

SELECTED ESSAYS

7. WHAT ARE THE IMPEDIMENTS TO IMPLEMENTING BIOTECHNOLOGY IN BANGLADESH?

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Today, the term biotechnology is largely synonymous with recombinant DNA technology. This is popularly called genetic engineering and can also be called molecular genetics. Since it has been confirmed beyond doubt that DNA molecules carry the hereditary information, scientists have started to utilize different DNA molecules to change or add new characteristics to different organisms. Thus, it is now possible to produce human insulin either from bacteria or from sheep as is being done by numerous pharmaceutical companies. By transferring DNA molecules between unrelated organisms, scientists in the developed countries have transformed many thousands of organisms for a variety of specific purposes. Application of this technology is not limited only to the field of drug production but has also extensively entered into the fields of agriculture, industry and the environment. Frost resistant tomatoes transformed with flounder fish antifreeze gene are already abundant in the New York market.

The possibilities for DNA engineering for the economic development of Bangladesh are tremendous. Previously, we presented this opinion through seminars like, (i) Genetic Engineering for the Development of Agriculture in Bangladesh (Jahangir *et al.*, 1992), and (ii) The Sky is the Limit for Agricultural Development in Bangladesh using Genetic Engineering (Jahangir *et al.*, 1994). Currently, our Laboratory is funded by the US Department of Commerce, US National Oceanic and Atmospheric Administration, US National Marine Fisheries Service to develop a stock of genetically marked lake sturgeon using the methods of genetic engineering. We have frequently invited many Bangladesh Government Policy Makers and Scholars visiting New York to discuss the possibilities of DNA engineering as could be applied to Bangladesh and to give them a tour of our laboratory[¶] for an orientation on the facilities needed for such work.

Our main focus at the moment is to enhance agricultural development. But once trained manpower becomes available in Bangladesh, many pharmaceutical and other technology based companies will compete for these experts in order to utilize biotechnology to manufacture life-saving drugs of unsurpassed purity and specificity at less expense as well as a plethora of other products. For instance, production of enzymes for industrial uses would be another field of potential economic development.

Today, people in Bangladesh do not earn enough for a modern living since few high-value high-tech products are manufactured in the country. Bright Bangladeshi brains that are being wasted today can be turned into the gold mines of tomorrow by giving them the right training and skills. We also have to realize what is advanced today may become out-of-date tomorrow. Hence, the country should develop scientific skills, scientists and viable institutions to serve herself as well as the whole world for the future. Currently 60% of our labor force is employed in agriculture. However, with the application of genetic engineering in agriculture, significantly fewer labor hours will be needed per unit production. Hence, additional labor will be available for (i) increased agricultural production and (ii) employment in the ever expanding industries in the country.

It is a myth that we will not be able to do biotechnology in Bangladesh. Quite conversely, in the past, we demonstrated that we can produce advanced scientific results. During the 1950's, S.N. Bose, from the University of Dhaka formulated many physical principles including world famous Bose-Einstein theory, a remarkable achievement for the entire history of science. (Ahmed, 1994).

It is very encouraging for us to see that the Bangladesh Government is considering establishing a Biotechnology Institute for DNA engineering in Bangladesh. Obviously, we all should welcome such an initiative. However, in order to be effective, we have to look at: (i) Do we have enough experienced manpower available in Bangladesh to man the institute? (ii) What shall be the source of continuous funding for chemicals, organisms and equipment needed for genetic engineering to keep the scientists fully engaged? (iii) Is it going to be a viable institute or will it turn into a show piece only? (iv) Should we expand the existing facilities as a first step before we open a full-scale institute? There are many questions similar in nature that come to us since we have some familiarity with the field. We think the scope of the fourth question raised above should be fully exploited. This question is not only raised by us, but also by M.S.U. Chowdhury, Chairman, Bangladesh Agricultural Research Council as mentioned in a Government sponsored Feasibility Report (1993).

Biotechnology is new to Bangladesh. Our experience is very limited in this field which also has been mentioned several times in the Feasibility Report (1993). If we are to be successful in this area, we have to gain some experience in this field before we commit ourselves to an ambitious project, like the establishment of a Biotechnology Center, otherwise this institute may not provide us with what is expected. Hence, as a first step, we should provide research funds to various scientists interested in DNA technology at existing research institutes and Universities in Bangladesh. Their achievements may be augmented and facilitated by collaborative research with as many laboratories as possible in the developed countries. These collaborations will (1) directly help in training the Bangladeshi participants, and (2) assuming that the projects will be conducted at laboratories in Bangladesh, (a) the experimental organisms will be directly related to the Bangladesh economy, and also (b), several laboratories functional in DNA engineering will be established in Bangladesh.

