

FEATURES

BIOTECHNOLOGY

There is a Tendency to Duplicate Breakthroughs without Consideration of Long-term Results

by Professor Ahmad S Islam

WHENEVER there is a publication in the top ten journals reporting some new breakthroughs in an applied field at the laboratory scale, the scientists all over the world tend to believe that probably there lies the solution of their problems. One case in point is the production of transgenic crop plants containing Bt (Bacillus thuringiensis) gene that produces insecticidal protein. The publication reporting the insertion of Bt into cultivars of cotton prompted a number of multinational companies to try this technology to produce insect resistant crops such as cotton, potato, maize etc. After conducting field trials some companies, namely, Monsanto released transgenic maize, cotton varieties resistant to insect larvae.

Those who grew transgenic corn noticed that Southwestern Corn Borer larvae did not intervene when placed on the Bt corn plants and therefore caused no damage. Survival and growth of fall Armyworm larvae was reduced in comparison to that on standard commercial hybrids. Plant damage was also significantly

reduced. The Bt corn plants also sustained significantly less damage than resistant hybrids developed by conventional plant breeding methods. But sooner than expected, they discovered that although initially the new varieties proved far better than the standard ones as regards their immunity to insect attack, they have, within a short period of time, become susceptible to these pests. New strains of insects have developed under selection pressure attacking the transgenic plants.

RENEWED fears over the safety of plants carrying genes from viruses may lead to curbs on genetically engineered crops in the US. Moves to clamp down on altered crops came as the biotechnology giant MONSANTO awaits permission to market a potato that carries a viral gene. Meanwhile Canadian research shows that the risk of wild viruses hijacking genes from engineered crops could be far higher than suspected.

Consensus among the breeders about the new strategy for producing insect resistant

transgenic crops: The inserted CRY IA (b1)/CRY IA (c) gene from Agrobacterium tumefaciens subspecies kurstaki in a crop conferring resistance to insect attack should be further engineered using suitable eukaryotic promoter in addition to the one contributed by the bacillus so that the expression of the gene is at its maximum. Furthermore, great controversy is going on at the users' end whether or not antibiotics such as kanamycin or hygromycin should be used as a marker gene to screen the transformed cells. It is argued that the cells of the transgenic food crops containing the genes resistant to antibiotics may pass on their genes to microbes in the gut; and the latter in turn may deliver them to pathogens now susceptible to antibiotics. Antibiotic resistance is one of the biggest problems facing human health and everything possible

should be done to minimize the use of antibiotics. In view of the above situation, it is now recommended to use suitable markers other than those for antibiotic resistance. One such gene is the one utilizing mannose. Antibiotic resistance genes with introns may also be used to prevent their expression in transgenics. Another approach, which has been already done successfully in a few instances, is to get rid of the harmful effects of antibiotics by eliminating antibiotic resistance genes already present in the transgenics.

Protease inhibitors genes: To speed up the process of natural defense mechanism, crops have been genetically engineered to express protease inhibitors genes all the time so that feeding insects, caterpillars and other organisms are immediately exposed to the insecticidal protein. Compare

this with an un-engineered plant which takes several days to reach a level capable of weakening or killing the grazing pests.

Transgenics and standard variety of a crop should be planted in the ratio of 80:20. To protect against the development of insect resistance, it is also recommended that fields are planted with 80% of a transgenic crop containing Bt or any resistance microbial gene interspersed with 20% of the standard susceptible variety.

Novel method available to insert a gene of interest in a pre-selected site of a chromosome to ensure its uniform expression: With the availability of two genes Cre/lox (Cre causing recombination and lox representing locus for crossover), isolated and cloned from the bacteriophage P1 at the Institute of Molecular Plant Sciences at Leiden University in the

Netherlands, it is now possible to insert a gene of interest into a specific chromosomal location in Arabidopsis thaliana.

Agrobacterium tumefaciens is used as a vector. 89% site-specific recombinants, representing precise integration were obtained. This novel approach may eliminate variation in gene expression level (random insertion of genes in the chromosome produce position effects). When perfected, this technique may be applied with the success to target a transgene to a single pre-selected chromosomal site of a crop plant of interest.

