International Biochemistry Confce : A Bird's Eye Review

Dr Harun K M Yusuf

THE 8th Symposium of the Federation of Asian and Oceanian Biochemists (FAOB) was held in Dhaka on June 11-13, 1991. Organised by the Bangladesh Biochemical Society (BBS), this was the first ever international meeting on Biochemistry being held in Bangladesh. More than 200 eminent biochemists, including some 38 from abroad participated in the Symposium. All sessions of the Symposium were arranged in the Dhaka Sheraton. The main theme of the Symposium was "Biochemistry in Health and Diseases."

The Symposium was inaugurated by Prime Minister Begum Khaleda Zia as the Chief Guest. The Special Guest of the inaugural ceremony was Professor M Maniruzzaman Miah, Vice-Chancellor, Dhaka University. Those who also spoke in the inaugural session were Organizing Chairman Professor K Ahmad and Organizing Secretary Professor Mustafizur Rahman, FAOB President Jesnuson Svasti, BBS President Professor Rafiqur Rahman and BBS Secretary Dr S S Qadri.

In her inaugural speech, Begum Zia called upon the scientists to play their expected role in the overall economic upliftment of the country. She stressed the need for the establishment in Dhaka of an International Biotechnological Research Centre to facilitate modern biochemical research in the fields of health and diseases, food, agriculture and nutrition, and biotechnology and vaccine development. Professor Maniruzzaman Miah called upon the Government to raise the status of the Biotechnology Research Centre already existing at Dhaka University, step by step with government and international assistance to that of an international centre.

The inaugural session was followed by the scientific sessions. For technical convenience, the Symposium was divided into a number of sessions. The first session was on the molecular mechanism of diseases. The session was presided over by Professor J Svasti and Professor R Rahman. The plenary speaker was Professor Masataka Mori of the University of Kumamoto, Japan. He presented a highly resourceful paper on the genetic explanation of the defects in the urea cycle and the diseases arising from these defects. He reported the base sequences of the genes responsible for the synthesis of all five enzymes involved in the cycle to convert in highly toxic sustance ammonia (coming from amino acid metabolism) into the neutral sustance urea.

The session began again after the mid-day break. Two invited speakers presented their papers at the beginning. The first was Professor Amar Nath Bhaduri of the Indian Institute of Chemical Biology, Calcutta. He described how Leishmania Donovani, the causative agent of kala-azar, thrives and exerts its pathogenicity through the divalent cation calcium. The second invited speaker was Professor Asis Datta from Jawaharlal Nehru University, New Delhi. He gave a beautiful presentation on the genetic studies aimed at controlling the pathogenic activity of the protozoa Candida albicans. The invited lectures were followed by short presentations. Participants were Liaquat Ali from the University of Uppsala, Sweden on the role of sodium in the release of insulin by the beta cells of the pancreas, Professor Nurun Nahar Rahman of Dhaka University on the biochemical mechanism of the action of a new drug Ajmalin which reduces platelet aggregation and therefore also the chance of heart attack, Mamun Ahmed of Dhaka University on the possible involvement of plasmids in inducing drug resistance in E-coli and Chowdhury Rafiqul Asan from Hirosaki University, Japan, on tumour resisting antigenic property of BCG, the causative agent of tuberculosis.

After the afternoon coffee-break, the session was presided over by Professor Bhaduri and Professor Muhammed Hussain of Agricultural University, Mymensingh. There was only one plenary speaker in this session. He was Professor W J O'sullivan of the New South Wales University of Australia. He spoke on how the intestinal parasite Giardia instestinalis lives on preformed pyrimidine (because it cannot synthesize pyrimidine, an essential substance for life, de novo) and how this utilization of pyrimidine could be blocked by drugs. He expressed hopes of success in finding out such drugs. With that the Symposium came to the end of its first day.

