in a process called "hybridization."

In the technique, diarrhoeal stool samples are spotted on a filter disc; and the disc is chemically treated, causing all the DNA in the sample to become single-stranded. The isotope-labeled probe for the specific diarrhoea-causing *E. coli* toxin gene then is added to the disc. If any bacterial DNA strand possesses the specific toxin, the probe will adhere to it. When the treated, probed filter disc is placed against ordinary X-ray film, any *E. coli*-positive stool is identified readily as a spot.

Since X-ray film is available in all countries, the only sophisticated inputs are the isotopes and genetic methods. These are less costly than the animal colonies and tissue culture facilities otherwise needed.

The value of this technique was proven in experiments with 984 toxigenic and 733 non-toxigenic *E. coli* samples, taken from diarrhoea patients in Bangladesh, the Philippines, Thailand and Indonesia. Thus, while no hybridization occurred in any of the samples having no toxin-bearing *E. coli*, hybridization did occur in almost all the stool samples that had been proved to have toxin-carrying *E. coli*, by standard measures used to detect disease-causing *E. coli*.

The new technique will make it possible to readily diagnose *E. coli*-caused diarrhoea among large populaces, where sophisticated science is lacking. For X-ray film is widely available in all countries; radioactive isotopes are inexpensive and simple to store; the filter paper disc is easily transported, both before and after use, without special care; and the test can be done in any household by specially trained personnel. Moreover, it is expected that, in a short time, a convenient chemical label may substitute for the isotopic one.

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11. Moseley SL, Hardy JW, Huq MI, Echeverria P, Falkow S. Isolation and nucleotide sequence determination of a gene encoding a heat-stable enterotoxin of *Escherichia coli*. *Infect Immun* 1983 Mar;39(3):1167-74.
Seriwatana J, Echeverria P, Escamilla J, Glass R, Huq I, Rockhill R, Stoll BJ. Identification of enterotoxigenic *Escherichia coli* in patients with diarrhoea in Asia with three enterotoxin gene probes. *Infect Immun* 1983 Oct;42(1):152-5.

DIARRHOEA : CONSEQUENCES AND TREATMENT

In 1983, studies continued about the drastic consequences of diarrhoeal disease and how to ameliorate these. As noted earlier, one of the two main causes of death among developing country children is diarrhoea, complicated by malnutrition.

In light of this, among the more important work was the continuing research of ICDDR,B biochemist-nutritionist Ayesha Molla – who, in recognition of her significant achievements in diarrhoea/nutrition research, was named Best Woman Scientist of the Year, by the Bangladesh Women Scientists' Association.

Drs. Molla

For the past five years, Dr. Molla and her husband – A. Majid Molla, an ICDDR,B pediatrician and gastroenterologist – have concentrated on the diarrhoea/malnutrition mechanism in children. Both have contributed significantly, with Majid responsible for the clinical part, and Ayesha for the biochemical. One of their major achievements has been classic studies[12] on nutrient absorption during diarrhoea...

* Belief Disproven

Thus, as a result of apparently the first attempt since 1948 to assess the importance of continued feeding during and immediately after diarrhoea by focussing on nutrient absorption, the Mollas' team dispelled two widely held beliefs.

Studying patients infected with the major pathogens *V. cholerae, E. coli, Shigella* and rotavirus, they proved that feeding diarrhoea patients is far from useless – because, despite a hastened transit time in the intestines, substantial nutrient absorption occurs; and that eating does not increase the volume or duration of diarrhoea. Their conclusion: eating during diarrhoea should be encouraged – thereby helping reduce post-diarrhoea malnutrition in vulnerable developing country children.

This finding, which involved nitrogen, fats, carbohydrates and calories, already has changed medical opinions. Unfortunately, it has not yet reached the grass roots level in many societies, where feeding often is withdrawn or modified for diarrhoea victims.

* Diarrhoea and Enzymes

In a related study, the Molla group found that diarrhoea has a negligible effect on secretion of digestive enzymes – thus offering a partial explanation for why significant digestion and absorption continue during diarrhoea.

* Vitamin A Connection

Also, Ayesha Molla was honored for complementary studies on the vitamin A/diarrhoea/malnutrition mechanism. This work is vital because, in many developing world children, repeated diarrhoeal infections aggravate malnutrition, and lead to vitamin A deficiency-caused blindness. A serious health hazard, most such blindness appears to be associated with or preceded by repeated diarrhoea.

Essentially, Dr. Molla's research showed that, during acute diarrhoea of diverse origins, prompt oral administration of water-soluble vitamin A is a highly effective means of preventing blindness and related eye diseases.

12. Molla A, Molla AM, Sarker SA, Khatun M. Whole gut transit time and its relationship to absorption of macronutrients during diarrhoea and after recovery. *Scand J Gastroenterol* 1983;18(4):537-43.
Molla A, Molla AM, Sarker SA, Khatun M. Effects of acute diarrhoea on absorption of macronutrients during disease and after recovery. In: Chen IC, Scrimshaw NS, eds. Diarrhea and malnutrition: interactions, mechanisms and interventions. New York: Plenum, 1983:143-54.
Molla AM, Molla A, Sarker SA, Rahaman MM Food intake during and after recovery from diarrhoea in children. In: Chen LC, Scrimshaw NS, eds. Diarrhoea and malnutrition: interactions, mechanisms and interventions. New York: Plenum, 1983:113-23.
Molla A, Islam A, Molla AM, Jahan F. Change in serum Vitamin A concentration after an oral dose in children with acute diarrhea. *J Pediatr* 1983 Dec;103(6):1000-2.

* Supplemental Feeding for Diarrhoeal Babies

From the above research on continued feeding during diarrhoea, it is evident that such a strategy is especially critical in malnourished children – who need as many calories as they can get, to replace diarrhoea losses and meet normal needs.

In developing countries, prolonged breast feeding is the rule. Unfortunately, the breast milk nutrients of poorly nourished women often are inadequate even for healthy babies after age six months.

Thus, it is obvious that supplemental foods should be given to keep diarrhoeal babies' nutritional statuses from deteriorating, often with drastic consequences.

This study,[13] led by ICDDR,B medical officer Shafiqul Alam Sarker, is valuable because it provides quantitative data about the intake of breast milk and supplemental food on acutely ill diarrhoeal babies. Such information is important to efforts to prevent diarrhoea's nutritional consequences.

Thirty-three breast-fed diarrhoeal babies, aged 8-24 months, were monitored for seven days during hospitalization and 14 days thereafter. At admission, 16 were exclusively breast-fed and 17 partially weaned. The former immediately were given weaning food.

Basically, it was found that all babies were able to consume 900-1,000 calories daily throughout their illness and recovery periods – but that their mothers were able to provide only 54 percent (for the exclusively breast-fed) and 40 percent (for the older babies) of this total calorie intake.

The resulting deficit of 46 to 60 percent, the researchers said, would have caused severe calorie deprivation. Thus, supplemental feeding had been critical during the illness and recovery periods. Also shown was that exclusively breast-fed diarrhoeal babies readily accept supplemental foods, without adverse effects.

The conclusion: attention should be given to increasing intake of high calorie foods in diarrhoeal babies, to prevent the debilitating diarrhoea-malnutrition cycle.

13. Sarker SA, Molla AM, Rahaman MM. Impact of supplementary food on intake of breast milk in diarrhea. *Lancet* 1983 Dec 10;2: 1349-51.

* Post-Diarrhoea Deaths

Speaking of diarrhoea/malnutrition, research done elsewhere has shown, based mainly on lay reports, an association between malnutrition and mortality. However, before the work to be described, no long-term study apparently had been done to establish the role of moderate and severe malnutrition as a fatality risk factor.

At the ICDDR,B's Matlab centre, demographic surveillance has been done for a large rural populace for 18 years (see page 21). Thus, there was an opportunity to monitor the nutritional states of children discharged from a hospital following treatment for diarrhoea.

A study[14] was done to discover whether babies' nutritional states, damaged by recent diarrhoeal attacks and endangered by the children's return to their unprotected environments, play a role in deaths due to diarrhoea reinfection over the next year. In charge was Swapan Kumar Roy, an ICDDR,B clinical research physician from Bangladesh.

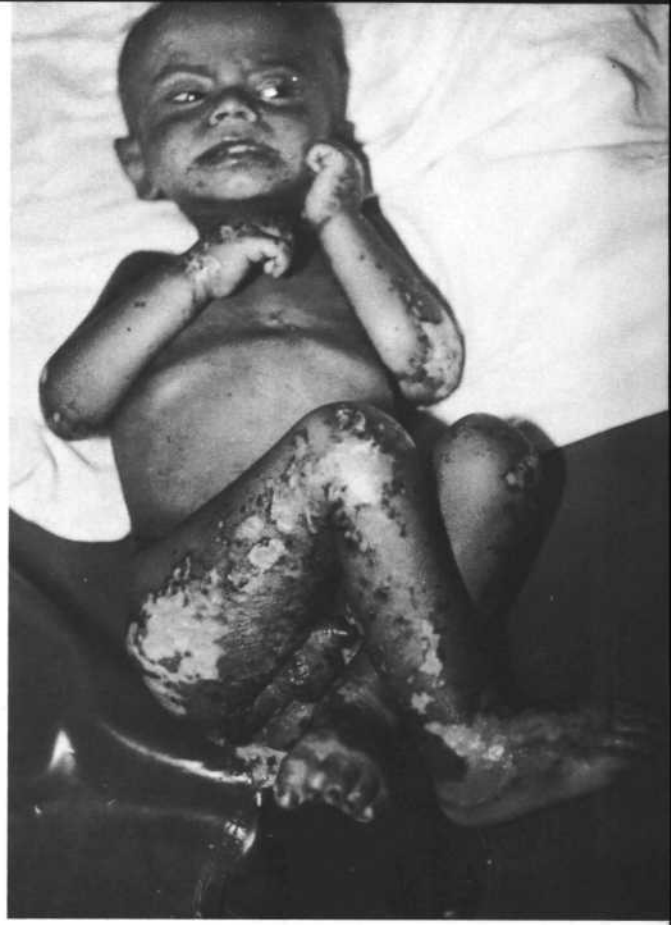
During a year's follow-up, 551 children, aged three months-to-three years, were found to have significantly more deaths (a total of 23) than their community peers. The first three months appeared to be crucial, with 16 (70 percent) deaths.

The severely malnourished (nutritional state below 56 percent of the international standard of weight for age) had 14 times more risk of dying than did their comparatively well-nourished counterparts (66-plus percent of the standard).

The highest mortality was in 2-year-olds, with one-third of the severely malnourished dying, compared to 1/10 of those moderately malnourished. In under-two children, there were no excess deaths, nor was mortality related to nutritional state.

A possible reason for the death rate difference in those under and over age two was that nutrition in under-two babies is related to birth weight, whereas malnutrition in over two-year-olds is related to available food. Also, since breast feeding is universal and prolonged in the study area, younger babies thus may have been protected against diarrhoeal reinfection, and given more nutrition.

These findings, coupled with lay reports that most deaths of severely malnourished children occur after prolonged diarrhoeal illness, indicate a crucial need to integrate diarrhoeal treatment with nutritional rehabilitation and home follow-up care for severely malnourished under-two children.



DIARRHOEA & MALNUTRITION work in a vicious cycle. One result: "kwashiorkor," a malnutrition disease sometimes manifested by skin ulcerations.

14. Roy SK, Chowdhury AKMA, Rahaman MM. Excess mortality among children discharged from hospital after treatment for diarrhoea in rural Bangladesh. *Br. Med J* 1983 Oct;287:1097-99.

* Cholera: Minimizing the Damage

Turning from the broader issue of diarrhoea/malnutrition to the most deadly of the diarrhoeal disease organisms, other ICDDR,B scientists sought ways to diminish the effects of cholera.

To lessen the consequences of any disease, scientists must understand the disease's mechanism, in order to choose the most effective remedy from among thousands of possibilities.

