

# Biotech

## NEWS

Newsletter of the Department of  
Biotechnology, Government of India

<http://www.biotechnews.gov.in>



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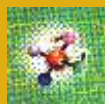
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Department of Biotechnology,  
Ministry of Science and Technology,  
Government of India



## Mail Box

### Response

It was a pleasure to flip through pages of 2nd and 3rd issues of Biotech News. It came across as a newsletter that seeks to go beyond than just being newsletter. What is notable about Biotech News is that it attempts to project the complex subject of biotechnology in a manner that can be comprehended even by a general clientele, especially the uninitiated school children. I hope that the same is being mailed to as many schools as possible.

I suggest that Biotech News does a series of articles on various cutting edge areas in the broad domain of biotechnology to provide a broad overview of the same for the appreciation of non-specialist audience, especially young children or should I say the budding scientists of tomorrow.

Biotech News can indeed be a very useful vehicle to create a better appreciation of the fast emerging field of Biotechnology that is now believed to have the potential to overtake Information Technology in terms of its economic value and number of people directly and indirectly connected to the same.

Dr. Shashikant, Associate Professor, Faculty of Forestry, University of Toronto, Ontario, Canada.

Biotechnology is the branch of science that has off late received great deal of attention at global as well as domestic levels. Biotech sector is growing at a rapid pace due to its versatility & capability to provide effective tools for sustained development and proper utilization available natural resources. However, biotechnology is a discipline that cannot survive, let alone thrive, without sufficient and assured funding. The role of biotechnology in Indian forestry is of utmost importance in food security and sustaining rural livelihoods. The availability of increased scientific talent in the field of forest biotechnology would certainly benefit the nation. Biotechnology can indeed enhance productivity and improve the commercial values associated with the forest produce manifold, though there may be some associated risks. Of course, biotechnology has the desired potential to meet the growing needs of our ever-increasing population.

Biotech News comes in at a time when the fact that the number of talented young students taking science as a career is going down is emerging as a major concern. I sincerely appreciate this initiative of the DBT and congratulate them for reintroducing the newsletter with reorganized content, fresh apparel and with increased periodicity.

Dr. R. L. Srivastava, IFS, Director, Arid Forest Research Institute, Jodhpur-342 005, Rajasthan. ■

## To the readers

The Department of Biotechnology has relaunched Biotech News - its official newsletter - with reorganized content, fresh attire and with increased periodicity. The earlier version, you may recall, was published twice a year at six-monthly intervals. We have felt that in order to maintain currency, and bring to its readers a flavour of the various developments in biotechnology as seen from DBT, the Newsletter ought to be brought out at more frequent and regular intervals. With three issues already now with the readers, it will now appear six times a year at 2-monthly intervals, both in hard copy version and the e-format.

As mentioned earlier, we have reorganized the content to make it more informative and user friendly. Each issue has one or more 'Feature' articles written by eminent life science experts. 'Cutting Edge' focuses on critical analysis of a frontier area of life sciences/biotechnology. 'Tech Update' highlights recent developments from institutions and industry. 'News Desk' will bring you a round up of various scientific meetings, brain-stormings, international collaborations etc. 'Tech Transfer' keeps you informed of latest technology transfers to industry and other user groups of biotech products, processes as well as launch of these in the market. 'Profile' seeks to provide snapshots of an institution active in biotechnology. Finally, 'Notice Board' alerts you to DBT's call for proposals, forthcoming meetings, positions vacant at DBT and its autonomous institutions, recent publications etc.

With all these changes, we aim to reach out to a larger section of the society, particularly, schools, colleges and post-graduate institutions, as well as industry and voluntary organizations interested in life sciences and biotechnology.

We have received a large number of letters appreciating this initiative. I hope readers will continue to write to us about what other modifications they would like to see in Biotech News.