The first session of the second day was on biotechnology and vaccine development and this was presided over by Professor M Rahman of Dhaka University, and Professor Wasim Ahmad Siddiqui of Hawaii University, who was also the plenary speaker of the session. Professor Siddiqui described his long research on the development of a vaccine against malaria. He was followed by two invited speaker — Professor B K Bacchawat of Delhi University who spoke on the application of liposome technology in the treatment and prevention of various diseases and Dr Ziauddin Ahmed of ICDDR,B, Dhaka on the developments in the preparation of a live oral vaccine against shigellosis (blood dysentery). Then, M Nasiruddin of Dhaka University presented a short paper on serum cholesterol and lipoprotein pattern in patients with myocardial infarction, diabetes and jaundice and Dr S K Datta of Jadavpur University, Calcutta on the ability of a fungus in expressing an extracellular dextrines.

Professor W J O'sullivan of Australia and Dr S S Qadri of Dhaka University presided over the session on clinical biochemistry as it began after lunch break. Professor Zafar Zaidi of Karachi University was the plenary speaker. He narrated his long research on different snake venoms and expressed hopes of the discovery of important medicines out of these venoms. Then several participants presented their short papers. These were on Shigella lytic virus by Hossain Uddin, Shekhar (Dhaka University), identification of Shigella by monoclonal antibody by Dr M Sayedul Islam (Dhaka University), polarization of immune cells (macrophages) in responsc to attack by Shigella by Dr Mrs Laila Nur Islam (Dhaka University) and on identification of E-coli by DNA probes by Dr S M Faruque (ICDDR, B).

As the session began after afternoon tea-break it was presided over by Professor Zaidi of Karachi University and Dr Nayyum Chowdhury of the Atomic Energy Commission, Dhaka. In this session, only short papers were presented. The speakers were Baizid Alam Shibib of Dhaka University on biochemical on anti-diabetic properties of coccinia indica (Telakucha), Dr M A Waqar of Aga Khan University Medical College Karachi, on the newly discovered antibacterial drug Aditoprim, S Akhtaruzzaman of Dhaka University on the antibacterial activity of certain plant extracts, Ghazi Nurun Nahar of Dhaka University on the effect of smoking on serum vitamin and mineral levels in humans. The session was rounded up by a commendable one-hour presentation from Professor Shozo Yamamoto of Tokushima University, Japan. He spoke on the molecular and catalytic properties of mammalian lipoxygenases the enzymes which produce leukotrienes (a kind of useful hormones) from long-chain polyunsaturated fatty acids.

The first session of the 3rd and the last day of the Symposium was on nutritional and agricultural biochemistry. The Chairpersons were Professor Masataka Mori (Japan) and Professor Harun K M Yusuf of Dhaka University. Professor Kunisuke Tanaka was the plenary speaker. He presented a very interesting talk on genetic manoeuvering on rice to increase digestibility of rice proteins (30% of rice protein is excreted undigested) and to increase the biological value of rice protein with insertion of the gene for milk protein casein in the genome of rice (rice-milk from paddy !). This was followed by an invited lecture by Professor Asis Datta of Jawaharlal Nehru University who spoke on the possibility of increasing crop potentiality of plants through molecular closing and genetic engineering.

After coffee break, several short presentations were made. These were by A Salam (Dhaka University) on changes in quality of carbohydrate and proteins of rice during storage under different conditions, Dr Quazi Salamatullah (Dhaka University) on the possible hypocholesterolemic effect of Pangas oil, Dr K B Datta (North Bengal University, India) on biochemical regulation of sex expression in flower polens, Dr R P Nandi (Darjeeling) on biochemical studies on various medicinal and aromatic plants, Dr Mrs Rownak Jahan Rahmatullah (Kansus University, USA) on genetic studies on barley alpha-amylase, A B Sarker (Dhaka University) on enzymic marker for regeneration of jute callus and by Professor Harun K M Yusuf (Dhaka University) on the presence in high proportions of long-chain omega-3 polyunsaturated fatty acids (which lower blood cholesterol and platelet aggregation, thus also the chances of heart attack) in the fishes of the Bay of Bengal.

After lunch break, the session on food and fermentation biochemistry and general biochemistry began with Professor B K Bacchawat (New Delhi) and Dr Nayyum Chowdhury (Dhaka) in the chair. Dr Nayyum Chowdhury, in his plenary lecture, described beautifully the processing and preservation of vegetables after brining and lactic acid fermentation. This was followed by short presentations.