Fortunately for cholera, the precise way cholera toxin causes the life-threatening loss of bodily fluids and salts has been defined (see page. 7 the Faisal Prize.) One result of this key discovery had been that the drugs predicted by laboratory studies to be effective have proven capable of reducing cholera-caused fluid losses.

Unfortunately, the first such promising "anti-secretory" drug developed and tested, "chlorpromazine," has sedative side effects which limit its widespread use.

Another such candidate is "nicotinic acid," a drug shown in test animals to inhibit and reverse intestinal secretion, induced by the toxins of both cholera and *E. coli* bacteria. While its anti-secretory mechanism is unclear, nicotinic acid is a component of vitamin B and an essential constituent of a good human diet. It seldom produces side-effects.

In 1983, Golam Hasan Rabbani, a Bangladeshi ICDDR,B clinical research physician, tested nicotinic acid in a controlled, randomized clinical trial.[15] Of 62 adults with severe cholera, 29 received nicotinic acid and 33 acted as controls. In the treated patients, fluid losses were reduced 31-47 percent in the disease's first critical 16 hours.

Not only was the drug highly effective, but it had no sedative effects—meaning that it and related compounds may prove of significant general use for patients with cholera and other severe watery diarrhoeas.

15. Rabbani GH, Bardhan PK, Butler T, Islam A. Reduction of fluid loss in cholera by nicotinic acid. *Lancet* 1983 Dec;24(31):1439-42.

MATLAB:
ASSESSING THE LARGER PROBLEMS

Having surveyed the more important individual ICDDR,B projects whose results were published in 1983, we shift emphasis now to the Centre's critical 18-year-old Matlab Experiment, which, in many ways, is the centerpiece of ICDDR,B research.

For in 1963 at Matlab upazilla (county), a rural area 45 kilometers southeast of Dhaka, the Centre's predecessor, the CRL, started small-scale data collection in 23 villages with a total population of 28,000. The system was designed to combine periodic censuses of the study populace with continuous registration of births, deaths and migrations. In 1975, data on marriages and divorces were added to the much expanded system.

In 1966, a census was done in an enlarged Matlab Demographic Surveillance Area, encompassing 110,000 people in 132 villages. In 1968, 101 adjacent villages were added, about doubling the census populace. Later, the study area was reduced, so that, by the 1982 census, it encompassed about 190,000 people in 149 villages.

The DSS's goal is to obtain reliable information about diverse changes in a community over time. Such data provide a unique foundation for measuring many things – especially the interactions among such variables as infectious diseases, health care, death and disease prevalence and causes, nutritional states and fertility.

Using the DSS, the Centre has two main goals. The first is basic research on the biosocial determinants of health versus disease, death, and fertility. Such studies attempt to assess how health, etc. is affected by complex factors, particularly socio-economic status, nutrition, hygiene and general educational levels, and religious and other beliefs and taboos.

The second aim: to try to improve big populations' health, via large-scale projects – while assessing such "result" factors as effectiveness, hazards, community acceptance and applicability; to monitor any problems; and to determine by results the ultimate value of such efforts.

To achieve these aims, the Matlab DSS has been divided into "treatment" and "comparison" areas, each with about 95,000 inhabitants. In both areas, extensive "vital events" data (births, deaths, etc.) is collected continuously

In the treatment area, trained "community health workers" (CHWs) make regular visits to communities. They train "bari" (a cluster of houses where the people are related) mothers to prepare and use oral rehydration solution for diarrhoea victims; dispense a variety of contraceptive devices and give family planning (FP) advice; and provide a growing list of maternal child health (MCH) services, aimed at the major child killers that can be effectively treated and prevented: diarrhoea, measles, neo-natal tetanus, and prevention of both maternal death in childbirth and maternal malnutrition, especially iron deficiency.

At the heart of this overall effort is found, in the treatment area, the ICDDR,B's 50-bed research centre-cum-hospital, mainly meant to monitor the incidences and pinpoint the causes of diarrhoeal diseases. Staffing this are five full-time doctors (one a female responsible for the MCH-FP program), five nurses and a few aides.

Also in the treatment area, the ICDDR,B has four sub-centres, each run by a woman paramedic with 18 months' MCH-FP training. Reporting to the woman physician at Matlab, these paramedics provide basic health care treatment for their areas. Working under each paramedic are 20 female CHWs, continuously trained and retrained until they have a repertoire of health and family planning-related activities.

PROVIDING SOME ANSWERS

Having described the purpose, structure and operations of the Matlab DSS, we turn now to its successes, as described in 1983 in two major reports,[16] with the principal authors being Dr. Lincoln C. Chen, former Scientific Director of the ICDDR,B; and Dr. Stan D'Souza, erstwhile Director of the Matlab Experiment.

Essentially, the reports graphically portray a critical overall success of the Matlab MCH-FP program: that, by focussing on provision of health measures designed to prevent disease and death, coupled with intensive dissemination of family planning advice, devices and medical follow-up, the Matlab effort has brought about a sharp decline in both death and birth rates.

Specifically, viewing for 1982 the comparison versus treatment area (the latter having benefitted from the MCH-FP effort) it is evident that:

—The overall birth rate in the treatment area was 17 percent lower: 36.9 per 1,000 populace versus 44.6 for the comparison area:

—There was a 21 percent difference in overall death rates: 12.5 versus 15.9;

—There was a 10 percent difference in infant mortality: 105.9 versus 118.3;

—There was a large difference in sustained contraceptive use: 34 versus 7 percent;

-The principal influences on these vital differences seemed to be widespread vaccination against measles and neonatal tetanus, use of ORS to prevent diarrhoeal dehydration deaths, and family planning services.

For example, it was shown that, while tetanus had been responsible for about 26 percent of total infant deaths in the Matlab area from 1975-77, the mortality rate among infants born to women immunized during pregnancy ranged from 45-68 percent less than for babies born to never-immunized women.

As for measles, though 80 percent of all treatment area children now have been immunized, analyses of the effects have not been completed.

Finally, there's ORS. While it is impossible to assess the success rate of ORS use out of the context of the overall MCH-FP program, it can be said that in 1982 the frequency of deaths from diarrhoeal diseases was 30 percent lower in the treatment than in the comparison area.

Importantly, the above results have been accomplished, not by a big, central hospital and sophisticated medical treatment, but by taking the solutions to where the problems exist: people's homes.

Still, while the successes described are encouraging, they represent only the tip of a very big iceberg. For example, serious health threats still exist, especially the other big killers: pneumonia, and related respiratory infections.

At the same time, answers to big questions still are being sought. One of these is what factors increase risks to health and life or, inversely, what interventions should be targeted on ?

One answer is provided by a recent Centre study—which showed that the single most important correlate of child survival is not, as might be expected, the family's wealth or the availability of medical facilities, but the mother's educational level. Thus, during very tough times in Bangladesh—the 1974-77 post-revolution and famine period—under-three children of mothers with no education were five times more likely to die than were children of mothers with seven or more years' education. Why this is so is unknown—and is the subject of on-going research.

16. Chen LC, Rahman M. D'Souza S, Chakraborty J, Sardar AM, Yunus M Mortality impact of an MCH-FP program in Matlab, Bangladesh. *Studies* in *Family Planning*. 1983 Aug-Sept;14(8/9):199-209.
D'Souza S. A population laboratory for studying disease processes and mortality—the demographic surveillance system, Matlab, Comilla, Bangladesh. *Rur Demogr (Dhaka)* 1981:8(1):29-51.

THE RESEARCH WORKING GROUPS

Community Services Research

An account of the ICDDR,B's Matlab Experiment leads logically to an explanation of who runs it; and from there to a description of how the Centre's overall activities are structured and implemented. For the Matlab DSS is the backbone of one of the ICDDR,B's five "Working Groups," specifically the CSRWG, for Community Services Research.

The CSRWG's goals already have been described (as those of the overall DSS effort). And while the Matlab DSS is by far its major responsibility, the Group also supervises two other scientific support branches: Data Management and Computer Information—branches whose activities obviously are crucial to the functioning of the DSS.

Moreover, in an effort related to its aim of helping improve health care, the CSRWG continues to support and assist three small community-run simple diarrhoea treatment facilities. Located in the greater Matlab area, these centres are manned by volunteers trained and retrained at the ICDDR,B, which also provides some medical supplies. Establishment of such centres is an ICDDR,B goal—since experience shows that it is more effective to have simple, easy access treatment facilities dispersed over a large area, than a sophisticated hospital in a single place. Research on how to translate the successful approaches developed at Matlab to the Bangladesh Government's overall health system, represents a major, new thrust of Centre efforts.

THE CENTRE also runs another, though smaller, less sophisticated field station operation than the Matlab one, at a place called Teknaf, at Bangladesh's southeastern tip. There, field studies have shown that dramatically improved water/sanitation facilities alone are not enough to bring down the diarrhoeal disease rate. Seemingly crucial is the need to educate people about the overall pollution-disease cycle; and to motivate them, especially mothers, to adopt better hygiene practices. This is especially difficult in the very conservative Teknaf area, where religious and cultural beliefs prevent women from talking to any man outside the immediate family and where strangers are avoided.

So, the ICDDR,B health worker (right), who comes from the area and is clad in a "burqa," goes from house-to-house, explaining the crucial need to use only the latrine (inside the bamboo enclosure), to wash hands properly afterwards and frequently, and to make sure even young children use a specific receptacle, if they cannot or will not use the latrine. ICDDR,B planners specially designed an earthenware potty (foreground) for toddlers; and had a local potter produce a few hundred. The pitcher is for storing water, for washing hands, flushing the toilet, and "ablutions," a cleansing ritual universally followed in the Teknaf area.

TRAINING OF DOCTORS and health workers from many countries represents a major part of ICDDR,B activities. As with all medical research, animal studies are crucial. Veterinarian K. A. Al-Mahmud (right) directs the Centre's Animal Laboratory, acknowledged as one of the world's finest.

Pathogenesis and Therapy

This Working Group focuses on gaining a better understanding of the mechanisms (pathogenesis) wherein diverse organisms produce infections leading to diarrhoea; and attempts to use such knowledge to devise effective preventives and treatments.

One of the PTWG's responsibilities, as well as a major framework for its research, is supervision of the ICDDR,B's Dhaka Station Hospital, mainly designed to treat diarrhoeal diseases and related complications. In 1983, there were a total of 71,650 patient visits—with a diarrhoeal case fatality rate of about half a percent.

Disease Transmission

Despite intensive studies by scientists in many disciplines, in about 30 percent or more of diarrhoea cases seen by the Centre no infectious disease-causing organism can be found.

Moreover, even for the recognized pathogens, much information is lacking about how they are transmitted; how they interact with human hosts and the environment in which they survive and thrive; and about how they can be successfully fought. With these unknowns in mind, DTWG scientists are doing comprehensive research in many areas.

Host Defense

It is not enough to identify diarrhoeal disease agents; and study their nature, disease mechanism, transmission mode and how they may be combatted. Scientists also must ask, "How does the human body respond to attacks by such disease agents?" and, "What human factors predispose some people more than others to contracting such serious illnesses?" Seeking such answers are HDWG scientists.

Nutrition

As we have seen (Molla experiments), diarrhoea and malnutrition seem inextricably intertwined. The broad goals of the NWG are to unravel the ways in which diarrhoea leads to malnutrition, and to discover how malnutrition modifies the course and outcome of diarrhoea.

Training, Extension & Communications

This, the final Working Group, is responsible, not only for widely diverse activities, but for many of the ICDDR,B's seemingly less glamorous, though no less vital achievements.

Training & Extension

Vigorously pursuing one of its major goals, the Centre in 1983 provided a diverse range of training courses, lectures, seminars, conferences and workshops—taught by experts of international stature from around the world.

Benefitting from this ever expanding Centre effort were 1,856 (up from about 1,000 in 1982) researchers, doctors, nurses and health personnel from Bangladesh and 48 other countries, mostly developing ones.