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# Translational Biology in India

## Smallpox to Stem Cells

Dr. D. Balasubramanian, L. V. Prasad Eye Institute, Banjara Hills, Hyderabad-500 034  
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As we enter the year 2007, we are all set to celebrate the 'shashti abda poorthi' of free and resurgent India. It is time then to look at what all has happened in our country, over the six decades, in the area of translational biology. This relatively newly coined term refers to the application of the ideas and results coming out of basic biological research to human welfare. This might be in the form of selection breeding of grains and crops to increase productivity in farms, birds, cattle and livestock to help the poultry, dairy and veterinary areas, and in human health and welfare. More recently, the phrases 'bench-to-bedside' and the even more evocative 'bedside-to-bench-to-bedside' have been used. Attention of the biological researcher is drawn to what the suffering patient needs and how can that need be addressed by using the methods and results obtained in the laboratory, and translating them into therapeutic use. In short, this is translational medicine.

Edward Jenner, who turned his question of how some milkmaids are not affected by cowpox into a vaccine, Louis



Pasteur who used his results on heat-killing of bacteria to give us the method to make milk safe for drinking, Wilhelm Roentgen who discovered x-rays and used them as a diagnostic tool, and Norman Borlaug

whose work on selection breeding of wheat gave us high yielding varieties are some notable translational biologists. One does not have to be the original discoverer of the idea or inventor of the method; he may stay as a bench scientist. But if he transforms the idea or the method into application, he becomes the translator.

India has had a rewarding history of the use of translational biology during its sixty years of freedom and resurgence. During the 1950s, when both free India and I were young children, I remember people walking into homes in villages, towns and cities distributing anti-malarial drugs, prompting us to use them and bribing us to do so with free cups

of tea. The village post office had free quinine available. DDT was used all over. This was all part of the first drive against malaria, called The National Malaria Eradication Programme. The NMEP-wallahs went all over the country, missing very few areas, and thanks to their efforts the prevalence of malaria came sharply down in ten years. Even more striking was the smallpox eradication campaign. Biologists of today point out, somewhat off-handedly, that the smallpox virus was an easy one to handle. It did not mutate the way many others do; storing, handling and administering were easy; the people were more willing, and so on. Thank God all this is true, and thank God again we did not need today's more complex biology to eradicate it. The point is that we did it with resounding success. Alas, the malaria parasite has been tougher to crack, with its drug-resistant strains and with public sanitation measures going down. But given time, there is no reason we cannot conquer malaria. Our little neighbour Sri Lanka is quite well on its way to do so.

If the 1950s was a period of public health measures using this microbial version of translational biology, the next decade of the 1960s offers a different version, this time in food and agriculture. This has been the decade of glory for the agricultural researchers, farmers, policy planners and end-users across our land. Borlaug's experiments with the high yielding dwarf wheat were translated into thousands and thousands of acres by these people. At the same time, better seeds and saplings of rice were found and propagated. Soya, until then an exotic novelty in India, was introduced in a big way. Irrigation, fertilizers, pesticides, post-harvest techniques, and top of them all acceptance by the farmer and the consumer led us to the Green Revolution. It was this decade that transformed India from a 'ship-to-mouth' nation into a 'silo-to-ship' one, in ten years.

The 1960s also brought new institutions of higher learning and research into India. While the IITs have become global brand names over these decades in engineering and technology, the Cinderellas have been the medical institutions such as CMC Vellore, Madras and Stanley medical colleges, KEM and King George hospitals, The Nutrition Institute Koonoor, Haffkine Institute and so forth, which pre-date 1970, but also the re-invigorated ICMR and the newly started AIIMS.



Feature

“ If the 1950s was a period of public health measures using this microbial version of translational biology, the next decade of the 1960s offers a different version, this time in food and agriculture „



## Smallpox to Stem Cells

### Feature

“While the 1960s was the decade of the Green Revolution, the 1980s ushered in the White Revolution. What is striking about it is that it did not need 'high science'. What it needed was community participation, ownership and transparency in all its action.”