Those who participated were Dr Jayasri Chowdhury (Calcutta University) on the risk of using azocolourants in foods and their microbial transformation in the intesting, Dr Syed Akhtar Hossain (Nottingham University, UK) on the stability of water-oil emulsion by meat muscle proteins, Professor O'sullivan (New South Wales University, Australia) on energy metabolism of the parasite Giardia intestinalis, Barun Kumar Chowdhury (Kumamoto University, Japan) on molecular closing and sequencing of human aspartate amino transferase (a key enzyme in gluconeogenesis), A H Talukder (Dhaka University) on alkaline phosphatase from ovarian cyst, Rashidul Haque (ICDDR, B) on an antigen of the parasite Toxocara canis, Dr Nadim Wajih (Karachi University) on some novel proteins from rabbit brain and Dr Alia Islam (Karachi University) on the hemoglobin of some sea snakes.

The last talk of the Symposium was given by Professor T Ramasarma of the Indian Institute of Science, Bangalore, in the concluding session presided over by Professor J Svasti and Professor K Ahmad.

In his one-hour long talk, Professor Ramasarma narrated very lucidly his three decade long association in research on coenzyme Q, also called ubiquinone. This substance is used as an anti-ageing tonic in many countries.

At the very end of the session, Professor M Rahman the Organizing Secretary, read out to the audience a number of recommendations. These included opening of the subject of biochemistry in all government and non-government colleges in consideration of its importance in health, diseases, food, nutrition and agriculture, teaching of biochemistry in all medical colleges with more seriousness than at present, initiation of collaborative research between industries and the Universities, praising of the Prime Minister for stressing on the need to establish an International Bio-technology Research Institute in Dhaka and calling upon the Government to take appropriate steps to, materialize the idea.

All recommendations were unanimously accepted.

The Symposium was declared to have come to the end after thanking all local and overseas participants for their contribution, all students and others who worked day and night in organizing the Symposium so well and all organizations and persons for their generous donations, in cash or kind, in holding the Symposium so successfully.

(The author is Professor of Biochemistry, Dhaka University.)

Radiation Processing of Natural Rubber Latex

SIGNIFICANT progress has been made in the last five years in developing new rubber material using radiation technology that holds important benefits for industries in Southeast Asia and the Pacific.

The technology is called radiation vulcanization of natural rubber latex, or RVNRL. It uses high-energy gamma radiation (it also can use electron beams) to initiate vulcanization, a process that chemically bonds molecules to produce rubber elasticity and strength. As with other radiation industrial processes, the products are not radioactive.

A driving force behind its development has been co-ordinated research through an international programme of the International Atomic Energy Agency (IAEA) and United Nations Development Programme (UNDP) known as the Regional Co-operative Agreement (RCA).

In the RVNRL process, radiation energy replaces the use of a sulphur-based process and produces a material that retains all properties of the conventional product. However, it has some additional remarkable qualities: the absence of carcinogenic nitrosoamines; extremely low cytotoxicity; absence of sulphur and zinc oxide; and high transparency and softness.

These properties are important for many products, particularly catheters, protective gloves, and other medical and hospital supplies. For such uses, it is important that products are free of contaminants, and toxic and carcinogenic components to avoid harmful effects in people. As safety requirements for such products become more stringent, RVNRL can provide a technical and economically viable alternative to the existing vulcanization process.

In the traditional methods, natural rubber latex is collected in the fields, then concentrated, stabilized, and shipped to industries for processing. The processing involves vulcanization, in which individual organic molecules are chemically bonded to produce a cross-linked, rubber-like structure that is then shaped into final products by different techniques.

One common technique is called "dipping", in which the latex forms around the mold and, after drying at elevated temperature, retains the desired shape and is elastic at room temperatures. At high temperatures, the material disintegrates and at very low temperatures it becomes brittle.

Such "dipped" products consume about 70 per cent of all the natural rubber latex produced. The largest amount of this is used to make gloves (surgical, household, and others), children's toy balloons, condoms catheters, and other products requiring high standards of hygiene. The largest single item produced from natural rubber latex are gloves used in medical examinations: about 12 billion pairs are made each year.