The "students" were trained in many technical and research aspects of diarrhoeal disease prevention, diagnosis, treatment and cure, so they could return home able to train others—thereby multiplying the ICDDR,B's outreach endeavors, resulting in widespread effective services.

International Training

- Two courses and two workshops, attended by 145 persons from 45 countries.
- Two inter-regional courses, run in collaboration with WHO and attended by 23 "students" from 21 nations. The aim: to increase clinicians' treatment and management abilities, so they could aid their own countries' diarrhoea control programs.
- Two major workshops. The first, in cooperation with UNICEF and attended by 25 researchers from 20 countries, sought to measure the health impacts of water/sanitation projects, and to make recommendations. The second, on the effects of a large water project in rural Bangladesh, was run in concert with UNDP, and attracted 53 researchers from 19 countries. Its aim: to plan a long-term multi-discipline research undertaking.
- A workshop for clinicians, organized in cooperation with WHO; and a conference, where research findings and experiences were discussed, co-sponsored by the National Institute of Cholera and Enteric Diseases (NICED), Calcutta, India.

National Training

In a major endeavor to help the Bangladesh Government establish a National Diarrhoeal Diseases Control Program, the ICDDR,B initiated a broad-ranging effort.

Thus, with some support from the Ford Foundation, the Centre ran eight short-courses, attended by 125 Government medical officers and paramedics, from 19 districts. Taught were such epidemic control measures as disease identification, prevention, treatment and reporting procedures.

Returning to their districts in time for the annual diarrhoea epidemic period, the trainees both used what they had learned and taught other medical officers. These latter officers, in turn, organized for village leaders training sessions aimed at educating the masses about ORS use and epidemic-related measures.

In another part of the effort, the Centre sent medical supplies and 20 medical teams, consisting of a physician, epidemiologist and microbiologist, to affected areas, to help Government personnel combat the outbreaks. Moreover, two Centre physicians were deputed to the Government's epidemic emergency control post, to help gather correct information about on-going epidemic eruptions.

Furthermore, 23 Government physicians and three senior health officials received intensive two-day training. And, finally, the Centre began one-year training courses for 18 government clinicians and pathologists.

* The Centre continued to aid Bangladesh's National Oral Rehydration Program (NORP), by supporting training courses for Village Volunteer Health Workers; and having NORP personnel both teach at some ICDDR,B training sessions, and arrange field visits for Centre students.
* Various aspects of diarrhoeal diseases, including management, pathology, and epidemic control, were covered by 15 training courses and two workshops, attended by 367 persons from Government and national health-related organizations. Another 1,322 Bangladeshis benefitted from short-courses and individual study.

* A total of 22 fellowships were provided—6 to Bangladeshis and 16 to research trainees from 10 other countries: China, Egypt, France, India, New Zealand, Nigeria, Sri-Lanka, Sweden, USA and Yemen.

Scientific Conferences & Workshops

Periodically, the Centre has convened a conference or workshop to explore, several years in advance, research areas which may need emphasis or a new direction. For such events, leading scientists in the pertinent fields have met in Dhaka, usually for a week or more, to review the state of the art, and to discuss new directions. The highlights:

1981—Conference on Experimental Cholera Vaccines
1981—International Conference on Shigellosis
1983—International Workshop on Measuring Health Impacts of Water and Sanitation Programmes
1983—Workshop on the Effects of a Large-Scale Water Control Project in Rural Bangladesh

In 1983, the Centre published the results (250 pages) of the *Shigella* Conference, the first of its kind. Already, some of the research ideas and directions suggested have been implemented—both by the ICDDR,B, which has begun giving increased attention to *Shigellae*-caused diseases called "shigellosis," and by researchers in other places.

Thus, nearing completion are studies, in animals and humans, that will better define the extent and mechanism of shigellosis. Moreover, epidemiological and intervention studies are underway; new anti-shigellosis vaccines are nearing the stage for field testing; and dysenteric illnesses usually caused by *Shigellae* have been shown to be related to a prior measles attack. Also, malnutrition and failure to grow in children have been correlated with shigellosis.

Still, given the extent and severity of the disease and the many related problems, much research remains to be done. An important example: since *Shigellae* are becoming increasingly antibiotic–resistant, and the disease is an intestinally "invasive" one of prolonged nature whose debilitating and deadly dehydration currently only can be treated with ORS, other therapeutic measures must be found.

Training Materials

In an important innovation, Dr. W.A.M. Cutting, an ICDDR,B consultant from the University of Edinburgh, Scotland, partially edited the overall curriculum materials used to teach students at Bangladesh's medical colleges; and compiled these materials into learning modules on diarrhoea.

Each module is expected to be incorporated into the normal medical school curriculum, rather than presented as a separate unit on diarrhoea. Hence, the modules have been divided into subject chapters: physiology, microbiology, pathology, etc.

The new modules will be evaluated in a medical faculty workshop, scheduled for August 1984, with final revision slated for year's end.

Staff Development

In an effort to upgrade their competence, 130 ICDDR,B staff members from diverse

disciplines were trained, 14 of them overseas, 15 at Bangladeshi institutions, and the rest in in-house programs.

Communications

Enhancing its efforts to share its expertise as widely as possible, the ICDDR,B in 1983 broadened the activities of DISC—the International Diarrhoeal Disease Information Service and Documentation Centre—the world's first clearing house solely devoted to disseminating information on diarrhoeal diseases.

As a major part of this effort, the Centre published the first two issues of a new quarterly "Journal of Diarrhoeal Diseases Research"—the first international endeavor of its kind. Edited and contributed to by research experts from around the world, the JDDR contains original scientific papers; and an annotated bibliography of published and unpublished diarrhoeal disease-related research papers from Asia.

The JDDR is off to an excellent start. It enjoys an early subscription total of 158 individuals and institutions in 40 countries, and unanimous praise from readers whose opinions were solicited. Moreover, it already is being indexed and abstracted by *Excerpta Medica*. Finally, in a promotional effort, about 3,700 complimentary copies of the JDDR have been distributed.

The JDDR is part of DISC, which began in 1982, and has been financed for three years by IDRC (International Development Research Centre), Canada. DISC collects, organizes, analyzes and disseminates pertinent literature, to help avoid unnecessary research duplication. It also helps speed up use of new practices, so that researchers and health practitioners can help achieve the ultimate goal: diarrhoeal disease prevention and control.

Included in DISC are a question-and-answer service; publication of specialized annotated bibliographies, as well as a Directory of Asian Scientists; and provision of reprints and microfiches. By the end of the year, DISC had enrolled 41 individuals and organizations from 20 countries as members.

Finally, in 1983, at the advice of the Centre's Board of Directors, DISC began an inventory of diarrhoeal disease-related research, completed or in progress in Bangladesh, for use by the Standing Committee of the ICDDR,B's Programme Coordination Committee (P. 28).

In other communications efforts, more than 33,000 copies of "Glimpse," the ICDDR,B's bi-monthly research newsletter, were distributed free to scientists and scientific organizations in 144 countries. Contained in "Glimpse" are descriptions of diarrhoea-related research at the ICDDR,B and at other developing world institutions; summaries of other major ICDDR,B activities, papers and publications; and notices about forthcoming conferences, meetings, etc.

Moreover, the Centre produced two important publications: the proceedings (250 pages) of the world's first (and important) conference on shigellosis, a major dysentery-type diarrhoeal disease; and Volume 11 (60 pages) in a series of reports on the Matlab DSS.

As in the past, most of these ICDDR,B publications were distributed free to most Bangladeshi health-related institutions and libraries, either as donations, or under exchange programs.

As for the ICDDR,B's library, 3,418 outside researchers, teachers and students used the facility. Besides access to 478 current journals, 15,471 books and bound journals, and 7,835 reprints and other documents, the library provided a national and international inter-library cooperation and loan service.

MANDATORY COMMITTEES

To coordinate research and prevent any actions prejudicial to Bangladesh's research interests in similar fields; and to ensure an ethical review process, the ICDDR,B Board of Trustees has established several ordinance-mandated committees.

Programme Coordination Committee (PCC)

To coordinate, strengthen and facilitate research efforts by Bangladeshi organizations, a major ICDDR,B endeavor, the Board of Trustees in December 1982 established a Programme Coordination Committee (PCC.) The PCC has 30 members: four from the ICDDR,B, and the rest from leading Government and private science, health, rural development, education, nutrition and population-related Bangladeshi institutions. The ICDDR,B has long-standing programs with most of these organizations, cooperating with them in research and training.

To facilitate and make more efficient the parent committee's work, the PCC also has a 13-member Standing Committee, whose members come from the PCC itself.

In 1983, the PCC met twice, and did the following:

* Discussed and adopted the PCC's operational guidelines;
* Considered collaborative programs in both training and research; and suggested that more effort should be made to strengthen such programs;
* Suggested ways of strengthening national research institutes' potentials in diarrhoeal disease research and related subjects;
* Suggested that the services of ICDDR,B Visiting Scientists should be utilized to the utmost, to share knowledge with other research organizations;
* Decided that the ICDDR,B should help Government efforts to manage and control diarrhoeal diseases during epidemics, and to educate rural people about diarrhoea preventive care. (This already has been implemented. See P.25).

As to the PCC itself, it is designed to advise the ICDDR,B's management and Board of Trustees, regarding research on diarrhoeal diseases and the related subjects of nutrition and fertility, and to:

* Establish links between international and national efforts;
* Recommend means of assisting in building national research capacities;
* Constantly endeavor to strengthen and coordinate research in the areas of ICDDR,B expertise;
* Identify any undesirable research overlaps between the Centre and national institutions;
* Mediate any inter-institutional controversies over undesirable research overlaps and competition;
* Maintain a running inventory of diarrhoea-related research and scientific personnel, for both the ICDDR,B and pertinent national institutions;
* Train qualified staff of national institutions to prepare research protocols; and, where appropriate, help them obtain funds for approved research protocols for collaborative projects. Provide Centre facilities, where appropriate, for doing such research;
* Consider any other related subjects/responsibilities assigned by the ICDDR,B Board of Trustees.

PCC Members

*1. Prof. M.A. Matin,
President
Bangladesh College Physicians and Surgeons

*2. Dr. Kamaluddin Ahmad
Director
Institute Nutrition and Food Science,
Dhaka University

*3. Dr. A.K.M. Aminul Haque
Vice-Chancellor
Bangladesh Agricultural University,
Mymensingh

*4. Brig. M.R. Chowdhury
Commandant,
Armed Forces Institute Pathology and Transfusion

*5. Dr. A.K. Khan
353, Elephant Road, Dhaka

*6. Mrs. Gole Afroz Mahbub
Senior Programme Officer,
The Pathfinder Fund

*7. Dr. Mofazzal Hussain
Project Director, National Oral Rehydration Project (GOB)

*8. Brig. M. Hedayetullah
Director General,
Health Services (GOB)

*9. Dr. Humayun K.M.A. Hye
Director (Manpower Development)
Director General's Office,
Health Services (GOB)

*10. Dr. Mobarak Hossain
Chief, Health Section,
Planning Commission,
Ministry Planning (GOB)

*11. Prof. Nurul Islam
Chairman
Bangladesh Medical Research Council &
Director, Institute Post-Graduate Medicine & Research

12. Dr. Md. Ibrahim
President, Bangladesh Institute Research & Rehabilitation in Diabetes, Endocrine & Metabolic Disorders