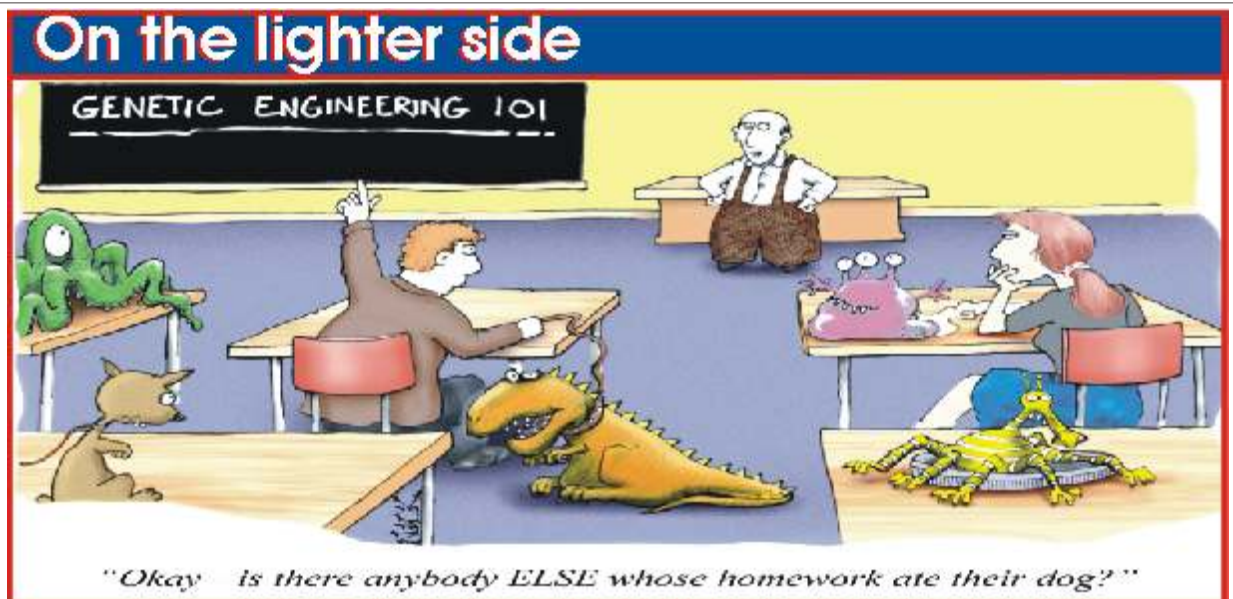
These played a significant and collaborative role in focusing attention on the use of biomedical research and practice in improving public health. The fruits of these efforts began to be felt across the country in the 1970s. This was the decade of translational nutrition. Results from biochemistry and intermediary metabolism were used to define what came to be known as protein-calorie malnutrition. The nutritive content and value of Indian food were catalogued for the first time. As the cause of goitre came to be known as the lack of iodine, a successful national campaign for the distribution and use of iodized salt was launched. And as the role of vitamin A in vision became known, the administration of mega doses of vitamin A to school-aged children was started, in order to counteract night blindness and associated aspects of vision impairment.

The enactment of the Indian Patents Act in 1970 that recognized processes instead of products allowed the growth of a large number of drug companies across India, both in the public and private sectors. As the cost of drugs plummeted, the effect on medical care and public health was perceptible. As India became party to the WTO patent regime since 2005, this special advantage we had of recognising only process patent has vanished. The government still has considerable freedom in 'unfreezing' many drugs and medical products from this restriction in the larger interest of national health. Despite this, many worry that the medical costs will skyrocket. Indian scientists are thus challenged to compete with the big pharma companies and invent new molecules, diagnostics and therapeutic products. How well they meet this challenge and come out winners is being keenly watched the world over. I

The reason for this optimism is because of some of the important and exciting developments that were initiated in the 1980s. This was the decade of new biology in India. Several research institutions devoted to modern biology came into being. Some university biology departments re-invented themselves through a 'make-over'. Many Indians trained abroad in the then-newly emerged disciplines of cell and molecular biology, genetic and recombinant techniques, immunology, structural biology and bioinformatics came back to work at these places. New medical institutions that included clinical and basic research as part of their charter emerged in the public, non-profit and corporate sectors. And the Department of Biotechnology (DBT) was born. It is from the programmes established by these scientists, the extra-mural grants and projects initiated by DBT and ICMR (and by DST, CSIR, ICAR, DRDO and DAE) that my optimism stems.

While the 1960s was the decade of the Green Revolution, the 1980s ushered in the White Revolution. What is striking about it is that it did not need 'high science'. What it needed was community participation, ownership and transparency in all its action. It was again during this decade that poultry and egg production went up in the country at an exponential level the Ovine Revolution on the steps of the Bovine. Of course, these are not related to translational biology per se. What they show is the power of community participation, empowerment and enterprise. They have surely made much of India healthier.