The potential use of radiation to vulcanize natural rubber latex was recognized very early. In the 1950s, it was studied in several countries, including India, Indonesia, the United Kingdom, Japan, France, USSR and Poland.

However, RVNRL was slow to get off the ground, although the basics of the process were developed long ago. The end products were at least as good as conventional ones, yet the economics of the process were not very attractive to justify investment in the new technology.

Interest in this technology was revived in 1982 with the start of the IAEA/UNDP regional project on industrial applications of isotopes and radiation. The use of radiation to vulcanize natural rubber latex was part of the programme.

Today, the cost of radiation sources and of the irradiation process has decreased significantly compared to 20 or 30 years ago. In a number of industries, radiation technologies have become well established; for example, for the sterilization of medical products, for crosslinking applications, or for radiation curing.

In 1983, a pilot plant for RVNRL was installed at the Center for Application of Isotopes and Radiation (CAIR) of the National Atomic Energy Agency, in Jakarta, Indonesia. During the period 1983-86, this plant was used for training of rubber researchers and demonstration of the basics of the technology to industry.

Following this initial phase, in 1986, the IAEA started a comprehensive programme on technology development with the main objectives of reducing the cost of irradiation and improving the quality of final products.

Early work on RVNRL in the 1950s was based on the use of carbon tetrachloride as a radiation sensitizer. The process worked, but has two important disadvantages: 1) high costs of irradiation (there was the need to use absorbed doses of the order of 40 kiloGray (kGy), which reduces the efficiency of radiation utilisation and consequently increases the cost); and 2) the toxicity of the radiation sensitizer, which necessarily remains as an additive in the final product.

Similarly, today's conventional sulphur process results in remnants of dithiocarbamates, a toxic and potentially harmful additive. Cytotoxicity and the presence of nitrosoamines increasingly are considered as dangerous substances in natural rubber latex products.

Several countries have introduced strict regulations on the presence of these substances in certain categories of products, in particular medical devices, and products used by small children such as rubber nipples and pacifiers. Another concern is the presence of nitrosoamines at the manufacturing site, where it poses potential health hazards to workers.

The first and most important breakthrough achieved by the regional programme was the discovery of a new radiation sensitizer, n-butyl acrylate (NBA). This additive, in small amounts (about 5 parts per 100), reduced the absorbed dose requirement from 30-50 kGy down to about 12 kGy. This had an obvious impact on the process economy.

Additionally, an analysis of the properties of the starting material identified the best latex for this process. Research also demonstrated that some process elements, like controlled heating and leaching, further improved the properties of the final product.

As expected, the analysis of products made from RVNRL found no evidence of the presence of nitrosoamines and the cytotoxicity was extremely low. The products do not contain any sulphur or zinc oxide. This is important in those cases where eventual disposal of the product by incineration may not be acceptable if sulphur is present.

Rubber products for medical and hygienic uses are obviously the most promising applications of RVNRL technology because of the absence of carcinogenic and toxic products. These essential requirements are easily met by the radiation technology and, at the moment, by no other alternative.

Within the technology development programme, test production of various products such as condoms, gloves, nipples, pacifiers, and toy balloons are now being carried out at different centres participating in the programme. Pilot production of condoms and gloves for medical examination is done in Indonesia. Products are tested extensively in various field locations.

In Thailand, the Office of Atomic Energy for Peace has started a co-operative project with a local manufacturer for test production of toy balloons using RVNRL technology. Preparation of the natural rubber latex is being done at the Thai Irradiation Centre in Bangkok.

Low-cost irradiators have been specifically designed for vulcanization applications, and the main parameters for estimating production costs and for conducting feasibility studies have been developed. — PTI Feature

ON-LINE MONITORING SYSTEM FOR POWER TRANSFORMERS

A microprocessor-based on-line monitoring system for power transformers has been developed for the first time in the country.

The continuous on-line monitoring system (OLMS), designed to improve the reliability and availability of power transformers, has been developed at the Bharat Heavy Electricals Limited (BHEL).

With the recent introduction of high-voltage transmission systems availability of such transformers is becoming increasingly important for reliable transmission of power.

In order to ensure increased availability of the transformers, systematic preventive maintenance and planned repairs are needed for which a complete knowledge of the history of operation and behaviour of the transformers is necessary.