13. Dr. K. Badruddoza
Executive Vice-Chairman,
Bangladesh Agricultural Research Council (GOB)

14. Prof. M. Mobarak Ali
Director, National Institute Preventive and Social Medicine (GOB)

15. Dr. Shafiqur Rahman
Director, Bangladesh Fertility Research Programme (GOB)

16. Mr. F.H. Abed
Executive Director, Bangladesh Rural Advancement Committee

17. Dr. Nazrul Islam
Chairman, Bangladesh Council Scientific & Industrial Research (GOB)

18. Dr. Munawara Binte Rahman
Director, Institute Public Health (GOB)

19. Dr. Md. Shamsul Haque
Vice-Chancellor, Dhaka University

20. Dr. S. Waliullah
Director General, National Institute Population Research & Training (GOB)

21. Mr. Shafiqur Rahman Chowdhury
Director, Management Information System, Directorate Population Control (GOB)

22. Dr. M.S. Akbar
Consultant Pediatrician, Shishu Hospital

23. Dr. Sultana Khanum
Medical Director, Children's Nutrition Unit, Save the Children (UK)

24. Dr. M.H. Rahman
Director, Institute Public Health & Nutrition (GOB)

25. Dr. A.T.M. Hussain
Principal,
Para-Medical Institute (GOB)

26. Dr. M.R. Khan
Senior Research Demographer,
Bangladesh Institute Development Studies

27. Dr. S.A. Akanda
Director, Institute Bangladesh Studies,
Rajshahi University

28. Dr. A.H.M. Abdus Sattar
Director
Bangladesh Medical Research Council

29. Maj. Gen. M. Shamsul Haque
Minister Health & Population
Control (GOB)

30. Mr. A.B.M. Golam Mustafa
Secretary, Health Division, Ministry
Health & Population Control (GOB)

31. Dr. Hajera Mahtab
Medical Director, Bangladesh Institute
Research & Rehabilitation in Diabetes,
Endocrine & Metabolic Disorders

32. Dr. Farida Huq
Head, Microbiological Laboratory,
Institute Public Health (GOB)

33. Dr. Ghyasuddin Ahmed
Associate Professor Population
Dynamics, National Institute Preventive
and Social Medicine (GOB)

34. Dr. Anwarul Azim Chowdhury
Microbiology Department,
Dhaka University

*35. Dr. W.B. Greenough, III
Director, ICDDR,B

36. Dr. M. Mujibur Rahaman
Associate Director,
Nutrition Program, ICDDR,B

*37. Dr. K.M.S. Aziz
Associate Director, Training, Extension,
Communications, ICDDR,B

38. Dr. Thomas C. Butler
Associate Director,
Pathogenesis/Therapy, ICDDR,B

(GOB = Government of Bangladesh)

*Members of the Standing Committee, of which Prof. M.A. Matin is President, Dr. Kamaluddin Ahmad is Vice-President, and Dr. K.M.S. Aziz is Member-Secretary.

The Ethical Review Committee (ERC)

Meeting monthly, the ERC examines and monitors the ethical aspects of research involving human subjects. It has 13 members: three from the ICDDR,B; one from the PCC's Standing Committee; and nine outsiders representing different professions, including one member from the Bangladesh Medical Research Council.

The ERC has a four-member sub-committee, that checks the implementation of ethical principles, audits informed consent procedures that make certain patients know that the quality of medical care would be unaffected if they do not agree to participate in a study; and that protocol procedures are followed strictly. In 1983, the ERC met 12 times; and considered 49 research protocols, approving 46. The ERC members were :

Dr. K.M.S. Aziz*	—	Basic Scientist and Chairman
Dr. M.M. Rahaman*	—	Clinician and Relieving Chairman
Dr. P. Speelman*	—	Laboratory Scientist
Dr. Humayun K.M.A. Hye	—	Pharmacologist
Dr. Khaleda Banu	—	Pediatrician
Dr. Sufia Ahmed	—	Woman and Non-Scientific Member
Mr. Md. Mofazzal Hossain Khan	—	Religious Representative
Mr. K.Z. Alam	—	Legal Profession Representative
Mrs. Husnara Kamal	—	Behavioral Scientist
Mrs. Taherunnessa Abdullah	—	Behavioral Scientist
Dr. T.A. Chowdhury	—	Gynecologist, Rep. Bangladesh Medical Research Council
Dr. Z. Sestak	—	WHO Acting Resident Representative
Dr. Kamaluddin Ahmad	—	Biochemist/nutritionist, Rep. PCC's Standing Committee

*ICDDR,B Members

EDUCATION about good hygiene and nutrition, as well as about diarrhoea prevention and care, represents the heart of the Urban Volunteers' training program.

OTHER COMMITTEES

URBAN VOLUNTEERS

Aiming to prevent and treat diarrhoea within Dhaka area communities, thereby reducing the numbers of patients coming to the ICDDR,B's main treatment centre, an Urban Volunteers training program was begun in 1981. The program teaches illiterate and semi-literate slum women to work as diarrhoeal disease volunteers in their own communities.

Training for two weeks in batches of 15 the women learn about general hygiene and nutrition, about how to treat most diarrhoeal dehydration with ORT, about how to spot dehydration severe enough to require hospitalization—and about diarrhoea prevention, including intensive training in good nutrition and hygiene practices. The program includes considerable practical experience at the ICDDR,B's Dhaka Treatment Centre.

The Volunteers take this extended treatment back to their own communities. There, in addition to dispensing a total of about 4,000 ready-made ORS packets a week, they also provide soap and vitamin A, as well as give mini-lectures they practiced at the Centre, on hygiene and nutrition.

Finally, in 1983, the project's activities were expanded. Aided by Volunteers and project staff, the urban slum communities were encouraged to assess their own water and sanitation sources and needs, and to take action for improvement.

In 1983, there were a total of 600 active Urban Volunteers, working in 15 of Dhaka's 18 districts.

Research Review Committee (RRC)

The RRC is made up of ICDDR,B researchers, except for one representative from the PCC's Standing Committee. The RRC reviews research protocols—examining their scientific value, significance, feasibility and researchers' capabilities, as well as their relationship to the Centre's objectives and financial means. During 1983, the RRC met 11 times; and considered 17 protocols, approving 15.

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Senior Lecturer
Department of Community Medicine
University of Nairobi, Kenya

BOARD OF TRUSTEES

At both its June and November meetings, the Board of Trustees once again focused on the Centre's diverse, complex financial affairs, after considering in-depth reports from its own Finance Committee and the ICDDR,B's Associate Directors for Resources Development and for Finance and Administration.

Finances

The Budget — Noting a "very uncertain financial climate," in which some donors' priorities are moving away from international health and related research, the Board approved a conservative, belt-tightening fiscal 1984 Centre budget of US $6.2 million. However, there was an important qualification, which might lead the Board, in June 1984, to increase available spending money by $300,000.

This depended on two things: whether the Bangladesh Government will agree to convert, from a one-year interest-free loan to a grant, $1.1 million accruing from residual funds in the defunct U.N. Relief Operations in Bangladesh (UNROB); and whether, with this, the Centre will achieve its fiscal 1984 income forecast of $7.4 million.

In May 1983, as agreed to by the Government, the Centre received the loan, to be used exclusively for health services in Bangladesh. The Board accepted the money with "deep appreciation," and asked the Government to make it a grant – as it is being used only for Bangladesh's benefit, and as the Centre will face "serious financial difficulties" if it must repay it. The Board said that, should the Government agree, and should the Centre reach its $7.4 million income forecast, the $300,000 expected from other sources would become available for equipment purchase and additional staff.

Overdrafts — The director was authorized to accept an overdraft limit from American Express/Dhaka of $1 million; and to use this as he sees fit, up to a $400,000 limit. Over that, the Board Chairman must approve.

Tighter Controls — To improve internal controls, it was resolved that only the Director, Associate Director for Administration and Finance and the Comptroller may handle bank matters.

Retirement Plan — Considering diverse, complex options for a Staff Retirement Plan, to replace the Provident Fund which was closed Dec. 31, 1983, the Board instructed the Director to implement on Jan. 1, 1984 a Fixed Income Plan, offered by AIRCO (American International Group.) Eligible are all full-time staff with a minimum one-year contract. PF participants were able to withdraw or transfer their savings into a credit union.

WHO Pay Scales — The Board noted that complete compliance with WHO pay scales has been achieved, except for some project staff. It was estimated that such conversions for existing project staff would lead to cost overruns of about $70,000. The Board said that:

THE BOARD OF TRUSTEES in session.

a. All future projects should be budgeted according to WHO scales with contingency for increases;
b. As soon as financially feasible, all project staff should go on WHO scales;
c. "Community Worker" personnel are neither project nor core staff, but are related to community or government scales and should remain so. WHO does not have such workers or scales for them.

Other Issues

Staffing— Extensively considering staff recruitment, promotion and related issues, the Board agreed to follow WHO policies. It decided that, to demonstrate the Centre's international character, a geographical distribution system for recruiting international staff, like that of WHO, will be established. Guidance will come from the way the Board itself is chosen.

1. International positions will be filled by contracts of up to three years, with tenure ordinarily not to exceed six years. The Board must approve all such appointments.
2. For all such posts without exception, country of citizenship will be the basis of contracts. In dual nationality cases, country of citizenship plus domicile will be used.
3. Any position to be upgraded must be advertised, international ones in international media. This will prevent "creeping promotion" or elevation beyond a person's capabilities.
4. A staffer whose post thus is upgraded must compete with other applicants. If successful, he or she will be promoted; otherwise, the choice will be to resign or to be reassigned.
5. The Director was asked to rank, by priority, all new and vacant positions. Twenty-one international posts were listed.
6. The Board agreed to the hiring, within budget limitations, of 15 candidates for international positions: 14 researchers and a personnel administrator.

PCC— Considering at length the important Programme Coordination Committee (PCC) established in 1982 (see P. 28), the Board said the PCC can play a key role in "linking an outstanding international effort with national ones." It said the PCC's goal is to pioneer in helping build, strengthen and coordinate Bangladeshi research capabilities by example and supportive action; and that this may provide a useful model for other developing countries.

Also, based on a PCC recommendation, the Board said the PCC's Standing Committee shall have 14 members: 7 suggested by the PCC, 1 by the Bangladesh Medical Research Council, 3 by the Government, and 3 by the Centre.

External Reviews — Considering the Centre's recent external review history, and seeking to implement in 1984 the two-year mandatory review, the Board decided that a detailed review shall be done of two Centre programs which enjoy "sufficient staffing continuity to utilize, implement and benefit from recommendations of an in-depth review." The programs are Nutrition, and Pathogenesis and Therapy.

Planning a long-term strategy, the Board said there will be a six-year cycle, with program-focused reviews in 1984 and 1986, and an overall review in 1988.

As to the External Review Committee, the Board named six reviewers for 1984; said the ERC should have "great freedom to describe and analyze Centre programs;" and defined the ERC's goals: critical analysis of research, and "guidance of the research effort toward realistic, pressing public health questions in developing nations."

Vaccine Trial— The Director was told to initiate steps leading to a field trial for an oral cholera vaccine (see P. 12) — steps which include study of the financial aspects and ERC processing. It was emphasized that Government and WHO concurrence is indispensable, and that close Government liason must be maintained.

Board Membership Changes — The Board welcomed four new members, re-elected another, changed Chairman, and expressed gratitude to out-going members. Those leaving were: Dr. C.W. Jones, Mr. M.K. Anwar, Dr. H.S. Al-Dabbagh and Prof. J. Holmgren. Reappointed was Dr. J. Sulianti of Indonesia. Prof. J. Kostrzewski of Poland replaced Dr. David J. Bradley as Chairman.

New members were: Dr. Immita Cornaz of Swiss Development Cooperation and Humanitarian Aid; Dr. Abdul Rahman Al-Swailem, Deputy Minister of Health, Saudi Arabia; Prof. Derrick Rowley, Dept. of Microbiology and Immunology, University of Adelaide, Australia; and Mr. A.B.M. Ghulam Mostafa, Secretary, Bangladesh Ministry of Health and Population Control.

RESOURCES DEVELOPMENT

Fulfilling its goal of garnering financial and technical support for the Centre, the Resources Development office received in 1983 contributions or commitments for a total of US $6.5 million, from 24 donors.