Now we turn to the 1990s. This was the decade of biotech companies. One of the first products that were marketed by them was the recombinant vaccine against Hepatitis B. Here



## Smallpox to Stem Cells

was an example of translational biology not quite bench-to bedside but bench-to-avoid-bedside. The academia-industry interaction that we were waiting for had arrived. The fact that indigenous production dropped the price by 100-fold meant vaccination became more prevalent and accessible to a far larger number of people. It is gratifying to note that today India makes and supplies about forty five percent of the world's need of vaccines against human diseases. State governments have taken pro-active measures and started 'biotech parks'. The number of academics and researchers turning into biotech entrepreneurs is steadily, though slowly, rising. The recent 'Golden Triangle' effort by the CSIR to bring academia, research laboratories and industry together is a welcome step in this enablement.

The excitement in the current decade in India is the birth, nurture and growth of stem cell biology and regenerative medicine. Stem cells possess two important and useful properties: they have the capacity of self-renewal and the ability to differentiate into any of the hundreds of different types of cells that are needed in order to make the various tissues, organs, limbs and ultimately the organism itself. Each of us is a product of one such stem cell namely, the fertilized egg cell of our mother. Self-renewal is the ability to multiply faithfully as identical copies without losing or changing any of the properties of the parent cell. The fertilized egg divides repeatedly to form blastomere, then blastocyst, then the embryo, foetus and finally the baby. Harvesting one cell from the blastomere or the inner cell mass of the blastocyst gives us an embryonic stem cell or ESC. Since ESCs have the ability to differentiate into any cell type, they are called totipotent. Much of the hope (and the hype), rests on the possibility that researchers would soon be able to take ESCs and grow them into the desired organ, thus making therapy possible. The field

is still in its infancy. Before the dream of generating organs is realised, there is a lot of basic biology that needs to be done: what genes out of the entire genome contained in ESCs are turned on and which are to be silenced; what cell-specific molecules need to be added and what should not; how many cell types are to be generated and how are they assembled into a multi-cellular organ and so on. Indeed, current excitement among cell biologists is to address and answer

these above and other questions rather than making organs. It is in these areas that one might expect the next Nobel to be awarded.

Stem cells are also found in some tissues and organs of the body. Since these occur in tissues that are already a product of differentiation and after the embryo has developed from the multicellular blob, these are referred to as adult stem cells or ASCs. They seem to

have the ability to differentiate into several other cell types, though not as versatile as ESCs. ASCs are pluripotent. ASCs have been isolated from the bone marrow, muscles and one part of the eye. Claims have been made that they are present in the liver, kidney and a few other organs but it is not clear whether these are progenitor cells (develop only into the host tissue), transiently amplifying cells (to help repair host tissue damage) or actual stem cells. This debate will soon be resolved through research; and it is also expected that ASCs will be found in several other parts of the body.

The pluripotency of ASCs is attractive for their use in some therapeutic applications. The favourite source for such purposes is the bone marrow, which provides both hematopoietic stem cells and mesenchymal stem cells (MSCs), which can generate other cell types. Indeed, successful therapeutic use has so far been achieved using ASCs and in particular MSCs of bone marrow. In our own country, surgeons have been able to harvest MSCs from the



“The excitement in the current decade in India is the birth, nurture and growth of stem cell biology and regenerative medicine. The excitement in the current decade in India is the birth, nurture and growth of stem cell biology and regenerative”



Have a heart

# Prospects of Biotechnology in Cardiology

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Cutting Edge

“As an emerging discipline, molecular cardiology has changed the conceptual thinking of cardiovascular development, pathophysiology, disease causation and disease pathogenesis.”

The sequencing of the human genome coupled with advances in automation and parallel technologies have provided powerful platforms for elucidating the underlying mechanisms of diseases and identification of treatment pathways, thus leading to major advancements in several domains of modern medicine. Cardiology is no exception. This essay is an overview of the progress and the prodigious potential of modern biotechnology in the field of cardiology.