A single gene responsible to confer resistance to both nematodes and aphids: The discovery that a single resistance gene is effective against a plant parasite and an insect pest belonging to two different Phyla has been reported in a recent issue of PNAS (Proceedings of the

National Academy of Sciences). Genes Mi and Meu-1, conferring resistance to aphids and nematodes were thought to be two separate genes. 2.3 Aphids and nematodes belong to different phyla, so initially there was no scope questioning to their separate identity. Recently the two genes, Mi and Meu-1 were sequenced and found that they were one and the same gene.

Aphids is a great enemy to crops sometimes devastating the entire population. Nematodes are equally dangerous. So there is a great need to incorporate the above gene in the crops that are grown in the Islamic countries.

Why build a costly molecular biology laboratory when the genetically modified material can be bought? A question is frequently asked as to why spend such a huge amount of money to build up a molecular biology laboratory when such GM (genetically modified) plants can be purchased at a much lesser cost from multinational companies. The answer to this question is not a difficult one. GM plants available with these companies need to be

tailored to suit the climate of different Islamic countries; not only that, even within the border lines of the same country like Pakistan, there are different climatic zones. A variety of a crop suitable for semi-arid regions of Sind and Punjab is not so for the mountainous region of North-Western Province or the dry Baluchistan region. The seeds of transgenic plants need to be grown in specially designed areas taking precaution that no pollen from such a GM variety is carried away either by the wind or insects and pollinate standard varieties. If the transgenics perform better than the standard varieties, then and then only transgenics could be recommended for distribution among farmers.

More often than not, transgenics direct from the suppliers fall short of the expectations of the farmers and as such are not accepted by them. Under such circumstances, the transgenics need to be either crossed to the standard local varieties or using molecular biology tools transgenics need to be produced in the laboratory of each Islamic country.

Promoting Activities and Research in the Area of Biotechnology

Vaccine Biotechnology, Transgenic Goat, Cows and the Necessity to Have Joint Venture

GENETICALLY engineered vaccines are now available but they cost too much and as such are not affordable by families with low income. For instance, each shot of Hepatitis B vaccine costs in Bangladesh \$10-\$12 and one needs three shots for immunization. Hepatitis B virus causes blood cancer and in most cases it is fatal; on the other hand, the vaccine against it, prevents the occurrence of this deadly disease.

In order for this vaccine to be available at a low price within the reach of common man, this vaccine needs to be produced within the country. Fortunately, this technology which has been developed at the Delhi Component of the International Centre for Genetic Engineering and Biotechnology (ICGEB) is available for transfer to member countries. Bangladesh, being one of the member country, can buy the protocol at a low cost.

Fortunately, we have Bangladeshi experts in this important field. Particularly, I shall mention the name of Dr. Ahmed A. Azad Ph.D. one of internationally known vaccine biotechnologists. Dr. Azad is now working as Chief Research Scientist, CSIRO, Division of Molecular Science, Australia. Because of his well-deserved reputation through his work and a large number of top-class publications, he has been recently elected by the Board of Governors of ICGEB, a member of the Council of Scientific Advisers of ICGEB.

Dr. Azad is at the moment in Dhaka being the invited principal speaker in a symposium on "Transfer of Hepatitis B Vaccine Technology" to be held on

the 17th of November. Dr. Nabin Khanna, the vaccine specialist working in the Delhi Component of ICGEB expert will be another main speaker in the same symposium. Dr. Virendra Chauhan, the Director of the same institute will also be attending the symposium. Dr. Azad, Dr. Chauhan and Dr. Khanna will be available for dialogue with any Bangladeshi pharmaceutical company or companies who would be willing to invest money to buy the technology and establish a factory for the production of the above vaccine. Suffice it to say at this point that the facilities created for production of Hepatitis B vaccine could also be used for the manufacture of other vaccines.

DNA vaccination: Dr. Azad thinks and I quote from his article which he is going to present in the above symposium, that research in this area can be initiated in Bangladesh without sophisticated equipment. DNA vaccination or genetic immunization is relatively simple. In this technique, the antigen (immunity-producing gene) is delivered directly into the muscle of the recipient. The protein-antigen, produced by DNA (through transcription and translation) then goes into peripheral circulation and confers immunity to the recipient of the vaccine. When perfected, only micrograms (one-millionth of a gram) of this vaccine will be necessary to immunize a person.