FORMALLY INAUGURATING the ICDDR,B's new Dhaka Treatment Centre was Dr. Ibrahim Shihata, Director-General, OPEC Fund. The Fund is the largest contributor to the Centre's Capital Development Program. From left are: M.R. Bashir, Associate Director Resources Development, ICDDR,B; Bernard Zagorin, Special Representative, UNDP Administrator, New York; Dr. Shihata; Jane Coon, U.S. Ambassador to Bangladesh; Mafizur Rahman, Secretary, External Resources Division, Bangladesh Finance Ministry; Maj. Gen. M. Shamsul Haq, Bangladesh Health Minister; M.K. Anwar, Secretary, Bangladesh Ministry Home Affairs; Dr. W.B. Greenough, III, Director, ICDDR,B.

New Donors

*The **Canadian International Development Agency (CIDA)** committed itself to becoming in 1984 one of the Centre's most important donors – by supporting the Demographic Surveillance System, including purchase of a new, powerful computer.

*The **Aga Khan Foundation** provided seed money for study of cereals other than rice in ORS.

*The **Arab Gulf Fund** began supporting the Urban Volunteers Project (see P. 31); training and international fellowships; and basic equipment.

*The **Federal Republic of Germany (FRG)** agreed to help support, via a tri-partite arrangement, technical assistance to diarrhoea management programs in six Southeast Asian nations (see below.)

*The **UNICEF** began long-term collaboration with the Centre – by supporting the training of key health personnel; activities in water and sanitation health impacts and development of cereal-based ORS.

*Belgium agreed to fund the Urban Volunteers projects; and to support traineeships in Belgium, in addition to deputing three scientist/technicians, under its technical assistance program.

*France loaned a scientist and support for his work at the Centre. And residual funds from the defunct **U.N. Relief Operations in Bangladesh** were given the Centre, for its training and free diarrhoeal treatment programs.

*The Ford Foundation began supporting an epidemic control preparedness project in Bangladesh, that will teach doctors and health officials how to prevent diarrhoeal disease outbreaks.

Continuing Donors

Commitments were renewed by several important donors:

*Switzerland at an enhanced level; **Japan**, a new donor in 1982, renewed its support; **SAREC** of **Sweden** for another two years of core and project support, including for an oral cholera vaccine trial (see P. 12.) Long-time donors **Australia** and **Great Britain** renewed their core support.

*UNDP renewed, for a second four years, funding of the Centre's critical basic clinical and immunological research. **USAID/Dhaka** renewed support for a cooperative project to examine the replicability, within Bangladesh Government health programs, of the Centre's integrated MCH-FP Matlab program (see P. 28).

*Funding was extended for both the **Population Council's** Operations Research grant, and **Canada's International Development Research Centre (IDRC)**-supported DISC project.

Collaborative Activities

*Via the Programme Coordination Committee (see P. 31), collaborative efforts were initiated between the Centre and such national institutions as the **Bangladesh National Research Council, the Institute for Post-Graduate Medicine and Research, and the Bangladesh Agricultural Research Council.**

*Similar cooperative efforts were established with three overseas institutions. Collaboration in demography with **Australian National University** and the **French Office de la Recherche Scientifique et Technique Outer-Mer (ORSTOM)** will be similar to long-standing cooperation between the ICDDR,B and Johns Hopkins University. ORSTOM also has deputed a scientist to the Centre. Also, with the **Free University of Belgium**, the ICDDR,B will conduct technical, training and scientific exchange.

*The **ICDDR,B Diarrhoeal Control Centre, in Damman, Saudi Arabia** was formally inaugurated. This clinic-cum-laboratory is pivotal to the Centre's technical assistance to Saudi Arabia's Eastern Province. Also, a wide-ranging **technical assistance program to Indonesia** was begun, funded by USAID/Jakarta.

The **Southeast Asian Health Ministers**, through the Bangladesh Government, asked the ICDDR,B to establish two-year diarrhoea management programs. These programs will be implemented under Technical Cooperation Among Developing Countries. Partial Funding will be provided in 1984 by The Federal Republic of Germany.

Consultative Group

The fourth **ICDDR,B Consultative Group** meeting was held in June in New York, during the UNDP Governing Council. Chaired by UNDP and attended by 25 delegations, the meeting addressed the Centre's program and requirements. Proceedings are available.

Capital Development

The new Dhaka Treatment Centre was inaugurated formally in March, by OPEC Fund Director-General Ibrahim Shihata. The Fund has been the biggest contributor to the Centre's Capital Development Program. Support is being sought for construction of phase two of the new building, and for urgently needed construction at the Centre's two field stations.

MANAGEMENT & ADMINISTRATION

The major issues faced by Management and Administration in 1983 were :

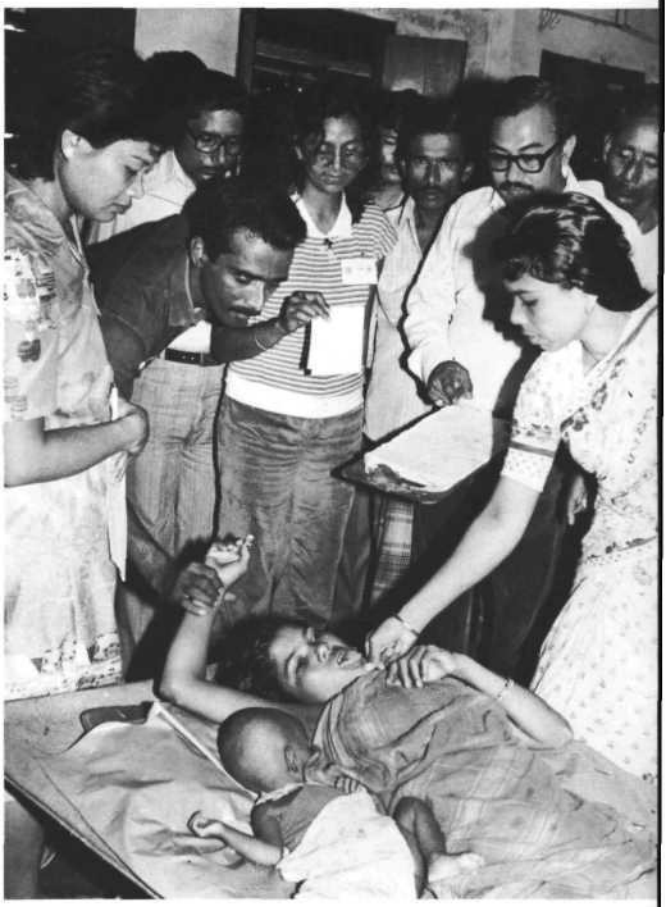
- Implementation of the WHO salary scale and benefits scheme for all staff;
- Establishment of a Staff Retirement Fund;
- Mobilization of cash deposits to the Reserve Fund;
- Setting up a mechanism to replace old and obsolete equipment and appliances.

A review of the Management and Administrative performance during the year showed that :

- The Centre converted all staff members to WHO pay scales and benefits, at a cost of more than U$ S 1 million;
- A Staff Retirement Plan to be implemented in 1984 was approved by the Board of Trustees;
- By the end of 1983 the Reserve Fund, begun in 1982, had cash deposits of $ 400,000;
- $ 277,000 was set aside as depreciation. The money will be used to replace old and obsolete equipment, so that the Centre's research activities are not unduly hampered.

With savings generated from cost-cutting measures implemented in 1982 and overall improvements in cost-effectiveness, it was possible for the Centre in 1983 to finance, from its own resources, expansion of various physical facilities in Dhaka and its field stations. As a result :

- The ground floor of the old hospital building was renovated, to provide additional offices for Centre staff;
- Kitchen facilities at the Matlab field station were expanded, to meet increased hospital and field staff requirements;
- A one-story hospital was built on the Centre's land in Teknaf, to provide hospital, laboratory and office facilities for the field station;



THE KALIR BAZAAR Community Treatment Centre not only is critical to local diarrhoeal victims, but serves as a training site for ICDDR,B "students" from around the world. Here, Rasheda Akhter, at 18 the youngest of the Kalir Bazaar Volunteers (see P. 4), helps ICDDR,B training physician Abu Eusof demonstrate a patient's condition. The Kalir Bazaar Centre is one of four such community-run efforts started and continuously aided by the ICDDR,B.

- At the Kalir Bazaar community treatment centre, work undertaken for extension of the verandah and construction of a septic tank was financed jointly by Australia and the Centre.

Financial Report

The Board of Trustees approved a 1983 operating budget of US $6.6 million. Total operating expenditures for the year were US $5,941,392. Compared with Financial Year 1982, operating expenditures in 1983 increased by US $1,592,610, as a result of:

* Conversion of all Centre staff to WHO pay scales and benefits from January 1, 1983. This cost more than US $1 million;
* Provision of US $277,000 for depreciation, an amount not provided in previous years;
* US $150,000 spent on the Saudi Arabian project;
* US S127,000 provided for retroactive salary increase adjustments during 1983, for local general services and scientific-technical-management staff, announced by the UN in January, 1984.

In Financial Year 1983, total donor contributions to the Operating Fund were US $5,276,216. After taking into account other receipts and after writing off exchange losses, net receipts for the year totalled US $5,375,321. This provided an income increase of US $800,895, compared to Financial Year 1982. With Financial Year 1983 expenditures at US $5,941,392, the year ended with an operating deficit of US $566,073. This deficit was funded by US $1,186,080, released by the Bangladesh Government to the Centre as an interest-free loan, from money remaining in the defunct United Nations Relief Operations in Bangladesh.

AUDITORS' REPORT TO THE BOARD OF TRUSTEES OF THE INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

We have audited the Balance Sheet of the International Centre for Diarrhoeal Disease Research, Bangladesh as of December 31, 1983, and the relative Receipts and Expenditure Account for the year ended on that date. These agree with the books and records maintained by the Centre and produced to us. Our examinations were 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 our opinion, and to the best of our information and according to the explanations given to us, the Balance Sheet and the Receipts and Expenditure Account, subject to the notes to the accounts attached thereto, give, respectively, a true and fair view of the Centre's state of affairs as of December 31, 1983 and the results of its operations for the year then ended.

Deloitte Haskins + Sells

DELOITTE HASKINS + SELLS
CHARTERED ACCOUNTANTS

AHMED REZA & CO.
CHARTERED ACCOUNTANTS

Dhaka, March 29, 1984

BALANCE SHEET AT DECEMBER 31, 1983

	Notes		1983		1982
Fixed Assets/less depreciation	2		3,614,402		3,491,215
Current Assets					
Stock of stores and spares	3	655,512		630,843	
Advances, deposits & prepayments	4	720,518		656,886	
Cash and bank balances	5	758,539		117,235	
		2,134,569		1,404,964	
Less :					
Current Liabilities					
Bank overdraft	6	439,433		512,507	
Current liabilities	7	2,193,188		701,838	
		2,632,621		1,214,345	
Net Current Assets			(498,052)		190,619
			US $ 3,116,350		US $ 3,681,834
Represented By Trustees Fund Accounts					
Capital Development Fund	8		3,899,292		1,817,893
Operating Fund	9		(1,182,942)		1,763,941
Reserve Fund	10		400,000		100,000
			US $ 3,116,350		US $ 3,681,834

NOTES FORM PART OF THE ACCOUNTS

Director
ICDDR,B

Member
Board of Trustees

Deloitte Haskins + Sells
Chartered Accountants

Ahmed Reza & Co.
Chartered Accountants

Dhaka, March 29, 1984

RECEIPTS AND EXPENDITURE ACCOUNT (OPERATING FUND) FOR THE YEAR ENDED DECEMBER 31, 1983

	Notes	1983	1982
RECEIPTS			
Contributions	11	5,276,212	4,712,879
Other receipts		113,005	72,821
		5,389,217	4,785,700
Less : Transferred to balance sheet to the extent capitalized		—	154,623
		5,389,217	4,631,077
Exchange gain/(loss)		(13,896)	(56,651)
		5,375,321	4,574,426
EXPENDITURE			
Personnel services and benefits	12	4,027,713	2,913,339
Supplies and materials		675,863	754,468
Travel expenses		524,349	275,780
Transportation of materials		123,842	149,224
Rent, communication and utilities		63,083	86,369
Printing and reproduction		42,375	40,573
Other contractual services		206,745	129,031
Depreciation		277,424	—
		5,941,394	4,348,784
SURPLUS/(DEFICIT)		US $ (566,073)	US $ 225,642

NOTES FORM PART OF THE ACCOUNTS

SOURCES AND APPLICATION OF FUNDS AT DECEMBER 31, 1983

	1983	1982
Source		
Capital Development Fund Receipt	589	955,485
Surplus as per Receipt and Expenditure Account	—	225,642
Transfer from Receipt and Expenditure Account	—	154,623
Currency adjustments	—	54,547
Decrease in Working Fund	688,671	—
Depreciation	277,424	—
	US $ 966,684	US $ 1,390,297
Application		
Additions to Fixed Assets	400,611	751,455
Increase in Working Fund	—	638,842
Deficit as per Receipts and Expenditure Account	566,073	—
	US $ 966,684	US $ 1,390,297

NOTES TO THE ACCOUNTS DECEMBER 31, 1983

1. ACCOUNTING POLICIES

(i) As no manner of presentation of annual accounts has been prescribed under Clause 18 of the International Centre for Diarrhoeal Disease Research, Bangladesh Ordinance 1978 (Ordinance No. LI of 1978) promulgated by the Government of Bangladesh, the format of the Balance Sheet and a Receipts and Expenditure Account as prepared have been considered appropriate.