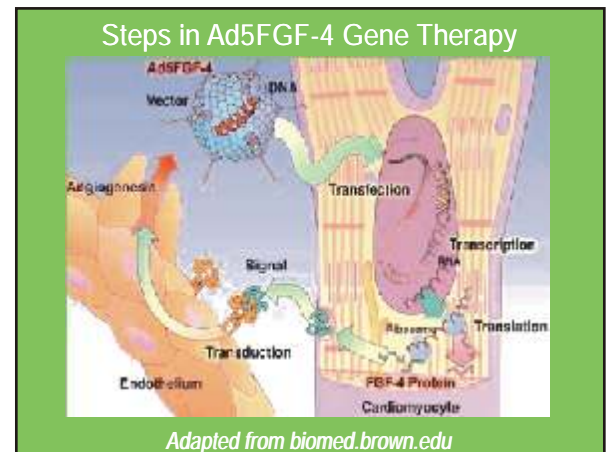
## Genomics

The genomic innovation has brought in its wake the field of 'molecular cardiology'. As an emerging discipline, molecular cardiology has changed the conceptual thinking of cardiovascular development, pathophysiology, disease causation and disease pathogenesis. Large-scale partial sequencing and analysis of the expressed sequenced tags (ESTs) from cDNA libraries are now leading to the discovery of novel genes and characterization of unique transcriptional patterns in different tissues. For example, studies by Hwang et al, (Circulation 1997) that reported an analysis of 84,904 ESTs from thirteen cDNA libraries of the cardiovascular system, represent an extensive compilation of cardiovascular gene expression information. The study also highlighted general differences in gene expression among different tissues and developmental states of the cardiovascular system. Comparisons between foetal heart and adult heart cDNA libraries, have thrown light on the relationship between RNA/protein expression and cell structure/motility in the foetal heart. The tremendous potential for genome-wide research for discovery of genes involved in cardiac remodeling in heart diseases is evident from the findings in investigations in cardiac hypertrophy. In a cardiac hypertrophy library, 34 genes have been observed to be potentially over expressed, including mitochondrial genome transcripts, myosin light chain-2, brain natriuretic peptide, desmin, HSP70, superoxide dismutase, ANF, alpha tropomyosin and alpha actin. The chance identification of over expression of several unexpected genes such as prostaglandin D synthases and metalloproteinase-4 in hypertrophy strongly suggests that these methods have great promise.

Besides ESTs, other techniques such as differential gene expression, serial analysis of gene expression (SAGE), DNA microarrays coupled with bio-informatic sequence analysis are currently reckoned as essential tools to identify and

characterize genes and pathways involved in cardiovascular development as well as disease pathogenesis. They are also useful to discover novel targets for drugs or gene therapy.

With microarray technology, cardiovascular scientists are expected to reach the next level of analysis -- the transcriptome. The customized cardiac specific 'Cardiochip' microarray based on > 10,000 distinct transcripts derived from cardiac cDNA libraries may in the immediate future extract the complete gene expression profiles of dilated and hypertrophic cardiomyopathy. The big challenge would be how to interpret the millions of data that comes out from large-scale analysis of



gene expression.

The use of technologies such as RNA interference and transgenic rescue animal models would help us to analyze the relationship between genes and function. Gene expression arrays integrated with studies in model organisms can be expected to identify the interaction of different genes among themselves and that with the environment. For example, a recent report describes the correlation between scavenger receptor B1, (a cell surface receptor for selective high-density lipoprotein (HDL) cholesterol uptake in the liver and in other tissues and the regulation of HDL metabolism) and protection against atherosclerosis in animal models. Should these results also apply to humans, this will become another new target for drug development in the future with major potential benefits..