Joint venture of 2-3 countries to manufacture recombinant DNA vaccine: In view of the enormous cost involved to

set up a molecular vaccine lab., none of the pharmaceutical companies in Bangladesh may decide to invest such a big capital outlay. In such a situation, two or three countries, say, Bangladesh, Malaysia and Pakistan may join hands and launch a joint venture project on the establishment of such a plant. I am sure Islamic Development Bank will gladly examine such a project and finance it, because investment in such enterprises will prove to be very much cost effective, in as much as the product can be imported to other developing countries needing vaccines. Needless to say that vaccines produced in the region encompassing developing countries will be available at a much lower cost than they are at present from multinational companies.

Oral vaccination with transgenic (genetically modified) plants: Now plants can be genetically modified for oral immunization. Experiments carried out in the recent past have shown that prototype (original/model) immunogenic proteins such as those seen in the serum are produced in transgenic plants. Such proteins, if eaten as food, trigger oral immunity to the consumer.

A young Bangladeshi Scientist, Dr. Sarwar Jahangir, Asst. Professor of Biotechnology, Stockton College, NJ is working in this area, namely on "Molecular farming for the production of vaccines and hormones" using crops and vegetables and (3) fish as a potential surrogate for vaccine produc-

tion. Obviously, this will be an easier area for Bangladeshi biotechnologists to do research; this kind of research projects involve less running expenses and in case of success it will be less costly to produce. Finally, if such genes are inserted in fruits like banana, the consumer will relish his food and at the same time be immune from a deadly disease like Hepatitis B.

Transgenic animals, and transgenic fish: Like transgenics in crop plants, transgenic animals are being marketed now. For instance, Nexia, a Quebec-Montreal based Company has released a special breed of transgenic goat called "Willow" BELE® (Breed Early Lactate Early). This particular type breeds all the year round. This special breed of goat contains a human gene; they mature early and cost less to feed. Housing them is less costly. They produce more milk and also a variety of recombinant proteins of therapeutic value. Pharmaceutical companies who use these proteins will be able to have their supplies at a much cheaper rate than was hitherto possible. The conventional companies will surely have a very tough time competing with these biotech companies with cheaper products.

Super cows: These are future transgenic cows in which the protein concentration is expected to increase by about 10%. This breed of cattle will contain additional elite casein genes. The Australian scientists working on this project have

successfully tested their new technology by working on mice and hope to produce transgenic cows within a year. The research team has successfully identified the genes for protein production in elite cattle. These genes have been successfully cloned and then introduced into transgenic mice. Since this technology has worked in mice successfully, the scientists expect to face no problem to breed transgenic cattle with a 10% higher production of milk and also proteins of therapeutic value within the next 12 months.

According to their estimate, the increase in the protein content by 10% will give the producers an economic return of \$62 million a year. This project would have taken seven years instead of 12 months if conventional breeding methods were resorted to.

Bangladesh won't be able to import these novel strains of transgenic animals; Bangladesh needs more milk, more meat and these transgenics would be a good source to try to increase production of milk and meat. But Bangladesh is not ready yet to import these animals even if she obtains funds to buy them. This is because Bangladesh is yet to introduce biosafety rules. Without these rules in place no multinational company would supply us what we need in terms of transgenics whether of plant, fish or animal origin.

Those of us who are concerned in the national development in the coming millennium, strongly feel that there is

an urgent necessity for our political leaders and decision makers to be fully aware about the great potentiality of biotechnology; and also of the fact that the success of reaping the full benefit of biotechnology is entirely dependent upon multi-disciplinary and multi-institutional approach and their linkage with the industry. In order for this to happen there should be a separate division i.e., DIVISION OF BIOTECH-

nology under the Ministry of S&T. Its personnel should be recruited from among the trained biotechnologists in order for them to critically study, evaluate and maintain a liaison between the scientists, the industry and relevant Ministries. Simultaneously, without further loss of time, the National Biotechnological Institute should come into being with adequate provision for financial support to the university de-

partments and research institutes where research work in biotechnology is making a satisfactory progress. The success story of India's biotechnology is the establishment SEVERAL YEARS BACK of a strong Department of Biotechnology headed by a scientist Secretary, Dr. Manju Sarma and a large number of Biotechnology institutes working under its umbrella at a huge budget.