We also have to realize that our educational curriculum needs to be updated to match the need for generating trained manpower in the field of DNA technology. Hence, as another priority, we should fund curricula development with more involvement in laboratory work including DNA technology at the Universities, Colleges and High Schools which will be the back bone for our entrance into DNA technology. Otherwise we may ultimately create an institute, like a white elephant, only for employment, not for scientific achievements and development of the country.

If we direct our national funds for curricula and educational development and support our existing research institutes and Universities for research in DNA technology, this will provide us with a solid foundation for our viable entrance into the field of DNA technology in future. This may be achieved by redirecting the costs of constructing new office buildings needed for the recommended Biotechnology Institute into research and education at the existing institutes at this early stage. This will soon lead us into a new era in that many industries will find it profitable to hire these scientists to manufacture many products through biotechnology. As a result, these products will be available at low cost in the internal market and some are likely to be marketed worldwide due to low manufacturing costs. This process will only make our foundation stronger. At this point, the country will be biotechnologically and economically more able to expand in this field and set-up not only one, but as many biotechnology institutes as needed.

Therefore, the major impediment for our entrance into the field of DNA technology is not the absence of a biotechnology institute, but rather the lack of training in this field and limited number of trained researchers available in this area. If we take steps to eradicate these problems, then we shall see that the existing institutes will be developing excellent scholars in DNA technology. At the same time, the country will excel in transgenic (i) jute, *Corchorus capsularis* and *C. olitorius*, (a) resistant to hairy caterpillars with *Bt* toxins, (b) low in lignin content fibers, etc., (ii) rice, *Oryza sativa*, resistant to tungro virus and yellow stem borer with quadrupled photosynthetic efficiency, and (ii) rohu, *Labeo rohita*, spawning in ponds and growing at double the rate of the existing stock, among many others.

We feel that the distinguished scientists in the Feasibility Report (1993) tried to cover only the minimum level of facilities needed, possibly keeping financial constraints in mind. However, we think that in order for a fully functional national institute to maintain its size and quality, much more in terms of yearly funding for equipment, supplies, journals and books will be needed. At the same time, we have to keep in mind that the enzymes, plasmids, virus, bacteria, media, chemicals, glassware, and equipment essential for this work are not produced in Bangladesh. Let us point out that the cost will be much less if research on DNA technology is carried out in the laboratories at the existing institutes with additional funding rather than creating a central Biotechnology Institute. Further, the existing institutes will be able to share expensive equipment among many researchers within a campus and also among closely located campuses. This will encourage and involve participation of more scientists from various institutes than within a single institute. Hence, at this preliminary stage, it may be more wise for us to invest our limited funds into research in DNA

technology at the existing institutes instead of constructing new buildings for a separate Biotechnology Institute.

In conclusion, we should not wait any longer to get into DNA technology. However, to achieve this end, the first step should include (1) curricula development at Schools, Colleges, and Universities; (2) support of the interested researchers at the existing institutes; (3) establishment of collaboration with foreign laboratories in order to develop enough trained manpower so that sufficient peer groups develop within the country for scientific interactions. Thus, we shall have (1) a process of ongoing training at schools, (2) more experienced researchers, and (3) the ability to have a viable Institute for Biotechnology in the future. At that stage of development we shall be able to decide about the need for an independent Biotechnology Institute. Without satisfying the above prerequisites, the establishment of such a Biotechnology Institute may turn out to be a futile exercise, which is not uncommon in Bangladesh.

REFERENCES:

F. Ahmed: (1994) "Scientific heritage of Bangladesh: from Boses to computers", The 8th Annual Conference of the Federation of Bangladesh Associations in North America, New Jersey, September 04, 1994.

Z.M.G.S. Jahangir, M.A. Rahman, A.K.M.N. Islam, and R.A. Eckhardt: (1992) "Genetic Engineering for the Development of Agriculture in Bangladesh." *In* First Agricultural Scientists Convention 1992, New York, July 26, 1992. H. Siddique, A. Hossain, M.F. Ali, and A. Rahman, eds., American Association of Bangladeshi Agricultural Scientists. pp 1-9.

Z.M.G.S. Jahangir, M.A. Rahman, T. Islam, P.R. Kar, and R.A. Eckhardt: (1994) "The Sky is the Limit for Agricultural Development in Bangladesh using Genetic Engineering." The 8th Annual Conference of the Federation of Bangladesh Associations in North America, New Jersey, September 04, 1994.

Feasibility Report. (1993) Feasibility Study for Establishing a Biotechnology Institute in Bangladesh. Final Report. April, 1993. Government of The People's Republic of Bangladesh, Ministry of Education, Science and Technology Division. Development Planners & Consultants and Sheltech Consultants (PVT), LTD, Dhaka, pp. 244 and Appendix 74 pages.

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