Such information can be obtained only by continuously monitoring the changes in the transformers and their subsystems.

The OLMS developed at BHEL is based on two microprocessors, is completely modular in design and can be easily upgraded to meet any future demands.

One of the two microprocessors is the Analog Data Sampling Unit (ADSU) and the other serves as the Central Processing Unit (CPU). (TP)

Science-in-Action is New Museum's Theme

VISITORS blow giant bubbles and make faces in anti-gravity mirrors. And for a place which has the world's highest number of mobile telephones per head, what could be more interesting than air tubes from the Victorian era, once used for summoning servants ?

We are in Hong Kong's new Science Museum, which opened recently in Tsim Sha Tsui East in the Kowloon Peninsula. The four-storey museum, which cost US$340 million, has just about everything: exhibits on life sciences, transportation, communications, robotics, engineering, earth science, computers and mathematics, energy, food science, basic science and a children's discovery zone.

Children can operate magnetic cranes. Adults can use an old strowger electro-mechanical exchange to make a telephone call, then watch how each digit that is dialed trips another switch in the complex process that routes the telephone call.

That may be slow for fast-paced Hong Kong. But visitors to the Science Museum can design their own car in the Transportation Hall. And yuppie Hong Kong can check the number of calories of a favourite meal. In the Life Science Hall, one can watch chicks break out of their shells or observe the human brain at work.

The main attraction is a four-storey, kinetic sculpture called the "Energy Machine." It is made of 70-foot and 50-foot towers which demonstrate how energy is converted. One tower holds various kings of lifting mechanisms, including a set of Archimedes screws and a human-powered treadmill.

They are designed to raise a series of balls to the top of the tower. As they descend through the other tower, the potential energy of the balls is converted into kinetic energy. As the balls travel along a number of paths, they trigger various processes which demonstrate energy conversion.

"We see our role as supplementing science education by approaching subjects from a different angle," says Dr Tai Minghing, chief curator of the museum. He says the museum's role is to stimulate interest rather than to teach.

A do-it-yourself, or hands-on, approach to science is luring crowds of youngsters to a new learning facility in Hong Kong

"The enormous appeal of the Science Museum was evidenced by the crowds of teenagers and families with young children, eagerly trying out exhibits and spilling out of the packed museum store," said Bonnie VanDorn, executive director of the Association of Science-Technology Centres.

"I tried to take photos of the exhibits. But instead I kept focusing on the delighted youngsters and their parents, enraptured by the interactive devices."

About 60 per cent of the 500 exhibits are hands-on. They include in armwrestling machine and a mediaeval bed of nails. When a volunteer lies on the flat bed, a button is pushed and nails protrude through the surface, lifting the "victim" off the bed. A guide says "the nails do not puncture the skin," but there are hardly any volunteers to try the device.

In the fitness section, people can test their own blood pressure, heart rate, hearing, eyesight, reflexes, hand-eye coordination, and strength. One of the few exhibits that are not hands-on is a favourite: "Betsy," a DC-3 airplane built in 1942. It was the first aircraft acquired by Cathay Pacific, Hong Kong's airline.

The museum has exhibition galleries, a 300-seat lecture theatre, classrooms, a laboratory, computer room, society room, snack bar and gift shop. About 70,000 square feet is devoted to exhibits.

The Hong Kong Urban Council initiated the project in 1976. Several members toured the United States and elsewhere to gather ideas. To carry out its plans, the Council employed an international cadre of exhibit designers.

"We tried to incorporate as much about the local culture and customs as possible," says Andy Kramer of West Office Design Associates of San Francisco which coordinated the exhibit plan. The museum contains exhibits on Chinese medicine, paper making and finger-counting in mathematics.

The building itself is a gray-blue superstructure clad in pink panels. At the northern end of the upper-level piazza is a semicircular echo wall. Water flows down a series of steps from a pyramid at the upper piazza to a shallow octagonal pool.

— Depthnews Asia

Corals for Bone Grafts

Scientists find a highly compatible substitute for human bone in the common coral. Lynghou Ramirez of IPS reports.