(ii) Receipts and expenditures of the Centre are required to be maintained in the prescribed manner. In the absence of a prescribed manner of recording transactions, the Centre has followed the generally accepted accounting principle for recording receipts and payments.

(iii) Fixed assets have been accounted for at material cost up to August 1981. Since September 1981, incidental expenses, such as labor, freight, insurance etc. (excluding clearing charges) also have been considered in arriving at the cost of fixed assets.

(iv) Stock of stores and spares have consistently been accounted for at materials cost only.

(v) "Receipts" and "Expenditure" of the Centre for the year to December 31, 1983 have been, as usual, accounted for on "cash" and "accrual" bases, respectively.

(vi) Depreciations on Fixed Assets have been charged during the year at rates varying from 2% to 20% on a straight line method. No provision has been made for depreciation up to December 31, 1982.

(vii) Accounts have been prepared on the basis of Historical Cost Convention, except to the extent reflected in note 14 of this account.

2. FIXED ASSETS

(i) The Board of Trustees has decided to provide depreciation on its fixed assets. As a result of of this change in accounting policy, depreciation on fixed assets has been charged to the Operating Fund, and assets purchased during the year have been charged to the Capital Development Fund. It may be noted that assets purchased out of the Operating Fund prior to the year 1983 amounting to US $2,080,810 also have been transferred to the Capital Development Fund.

(ii) 4.10 acres and 0.51 acres of land situated at Mohakhali (Dhaka) and Matlab (Comilla), respectively, received as a donation have not been accounted for, pending determination of their values by competent valuers.

(iii) Buildings include an amount of US $ 52,841 spent on the extension of the Institute of Public Health, owned by the Government of Bangladesh, and at present partly accommodating the Centre. The new extension was made for use by the International Centre for Diarrhoeal Disease Research, Bangladesh, with permission from the Bangladesh Government.

(iv) All assets of $ 50 or below capitalized in the books amounted to $ 78,042, and have been written off in the previous year from fixed assets. The same amount was reduced from the operating fund. The Centre maintained a separate register for such assets.

(v)

	COST			Depreciation		Balance
	Opening balance on 1-1-1983	Additions	Total as of 31-12-1983	Rates	Charged for the year	as on Dec. 31, 1983
Capital Development Fund						
Land (including development exp.)	66,748	10	66,758		—	66,758
Buildings	95,806	1,506,546	1,602,352	2%	32,047	1,570,305
Vehicles	279,233	3,846	283,079	20%	56,616	226,463
Furniture	291,114	6,074	297,188	10%	29,719	267,469
Equipment	1,499,176	39,227	1,538,403	10%	153,840	1,384,563
Books and other assets	73,287	30,759	104,046	5%	5,202	98,844
Capital W. I. P. (buildings)	1,185,851	(1,185,851)	—		—	—
US $	3,491,215	400,611	3,891,826		277,424	3,614,402

		1983		1982
3. STOCK OF STORES AND SPARES				
Capital Development Fund				
Building materials		29,174		—
Operating Fund				
Supply stores		462,957		440,444
Maintenance stores		163,381		190,399
		626,338		630,843
	US $	655,512	US $	630,843

Drugs abandoned by the Government of Bangladesh amounted to US $ 31,731 have not yet been written off.

4. ADVANCES, DEPOSITS AND PRE-PAYMENTS				
Capital Development Fund				
Advance against building construction		376,049		387,184
Operating Fund				
Advance against supply		92,745		83,808
Advance against travelling and other expenses		60,527		22,999
Other advances		186,633		160,696
Deposits		4,564		2,199
		344,469		269,702
	US $	720,518	US $	656,886

5. CASH AND BANK BALANCES				
Cash at Banks				
US $ Account				
American Express International Banking Corporation, New York		337,505		1,503
American Express International Banking Corporation, Reserve Account		299,214		—
American Express International Banking Corporation, Switzerland		401		479
American Express International Banking Corporation, Dhaka		55,978		18,676
Janata Bank, Dhaka		3,138		3,024
		696,236		23,682
Taka Account				
Agrani Bank, BAF Branch, Dhaka		35,990		67,714
Agrani Bank, Head Office, Dhaka		32		—
Agrani Bank, Teknaf		329		329
Agrani Bank, Matlab		419		1,327
Janata Bank, Dhaka		3,365		516
American Express International Banking Corporation, Dhaka		—		8,961
		40,135		78,847

		1983		1982
UK £ Account				
American Express International Banking Corporation, London		8,800		14,022
SFR Account				
American Express International Banking Corporation, Switzerland		12,888		14
		758,059		116,565
Cash in hand		480		670
	US $	758,539	US $	117,235

AEIBC, New York erroneously called back US $ 100,786 from the Reserve Account. Including this, the Reserve Account balance would have been US $400,000.

6. BANK OVERDRAFT

US $ Account				
American Express International Banking Corporation, New York		—		512,507
Taka Account				
American Express International Banking Corporation, Dhaka		439,433		—
	US $	439,433	US $	512,507

The above overdraft is collateralized by hypothecation of the Centre's assets.

7. OTHER CURRENT LIABILITIES

Capital Development Fund				
For building construction		397,700		344,509
Operating Fund				
For supplies and materials		117,182		70,939
For expenses		461,178		256,858
Security and other deposits		31,048		29,532
Interest-free loan (unsecured)		1,186,080		
		1,795,488		357,329
	US $	2,193,188	US $	701,838

8. CAPITAL DEVELOPMENT FUND

Balance at 1 January, 1983		1,817,893		832,675
Add : Receipts during the year		589		955,485
		1,818,482		1,788,160
Transferred from operating fund		2,080,810		
Adjustment for currency translation				29,733
	US $	3,899,292	US $	1,817,893

	1983	1982
Represented By		
Fixed Assets	3,614,402	1,410,405
Current Assets		
Stock of stores and spares	29,174	
Advances, deposits and prepayments	376,049	387,184
Balance with Operating Fund	277,367	364,813
	682,590	751,997
Less : **Current Liabilities**	397,700	344,509
Net Current Assets	284,890	407,488
	US $ 3,899,292	US $ 1,817,893

9. OPERATING FUND

		1983	1982
Balance at 1 January 1983		1,763,941	1,536,904
Add :	Adjustment for currency translation	—	24,814
	Transferred from Receipts and Expenditure Account	—	154,623
		1,763,941	1,716,341
Less :	Adjustment for writing off Fixed Assets under S 50	—	78,042
	Transfer of Fixed Assets to Capital Development Fund	2,080,810	—
	Transfer to Reserve Fund	300,000	100,000
		(616,869)	1,538,299
Surplus/(Deficit) for the year ended December 31, 1983		(566,073)	225,642
		US $ (1,182,942)	US $ 1,763,941
Represented By:			
Fixed Assets		—	2,080,810
Current Assets			
Stock of stores and spares		626,338	630,843
Advances, deposits and prepayments		344,469	269,702
Cash and bank balances		758,539	117,235
		1,729,346	1,017,780
Less : **Current Liabilities**			
Bank overdraft		439,433	512,507
Current liabilities		1,795,488	357,329
Payable to Capital Development Fund		277,367	364,813
Payable to Reserve Fund		400,000	100,000
		2,912,288	1,334,649
Net Current Assets		(1,182,942)	(316,869)
		US $ (1,182,942)	US $ 1,763,941

		1983		1982
10. RESERVE FUND				
Balance at 1 January, 1983		100,000		
Add : Transferred from Operating Fund during the year		300,000		100,000
	US $	400,000	US $	100,000
11. CONTRIBUTIONS				
(i) **Capital Development Fund**				
Australian Government		589		
OPEC (Organisation of Petroleum Exporting Countries) Fund for Development		—		950,000
West German Government		—		5,485
	US $	589	US $	955,485
(ii) **Operating Fund**				
(a) **Unrestricted**				
Australia		162,589		163,133
Bangladesh		34,440		36,120
Sweden				148,800
Japan		200,000		200,000
Saudi Arabia		100,000		100,000
USAID-Washington		2,217,000		1,900,000
Switzerland		576,545		271,000
United Kingdom		178,308		197,890
Belgium		74,766		
Private Contributions		14,000		14,560
		3,557,648		3,031,503
(b) **Restricted**				
Arab Gulf Fund		70,000		—
Aga Khan Foundation		39,038		75,000
France		44,371		—
UNFPA (United Nation's Fund for Population Activities, through Bangladesh Government)		88,150		58,925
UNFPA-DSS, Matlab		394,270		332,990
IDRC (International Development Research Centre), Canada		62,666		142,633
UNICEF		—		20,836
Bangladesh-German (FRG) Technical Cooperation		50,000		—
UNDP/WHO		286,336		325,901
SAREC (Swedish Agency for Research & Cooperation), Sweden		38,733		110,722
Ford Foundation		50,000		—
USAID-Dhaka, MCH-FP Extension		326,479		438,658
USAID-Jakarta		912		44,298
USAID-Dhaka, NIROG Project		11,397		—
Population Council-Operations Research		62,067		37,240
UNDP-Embankment Workshop		35,000		—
Helen Keller International Foundation		—		13,036
Roche Far East Research Foundation		—		5,000
Netherland-MAT		6,300		—
The Johns Hopkins University		13,255		—
CIDA/World Bank – Hand Pump Project		131,218		—
Princeton University		1,057		—
Miscellaneous Contributions		—		9,273
	US $	1,711,249	US $	1,614,512

		1983		1982
(c) **Contributions in Kind**				
Japan		—		62,908
UNFPA		6,709		—
Miscellaneous		606		3,956
	US $	7,315	US $	66,864
	US $	5,276,212	US $	4,712,879

Grants by way of various scrvices rendered by the donor agencies to the Centre have not been considered in these accounts.

12. **Personnel Services**

Expenditures on the above account include US $ 37,950 paid as honorariums to the members of the Board of Trustees. This also includes a retroactive provision to January 1, 1983, in the sum of US $ 127,100 for increased salary and benefits, as per revision 8 of the UN local pay scale.