The author is President Bangladesh Association for Plant Tissue Culture

Forensic Labs in India

Urgent Need of Autopsy



Jayanta Bhattacharya writes from New Delhi

EVEN as an autopsy increasingly becomes indispensable for ascertaining the cause of death, forensic laboratories around India have come under scrutiny with allegations of violation of procedures in conducting post mortem and manipulation of the reports.

Last month, Senator Joseph Lieberman (Democrat of Connecticut) and two other senators took a step in that direction by introducing a bill to reward companies that take early voluntary action to reduce their emissions.

They recognize the reality that more has to be done, they accept the science," said Eileen Claussen, executive director of the Pew Center and former assistant secretary of state for Oceans and International Environmental and Scientific Affairs.

"Science has told us we potentially have a very serious problem," remarked Robert Burt, chief executive officer of FMC Corporation, a major chemical and equipment company. He said the evidence includes record-high global temperatures in recent years, unpredictable changes in weather, and computer models that forecast a warming of 1 to 3 degrees Centigrade by 2100.

British Petroleum, Royal Dutch Shell, United Technologies and IBM recently announced specific numerical commitments for reducing their emissions. British Petroleum, for example, has set itself an internal target of cutting greenhouse gas emissions by 10 per cent by 2010, exceeding the Kyoto average.

In addition, General Motors, Monsanto and British Petroleum have teamed up with the World Resources Institute, an environmental think tank, to push for legislation on a domestic "early action" programme that will ensure that companies get credit for greenhouse gas reductions before an international framework is in place.

ports received by NHRC mentioning a large number of cases pending in different laboratories delaying justice.

Moreover, due to the threat by criminals and flow of money, the presence of eye-witnesses is becoming rarer, says Tiwari.

Recently a video tape of the post mortem of a tribal who had died in police custody was screened in a court in Calcutta to show how the exercise is carried out by untrained non-medical people in open dirty surroundings.

An unskilled assistant was seen repeatedly stabbing at the throat of the corpse making an incision. The internal organs were then ripped out and planked on the floor of the hospital verandah.

In certain cases post mortem had not been carried out properly and in others, inordinate delay had occurred in the submission of post mortem report," an NHRC report says.

In other cases, instead of preservation in saline solution, the viscera is manhandled and quite often lost.

According to a criminal lawyer "if the post-mortem report does not come within 90 days, the accused cannot be chargesheeted and is released on bail. This delays the entire trial process".

The Forensic Science Division reviewed the pendency of viscera cases in all the laboratories in the country and observed that the root cause of the problem was that every post-mortem case was invariably being sent for a forensic laboratory examination irrespective of whether the cause of death was suspected to have been poisoning or not.

The scene of crime is a treasure of clues which can lead the investigation to the culprits. In case the relevant clues are not properly identified, collected and packed before being sent to

the laboratory for examination, the effort goes waste.

"But most of the investigating officers at thana level do not possess an adequate scientific knowledge to identify, collect and pack the clues from the scene of crime," Tiwari says.

"With this in view, mobile forensic science units need to be established at each district headquarters so that the services of scientists are instantly available at the scene of crimes to help the investigating officers in properly examining the crimes," Tiwari says.

Sources in NHRC say that the post-mortem report format, used in various states, is vague and more often than not leaves scope for manipulation.

"To plug the loopholes, the autopsy format was revised to make it more incisive and purposeful, illustrative and comprehensive for clear understanding by the autopsy surgeons at all levels. The revised autopsy format was submitted to the NHRC for recommending to all the state governments for implementation," Tiwari says.

The commission, while deciding to evolve guidelines for satisfactory working of the laboratories in the country, has asked the Union and State governments to help the core group in its work.

Tiwari suggests fast issuing of forensic findings to expedite investigations and trials. "This can be achieved by establishing forensic labs at every police range, headquarters which would function under the administrative control of the state forensic laboratories," he says.

The NHRC has also recommended setting up of forensic laboratories in all the state capitals and launching of at least one mobile laboratory in each district and videotaping of all the post-mortems in case of unnatural deaths.