IN an era where advanced technology has dominated medical science, even the most modern doctors are still discovering the healing wonders of nature.

After years of research and experimentation, US experts have found the perfect substitute for bone grafts and synthetic materials in orthopaedic surgery: corals.

Researchers from various US universities in the 1980's found that the porous structure of certain inert corals are identical to human bones, with numerous interconnected canals that allow continuous blood flow.

But a major breakthrough came only in the last two years, with coral implants on 19 patients yielding considerably better results than synthetic prosthesis or bone grafts.

Corals fit perfectly into the space left by missing bone fragments when a fracture occurs and allow rapid healing of the new bone material.

"I think this will become a very popular technique," said Philip Spiegel, orthopaedic professor at the Southern University of Florida, who has used corals in thigh bone (femur), upper arm (humerus) and skull operations.

Plastic surgeons now prefer corals in reconstructing facial bones destroyed by cancer or accidents. Corals are "uniquely compatible" with the human skeleton so the body does not reject them. And they do not cause inflammations or infections.

Timothy Miller, a plastic surgeon from the University of Los Angeles, said fragments of adjacent bones recognise the calcium in corals and store it in the body tissues as if it were part of the system.

After the coral is implanted, it starts to disintegrate and human cells fill in the empty spaces, he added.

Experimental surgery on patients showed that in 18 months, the healed fracture only contains one-third of the coral filling.

Traditional reconstructive surgery employs prosthesis, the system of replacing body parts with stainless steel or metal plates, screws and other artificial materials. Splints and plaster casts are used to immobilise the bones while they heal.

In some cases, doctors may graft bones from the patient's own body, from deep-freeze human bone banks now common in many major cities, or from animals (usually cows).

Scientists say 10 per cent of these operations fail because the body rejects the implants or because infections develop as a natural reaction to the foreign elements.

Implanting a dead person's bone presents risks of viral transmission as in the case of hepatitis and acquired immune deficiency syndrome (Aids) which are not detected in pre-surgery tests.

Spiegel said: "The (grafted) bones could get infected and synthetic materials could cause inflammations and great pain. If we graft a little of the hip bone in the arm, the patient cannot walk for about two weeks."

When corals are used, however, the body's natural systems that reject foreign matter are not activated, he added.

Corals used are of the porita and ginopora varieties which are exposed to high temperatures to transform calcium carbonate — the coral's main component — to hydroxyapatite, an inorganic compound that hardens bones and teeth.

After a coral transplant, microorganisms and other living elements in the coral die, leaving only its porous structure which later adjusts to the required shape of the bone's missing parts.

US doctors say corals are easier to manage because they are more fragile than bones. After an implant, the coral filling is transformed into excellent quality bone.

"It is made of the same material so the bone welcomes it without undergoing trauma," said Miller.

Scientists have also found that corals double their capacity to adapt if they are injected with growth-stimulating morphogenic bone proteins before being implanted.

ANTIGEN TO DETECT AMOEBIASIS PURIFIED

Scientists have taken a step forward in the accurate detection of amoebiasis by purifying and characterising the antigen for Entamoeba histolytica, the parasite that causes the intestinal disorder.

Amoebiasis is a significant cause of morbidity and mortality the world over.

Current methods of detection of intestinal amoebiasis still rely on the demonstration of cysts of amoebae in the stools of patients by simple microscopic examination. The method is often unreliable because of the presence of a number of amoeba or disintegrated bits of the parasites in the stools of infected patients, which are difficult to detect.

Moreover, extraintestinal amoebiasis is difficult to diagnose by this means.

Earlier serological tests using crude E histolytica antigens were not successful as they gave false positive tests in the presence of infection due to other intestinal parasites.

Recently, scientists from the Span Research Centre, Surat, attempted to isolate and characterise a specific E histolytica antigen for diagnostic purposes.

The soluble crude antigen was fractionated by gel filtration into four portions, of which the first, weighing 669 Kilo Daltons, was found to be more specific and sensitive for detection of antibodies in amoebiasis.The Surat researchers reported their findings in the "Indian Journal of Experimental Biology."

Of the various tests enzyme linked immunosrbent assay (ELISA) proved to be the most sensitive in detecting the antibodies.