13. **Taxation**

Income tax payable by its Bangladeshi employees are borne by the Centre. With respect to expatriate employees, no tax is paid or deducted in Bangladesh from their remuneration. In this connection, reference may be made to Clause 21(2) of the Bangladesh Ordinance No. L1 of 1978, which provides, *inter alia,* that remuneration of such expatriate employees will be exempt from income tax in Bangladesh, if such remuneration of the person also is exempt from tax payment in the country of his domicile or permanent residence, and if evidence in respect of the said exemption is produced to the income tax authority concerned in Bangladesh. Efforts are being made to obtain tax exemption for its employees from the Government of Bangladesh.

14. **Currency Translation**

Rates of exchange used for the translation of various currencies for the purpose of these accounts as at December 31, 1983 are as follows:

Currency	Average rate used for the conversion of monthly expenditures of Fixed Assets and stock of stores and spares in US $	Bank rates used for other items at December 31, 1983 in US $
Tk. 1.00	0.041	0.041
UK£ 1.00	1.518	1.453
SFR 1.00	0.474	0.459

15. **Contingent Liabilities :** In respect of—
(i) Prior years' tax on expatriates salaries US $ 110,000 and,
(ii) Severance pay not provided for US $ 200,000

16. **Capital Commitment :** In the opinion of the management, this amount is considered to be $ 500,000.

PUBLICATIONS DURING 1983

Internal Publications Series

Scientific Report

59 Chowdhury MK, Karim MR, Mostafa G, Sarder AM, D'Souza S. Demographic Surveillance System-Matlab. v. 11. Vital events and migration—tables 1981. Nov 1983. 60 p.

Special Publication

20 Rahaman MM, Greenough WB, III, Novak NR, Rahman S, eds. Shigellosis: a continuing global problem; Proceedings of an international conference, Cox's Bazaar, Bangladesh, 15-20 June 1981. Sep 1983. ii, 250 p.

Journal

Journal of Diarrhoeal Diseases Research. v. 1, no. 1, March 1983
v. 1, no. 2, June 1983

Newsletter

Glimpse. v. 5, nos. 1-6, Jan-Dec 1983

Original Scientific Papers

Bhatia S. Contraceptive users in rural Bangladesh: a time trend analysis. Stud Fam Plann 1983 Jan;14(1):20-8

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STAFF LIST

MANAGEMENT STAFF

K.M.S. Aziz, MSc, PhD	Bangladesh	Associate Director, Training, Extension & Communication
M.R. Bashir, BA	Bangladesh	Associate Director, Resources Development
Thomas C. Butler, MD	USA	Associate Director, Pathogenesis & Therapy Programme
**Stanislaus D'Souza, PhD	India	Associate Director, Community Services Research Programme
Michael F.L. Goon, MBA	Malaysia	Associate Director, Administration & Finance
William B. Greenough III, BA, MD, FACP	USA	Director
M. Mujibur Rahaman, MBBS, MSc, PhD	Bangladesh	Associate Director, Nutrition Programme
**Aziz R. Samadi, MD, DPH	Afghanistan	Associate Director, Disease Transmission Programme

PATHOGENESIS & THERAPY PROGRAMME

G. Milita Adhikari	Bangladesh	Senior Staff Nurse
Mafizuddin Ahmed	Bangladesh	Senior Research Officer
Shahnaz Ahmed	Bangladesh	Secretary
**Syed Masud Ahmed, MBBS	Bangladesh	Clinical Research Trainee
Md. Nur Haque Alam, MBBS	Bangladesh	Medical Officer
*M. Shawkat Ali	Bangladesh	Hospital Services Supervisor
Meer Md. Ramzan Ali	Bangladesh	Secretary
Md. Hasan Ali, BSc, MBBS, DTCD	Bangladesh	Paediatric Physician
M. Abul Kalam Azad, MBBS	Bangladesh	Medical Officer
Abdul Aziz	Bangladesh	Assistant Matron
Anita Baidya	Bangladesh	Senior Staff Nurse
Rita Baidya	Bangladesh	Senior Staff Nurse
Pradip Kumar Bardhan, MBBS	Bangladesh	Clinical Research Physician
Annie A. Baroi	Bangladesh	Senior Staff Nurse
Mansura Begum, MBBS	Bangladesh	Medical Officer
*Michael Bennish, MD	USA	Consultant
Pankajini Biswas	Bangladesh	Matron
Florence Daring	Bangladesh	Senior Staff Nurse
Ignatius Costa	Bangladesh	Senior X-Ray Technician
Santona D'Cruze	Bangladesh	Senior Staff Nurse
*Wendy French, SRN	UK	Nurse Physician Assistant
Madhabi Ghose	Bangladesh	Senior Staff Nurse
Bernard Gomes	Bangladesh	Senior Staff Nurse
*Irene Suma Gomes	Bangladesh	Senior Staff Nurse
U. Elizabeth Gomes	Bangladesh	Senior Staff Nurse
Maloti A. Gomes	Bangladesh	Senior Staff Nurse
*Ratan Chandra Goswami	Bangladesh	Senior Staff Nurse
M. Gita Halder	Bangladesh	Senior Staff Nurse
Sushama E. Halder	Bangladesh	Senior Staff Nurse
Smriti K. Halder	Bangladesh	Senior Staff Nurse
*Md. Sayedul Hoque, MBBS	Bangladesh	Medical Officer
*Mahfuzul Haque, MBBS	Bangladesh	Medical Officer
Md. Shahadat Hossain, MBBS	Bangladesh	Medical Officer

*New appointment in 1983 **Left during 1983 ***Leave of absence

*Amir Hossain, BSc (Nursing), MPH	Bangladesh	Senior Staff Nurse
*Md. Nurul Huda, MBBS	Bangladesh	Medical Officer
*Wendy Hussain, SRN, RSCN	UK	Consultant
Rafiqul Islam MBBS, DTM&H	Bangladesh	Clinical Researcher & Chief Physician
Asma Khanam, MBBS, MPH	Bangladesh	Community Medicine Research Physician
A.K.M. Iqbal Kabir, MBBS	Bangladesh	Clinical Research Physician
Hosne Ara Kabir	Bangladesh	Senior Staff Nurse
Makhduma Khatun, BSc	Bangladesh	Research Officer
Naseha Khatun, MSc	Bangladesh	Dietician
Abdul Majid	Bangladesh	Pharmacy Incharge
A. Majid Molla, MBBS, PhD, DCH	Bangladesh	Paediatrician & Gastroenterologist
Manakhushi Mondal	Bangladesh	Senior Staff Nurse
Samir Kumar Nath, MBBS	Bangladesh	Medical Officer
Suratun Nessa	Bangladesh	Assistant Matron
Barlin Chandra Nokrek	Bangladesh	Senior Staff Nurse
*D. Patte, MD	France	Dhaka Hospital Head
Momota H. Purification	Bangladesh	Senior Staff Nurse
Golam Hasan Rabbani, MBBS, MPH	Bangladesh	Clinical Research Physician
M. Lutfor Rahman	Bangladesh	Senior Staff Nurse
Mahbubur Rahman, MBBS	Bangladesh	Medical Officer
Hosna Ara Rahman	Bangladesh	Senior Staff Nurse
Swapan Kumar Roy, MBBS	Bangladesh	Clinical Research Physician
Mabel V. Rozario	Bangladesh	Senior Staff Nurse
Abdus Salam, MBBS	Bangladesh	Medical Officer
Md. Shafiqul Alam Sarkar, MBBS	Bangladesh	Medical Officer
M.A. Sattar	Bangladesh	Senior Staff Nurse
M.B. Shamsuddin	Bangladesh	Secretary
Pieter Speelman, MD	Netherlands	Gastroenterologist
Anita Stephen	Bangladesh	Assistant Matron
**Barbara Stoll, MD	USA	Paediatrician
Marc J. Struelens, MD	Belgium	Clinical Research Physician
Isabella Vesters, SRN Graduate Nurse	Belgium	Nurse-Physician's Assistant

DISEASE TRANSMISSION PROGRAMME

Waseque Uddin Ahmed	Bangladesh	Senior Research Officer
Qazi Shafi Ahmed, MSc	Bangladesh	Senior Research Officer
Saiyeda Qadsiya Akhter, MSc, PhD	Bangladesh	Microbiologist
Khorshed Alam, BSc	Bangladesh	Senior Research Officer
A.R.M. Abdul Alim, BSc	Bangladesh	Senior Research Officer
Md. Ansaruzzaman, BSc	Bangladesh	Research Officer
Hasina Banu, MA, MS	Bangladesh	Senior Field Research Officer
Bidyut Banerjee	Bangladesh	Secretary
Saleha Chowdhury, BA	Bangladesh	Secretary
*John Clemens, MD	USA	Consultant
**Roger Glass, MD, MPH	USA	Epidemiologist
Khaleda Haider, MSc	Bangladesh	Senior Research Officer
**Md. Moshaddeque Hossain, MBBS	Bangladesh	Research Trainee (Clinical Epidemiology)
Md. Imdadul Huq, DBact, PhD	Bangladesh	Microbiologist
***Anwarul Huq, MSc	Bangladesh	Research Officer
**Syed Shafiqul Islam, MBBS	Bangladesh	Research Trainee (Clinical Epidemiology)
M.U. Khan, MBBS, DPH	Bangladesh	Epidemiologist
A.K.M. Golam Kibriya	Bangladesh	Senior Research Officer
Prabashi Mahmud	Bangladesh	Secretary
M.A. Salek Mian	Bangladesh	Research Officer
A. Latif Mian, BSc, MBBS, DPH, PPD	Bangladesh	Consultant

K.A. Monsur, MB (Cal), DCP, D. Bact, FRC Path	Bangladesh	Consultant
*K.M. Moniruzzaman, MBBS, FCPS	Bangladesh	Senior Research Officer
P.K. Bose Neogi, BSc	Bangladesh	Senior Research Officer
*Goutom Poddar, MBBS	Bangladesh	Senior Research Officer
Md. Zeaur Rahim, MSc	Bangladesh	Research Trainee (Microbiology)
Suhas C. Sanyal, MD, PhD	India	Microbiologist
Md. Shahidullah	Bangladesh	Field Research Officer
Nigar Sayem Shahid, MBBS, MSc, DPH	Bangladesh	Epidemiologist

HOST DEFENSE PROGRAMME

Ansaruddin Ahmed, MBBS	Bangladesh	Immunologist
Md. Shamsul Huda, BA	Bangladesh	Research Officer
Sushama Pashi	Bangladesh	Research Officer

NUTRITION PROGRAMME

Noor M. Abdel, MBBS, Dip in Nutrn	Bangladesh	Research Trainee
*Shabbir Ahmed, MSc	Bangladesh	Research Officer
**Zulfia Ahmed, MA	Bangladesh	Research Officer
K.A. Al-Mahmud, MSc (Vet)	Bangladesh	Animal Resources Branch Head
Ahmed Nurul Alam, MBBS, PhD	Bangladesh	Clinician – Nutritionist
Md. Akbar Ali, BSc	Bangladesh	Biochemistry Branch Head
Shahan Ara Begum, MSc	Bangladesh	Research Officer
Golk Behari Chakma	Bangladesh	Senior Staff Nurse
Ashish Kumar Chowdhury, MSc	Bangladesh	Senior Research Officer
Sankari Das, BA	Bangladesh	Field Research Officer
Kh. Zahid Hasan, MBBS, MPH	Bangladesh	Epidemiologist
*Fitzroy Henry, PhD	Guayana	Consultant
Md. Anowar Hossain, MBBS	Bangladesh	Acting Teknaf Station Head
K.M. Nashirul Islam, MSc (AH)	Bangladesh	Animal Husbandry Officer
Ferdous Jahan, MSc	Bangladesh	Research Officer
Obaida Kabir, BA	Bangladesh	Secretary
*Awal Dad Khan, MA	Bangladesh	Senior Field Research Officer
Ayesha Molla, PhD	Bangladesh	Biochemist-Nutritionist
M.M.H. Munshi, MBBS, MPH	Bangladesh	Teknaf Field Station Head
Md. Yeakub Patwary, MA	Bangladesh	Senior Field Research Officer
Sabiha Rahman, MSc	Bangladesh	Research Trainee
M. Abdur Rahim, MSc	Bangladesh	Research Officer
A.S.M. Hamidur Rahman, MSc (Vet)	Bangladesh	Veterinary Officer
M. Mujibur Rahman, MSc	Bangladesh	Senior Research Officer
Nayma Rizvi, MA (Geo), MA (Anthro), PhD	USA	Nutritionist-Anthropologist
Farida Sultana	Bangladesh	Secretary
M.A. Wahed, BSc	Bangladesh	Senior Research Officer