Complaints and various re-

Growing Number of US Companies Pledge Action for Climate Change

by Jim Fuller

OFFICIALS attending the climate change conference in Buenos Aires said one of the most important things to happen since the Kyoto Protocol was adopted last year is the growing number of corporations pledging to reduce their greenhouse gas emissions to combat global warming.

The officials pointed out that a growing number of leading U.S. corporations that just a year ago rejected the idea that there was any need for action on climate change are now acknowledging that the threat is real.

Under Secretary of State Stuart Eizenstat, head of the U.S. delegation at the climate change conference, said in a speech delivered November 12 that many corporations are now working to turn the promise of Kyoto into a reality, and that some have even pledged to voluntarily reduce their emissions below the Kyoto target.

Environmental ministers and officials from over 160 countries gathered in Buenos Aires to negotiate rules for meeting the emissions reduction targets agreed to last year in Kyoto, Japan. The protocol calls on developed countries to reduce their emissions by an average of 5 per cent below 1990 levels by 2010.

"We've got literally dozens of companies -- world-class companies -- who want to be part of the solution, who have formed groups to try to make Kyoto work," Eizenstat told reporters. "Just today... the Southern Company, the largest utility in the United States, put out a very strong, positive statement about Kyoto -- about participating in it, about making it work, about making flexible mechanisms work. This is a sea change in the position of many companies."

Officials pointed out that the statement by Southern Company was all the more signifi-

cant because the company is a member of the Global Climate Coalition, a vociferous opponent to taking action on stabilizing greenhouse gas emissions on current scientific evidence.

Eizenstat pointed out that some multi-national companies with large operations in the United States, like British Petroleum, have actually launched their own internal emissions-trading system between units within the firm as an experiment to view how trading works and help them reach their targets.

"These companies are trying to prove [that trading works] in the intra-company level, and that's also a very positive development," Eizenstat said. "They are also talking about trying to encourage their suppliers, who are small and medium-sized businesses... to get more engaged. So the large companies are going to set examples for smaller companies."

He also said that the Clinton administration is reaching out "very aggressively" to the mainly smaller business units that make up the agricultural sector.

"We have talked to farm organizations, who had been very dubious about the Kyoto Protocol and climate change, he said. "I'm not trying to... suggest that they've turned overnight into great supporters. But they are really willing to listen; they are open. We have had good debates

and good discussions. "I don't want to in any way underplay the continued opposition of other large segments of U.S. business," but we are noticing a change in the way many corporations are viewing climate change, he added.

Todd Stern, assistant to the president for special projects, said that the White House Task Force on Climate Change, with the cooperation of several federal agencies, has had a very positive dialogue with the top management of the major sectors of U.S. industry, including steel, aluminum, electric utilities, gas pipelines, cement and forest products.

"We are working to encourage those sectors to undertake voluntarily policies to reduce their emissions, improve their energy efficiency," and seeking ways that the federal government can help in the effort, Stern said. "So this is a beginning and we will be extending that outreach programme significantly in the year ahead and in the years after that."

"There's been a tremendous change in the United States... the beginnings of a change in attitude in the business sector," said Dirk Forrester, chairman of the White House Task Force on Climate Change. "We've seen the formation of several new initiatives between environmental organizations and our private sector."

During the last year, 20 ma-

corporations -- including DuPont, Boeing, United Technologies, Enron and British Petroleum -- have joined with the Pew Center on Global Climate Change and the Environmental Defense Fund to promote actions to address climate change.

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In addition, General Motors, Monsanto and British

Garfield

YOU'RE A LAZY PIG!

James Bond

BY JIM FLEMING
DRAWING BY MORAK

PROJECT SEA SLAVE WAS BASED ON MALDIVES ISLANDS?

HOW DID HE KNOW IT WAS ME?

A CRUISER FROM THERE RENDEZVOUSED AT SEA WITH A TRANSPORT DOCK FOR THE SUB'S TRIAL RUN

HOWEVER, ALL VISITORS TO THE MALDIVES HAVE BEEN THOROUGHLY SCREENED BEFORE ANY SINCE THE TRIAL RUN

YOUR BEST CHECKPOINT -- AND THE MOST LIKELY OBSERVATION POST FOR GENEVA AGENTS WILL BE THE PSYCHIC ISLANDS TO THE SOUTHWEST!