COMMUNITY SERVICES RESEARCH PROGRAMME

Sk. Jaynal Abedin, MCom	Bangladesh	Programmer
*Jalaluddin Akbar, M. Stat.	Bangladesh	Demographer
Md. Nurul Alam, MA	Bangladesh	Statistical Officer
K.M.A. Aziz, PhD	Bangladesh	Anthropologist
*Laila Baqee, MSc, MUPR	Bangladesh	Operations Researcher
Md. Abdullah-Hel Baqui, MBBS	Bangladesh	Senior Medical Officer
**Md. Abdul Bari, MBA	Bangladesh	Trainee Programmer

Abdul Bari, MBBS	Bangladesh	Medical Officer
Saleha Begum, MA	Bangladesh	Programmer Assistant
*Shushum Bhatia, MBBS, MPH	India,	Consultant
***Md. Abbas Uddin Bhuiyan, MA	Bangladesh	Research Associate
Jyotsnamoy Chakraborty	Bangladesh	Senior Field Research Officer
A.K.M. Alauddin Chowdhury, ScD	Bangladesh	Demographer
***Mridul K. Chowdhury, MSc, MPhil	Bangladesh	Statistician
A.I. Chowdhury	Bangladesh	Statistical Officer
*Shahriar Chowdhury, MSc	Bangladesh	Trainee Statistician
*Q.G.M. Farooqi, MA, Dip in PM	Bangladesh	Senior Field Research Officer
Md. Giashuddin, MBBS	Bangladesh	Medical Officer
Sentu B. Gomes	Bangladesh	Secretary
**Md. Azizul Haque	Bangladesh	Senior Field Research Officer
Md. Emdadul Haque, MA	Bangladesh	Senior Field Research Officer
**Mirza I. Haque, BA, Dip PM, AIPM, LLB	Bangladesh	Senior Administrative Officer
**Md. Emdadul Haque, MBBS	Bangladesh	Medical Officer
Md. Mokbul Hossain	Bangladesh	Field Research Officer
Mian Bazle Hossain, MSc	Bangladesh	Statistical Officer
A.M. Mushtaqul Huq, MBBS	Bangladesh	Consultant
*M. Zahrul Huq	Bangladesh	Senior Staff Nurse
*Zahidul Huq, MBBS, MPH	Bangladesh	Consultant
Shafiqul Islam, MA	Bangladesh	Sociologist
A.K.M. Nurul Islam	Bangladesh	Field Research Officer
Md. Mahfuzul Islam	Bangladesh	Field Research Officer
**Nasrin Jahan, MBBS	Bangladesh	Medical Officer
Khaled Jahangir, BA	Bangladesh	Senior Coordination Officer
***Md. Rezaul Karim, MSc	Bangladesh	Research Associate
Md. Khalequzzaman, MBBS	Bangladesh	Medical Officer
Mehrab Ali Khan, MSc	Bangladesh	Statistical Officer
*Marjorie Koblinsky, PhD	USA	Consultant
M.M. Rahman Khan	Bangladesh	Senior Field Research Officer
David Leon, MA	USA	Computer Analyst
*A.B.M. Khorshed Alam Mazumder, MA	Bangladesh	Demographer
Amal Krishna Mitra, MBBS	Bangladesh	Medical Officer
Mohd. Mohsin	Bangladesh	Computer Operator
Md. Ibrahim Mollah, MSc, DIH	Bangladesh	Programmer
Abdullah Hel-Mostafa, BSc, DIP, EDP	Bangladesh	Computer Manager
Md. Easin Aziz Muttaqi, MSc	Bangladesh	Programmer
Lutfun Nahar, MA	Bangladesh	Statistical Officer
*Dexter J. Palmer	Bangladesh	Secretary
James F. Phillips, PhD	USA	Demographer
Md. Anisur Rahman, MSc	Bangladesh	Programmer
Md. Mafizur Rahman, MA	Bangladesh	Senior Field Research Officer
Mokhlesur Rahman	Bangladesh	Field Research Officer
***Makhlisur Rahman, MA	Bangladesh	Sociologist
Sayeedur Rahman	Bangladesh	Senior Computer Operator
Mizanur Rahman, MSc	Bangladesh	Senior Statistical Officer
**Mizanur Rahman, MBBS, MPH	Bangladesh	Senior Medical Officer
A.S.M. Mizanur Rahman, MBBS, MSc	Bangladesh	Clinician/Epidemiologist
***M.A. Razzaque, MSc	Bangladesh	Senior Statistical Officer
**A. Khayer Ubaidur Rob, MS	Bangladesh	Statistician/Demographer
Nikhil Chandra Roy, MSc	Bangladesh	Medical Records Assistant
Loretta Saldanha	India	Executive Secretary
Sirajus Salekin, MCom	Bangladesh	Trainee Programmer
A. Mazid Sarder	Bangladesh	Senior Field Research Officer
Jatindra Nath Sarker	Bangladesh	Secretary

Thomas M. Sarker, MSc	Bangladesh	Computer Operator
**A.P. Satterthwaite, MD	USA	Consultant
M.A. Kashem Shaikh, M A	Bangladesh	Acting Data Management Branch Head
Md. Shahidullah, MSc	Bangladesh	Trainee Statistician
*Bonita Stanton, MD	USA	Consultant
*Bogdan Wojtyniak, D.Sc	Poland	Demographer
Md. Yunus, MBBS, MSc	Bangladesh	Matlab & MCH-FP Coordinator
**Md. Shahadat Zaman	Bangladesh	Field Research Officer
***Susan Zimicki, MS, MS (IH)	USA	Epidemiologist

TRAINING, EXTENSION & COMMUNICATIONS

Hasan Shareef Ahmed, MCom, LLB	Bangladesh	Publication Officer
***Rezia Laila Akbar, MBBS, MPH	Bangladesh	Training Coordinator
*Dr. K A H M Akram, MBBS	Bangladesh	Medical Officer
[1]Meer Mushtaq Ali, MA, Dip in PM	Bangladesh	Manager, Training, Extension & Communication
Mir Motasem Ali, MA	Bangladesh	Serials Librarian
Asem Ansari, BFA	Bangladesh	Head, Medical Illustration Cell
*Zillul Bari M. Bakth, MA	Bangladesh	Senior Coordination Officer
Najma Dey, BFA	Bangladesh	Assistant Medical Illustrator
**Eva G. Doherty	Australia	Nurse Volunteer
Teresa Derozhinsky	Italy	Consultant
Abu Eusof, MBBS	Bangladesh	Team Leader, Training
A.S. Golam Faruque, MBBS	Bangladesh	Training Physician
Cyril Gomes	Bangladesh	Secretary
Farhad Hossain, MA	Bangladesh	Librarian
Md. Nurul Huda, MA, DPH	Bangladesh	Senior Publication Officer
*Rafiqul Islam, MSc, PhD	Bangladesh	Training Coordinator
Iftekharul Islam, M. Pharm	Bangladesh	Scientific Documentation Officer
***Sirajul Islam, MSc	Bangladesh	Senior Research Officer
*Dr. A B M Qamrul Islam, MBBS	Bangladesh	Medical Officer
*Tajkera Khair, MSc, MA	Bangladesh	Senior Field Research Officer
Md. Shamsul Islam Khan, MA, Dip in PM	Bangladesh	Head, Library & Publication Branch
*Abdul Mazid	Bangladesh	Secretary
Md. Ali Arshad Meah, BA	Bangladesh	Secretary
*Md. Akhteruzzaman Mollah MSc	Bangladesh	Senior Research Officer
Habib M Nasirullah, M Pharm	Bangladesh	Documentation Officer
Shereen Rahman, MA	Bangladesh	Associate Editor
Bejoy R. Saha, MBA, Dip in PM	Bangladesh	Training & Extension Manager
Sharon Sargeant	Bangladesh	Editorial Secretary
Sunil Sukla, BFA	Bangladesh	Assistant Medical Illustrator

RESOURCES DEVELOPMENT

A.K. Azad, MA, LLB	Bangladesh	Public Relation & Information Officer
Mustafa Iqbal Ali, MBA	Bangladesh	Programme Officer
M. Hanifur Rahman	Bangladesh	Secretary
Suzanne Smith, AB	USA	Development Officer

1 Died during 1983

FINANCE AND ADMINISTRATION

Ashrafuddin Ahmed, MSc, BScEngr. (Mech)	Bangladesh	Maintenance Branch Head
**Badruddin Ahmed, MBA	Bangladesh	Cost Accounting Head
Md. Mahbubul Alam, BSc	Bangladesh	Procurement Officer
Chowdhury S. Alam	Bangladesh	Secretary
Fakir Anjuman Ara, MBBS	Bangladesh	Clinician (Staff Clinic)
Anjali Baidya	Bangladesh	Senior Staff Nurse
**Lorraine F.C. Barlow	Bangladesh	Secretary
Judith Chowdhury	Australia	Executive Secretary
*Sonja Waara-Conway, BSc	Sweden	Consultant
Rabindra Das, Dip in Engr. (Civil)	Bangladesh	Construction Supervisor
Nikhil Kumar Datta, MCom, ACMA	Bangladesh	Accounts Officer
Md. Abul Hashem	Bangladesh	Senior Accounts Officer
Md. Shamsul Hoque, BCom, CA (Int)	Bangladesh	Senior Accounts Officer
A.K.M. Nazrul Islam, MA, LLB	Bangladesh	Senior Travel Officer
M. A. Jabbar	Bangladesh	Senior Personnel Officer
M. Rahman Khalili, ACA	Bangladesh	Financial Accounting Head
*Abdul Hamid Khan, Dip Engr. (Civil)	Bangladesh	Site Supervisor
S.A.A. Abdul Matin, BCom	Bangladesh	Accounts Officer
A.K.M. Abdul Matin, BA	Bangladesh	Senior Transport Officer
Noor Mohd. Mermalat	Bangladesh	Senior Technical Officer (Acting)
Mir Mohiuddin	Bangladesh	Senior Coordination Officer
Shamima Moin, MCom, MBA	Bangladesh	Budget Accounting Head
M. Golam Morshed, MA, LLB	Bangladesh	Supply Branch Head
Naomi Rock Novak, MS (Journalism)	USA	Consultant Communications coordinator
Md. Mujibur Rahman	Bangladesh	Senior Estate Officer
Md. Mizanur Rahman, MCom	Bangladesh	Senior Accounts Officer
Mofzalur Rahman	Bangladesh	Technical Officer
M. Bozlur Rahman, MCom	Bangladesh	Budget Officer
*Md. Matiur Rahman, MBBS	Bangladesh	Medical Officer
*Md. Mukhlesur Rahman, BSc, Dip in PM	Bangladesh	Personnel Officer
A. Razzaque	Bangladesh	Senior Technical Officer
A.K.M. Md. Abdus Samad, MCom	Bangladesh	Senior Accounts Officer
S.M. Abdus Sattar, BA	Bangladesh	Administrative Officer
Shipan Kumar Sarker, BCom, AIPM	Bangladesh	Secretary
Mohd. Jalil Sarker	Bangladesh	Secretary
Md. Shahabuddin	Bangladesh	Controller
R.H. Sircar	Bangladesh	Secretary
M. Sobhani	Bangladesh	Bio-Engineering Cell Head
*Md. A. Hossain Talukder, Dip in Engr. (Civil)	Bangladesh	Site Supervisor