## Proteomics

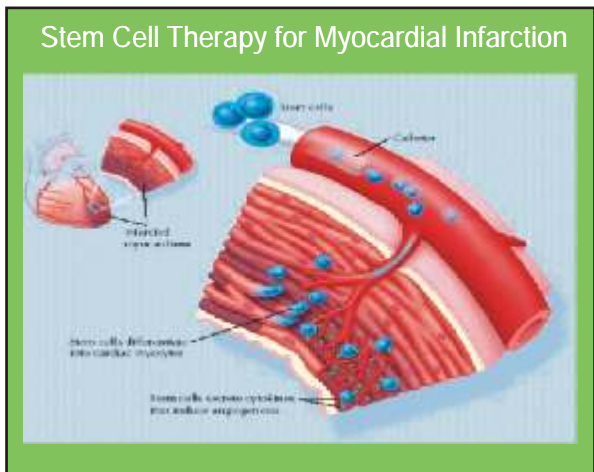


# Prospects of Biotechnology in Cardiology

global study of proteins. In general, with the accumulation of vast amounts of DNA sequences in databases, researchers have become aware that merely having complete sequences of genomes and transcriptional changes for thousands of genes simultaneously will not be sufficient to elucidate, in molecular terms, the etiology and pathophysiology of cardiovascular disease. Using a multitude of experimental techniques, proteomic analyses enable the identification and characterization of various disease-induced protein changes, as may occur during the onset and development of chronic heart disease (eg: heart failure). The overall goal of this effort is to identify serum biomarkers for diagnosis, therapeutic

genetics highlights the multi factorial nature of these diseases and also helps focus on specific molecular targets on the basis of these variations, which is the essence of the burgeoning field of pharmacogenomics. The future will no doubt see a comprehensive database of cardiovascular candidate gene polymorphisms from cross-sections of populations that are likely to result in improved understanding of molecular contributors to these diseases and designing of new drugs and personalized therapies for different individuals with diverse genetic background.

Nutrigenetics and nutrigenomics are other promising multidisciplinary fields that focus on studying the interactions among nutritional factors, genetic factors and health outcomes. These two fields have tremendous potential to change the future of dietary guidelines and personal recommendations based on the individual's genetic make up.



## Transgenic Technology

Transgenic technology has provided unthinkable opportunities for investigators to study the mechanisms of human diseases and also an alternative way to produce therapeutic proteins to treat heart diseases. The technology by targeting the gene expression to a specific part of the cardiovascular system, allows either the over expression or the suppression of a gene, altering the corresponding cardiac or vascular function. During the last decade, transgenic and gene-targeted mouse technologies have provided invaluable insights into the molecular basis of cardiovascular diseases. Various transgenic models with altered phenotypes such as cardiac hypertrophy, cardiac failure, myocardial dysfunction and hypertension are available today in mice, rats and rabbits. These models provide insights into respective modeled human cardiovascular diseases and risk factor susceptibility. They are also useful to systematically dissect the multifaceted complexities apparent in human cardiovascular diseases. Given the recapitulation of many features of human cardiovascular disease, these transgenic animal models can contribute significantly to the understanding of human cardiovascular pathophysiology.

## Bioengineering

Interventional cardiology has evolved faster than any other type of treatment in the field of cardiovascular diseases. Ongoing research on the use of drug eluting stents, catheter based bypass graft therapeutic angiogenesis and myogenesis, and the catheter based devices to detect the plaque vulnerability and composition (lipid-rich atheromatous core, thin fibrous cap, and expansive vessel remodeling) may

monitoring and risk stratification of cardiovascular diseases. Recent studies have yielded substantial amount of proteomics data in atherosclerosis, which may serve as a pragmatic source of new biologic markers of the disease. Proteomics may enable us to identify, by differential analysis, protein alterations associated with the onset of heart disease and its progression, outcome, and response to therapy.

## Genetics

Recent advances in genotyping technology and new approaches to examining gene and protein function have provided the means to unravel the genetic basis of CVDs. In humans, genome-wide scans have resulted in the identification of several chromosomal loci that are linked to various heart diseases. High-throughput genotyping methods are further facilitating the detection and analysis of single-nucleotide polymorphisms within these genes. Over the last few years, substantial progress has been made in defining the molecular basis of several genetically transmitted non-atherosclerotic CVDs such as hypertrophic and dilated cardiomyopathies, long-QT syndrome and essential hypertension. An understanding of the cardiovascular

“Recent studies have yielded substantial amount of proteomics data in atherosclerosis, which may serve as a pragmatic source of new biologic markers of the disease”



## Prospects of Biotechnology in Cardiology

result in additional diagnostic and therapeutic options for patients with coronary artery disease. Other cardiac interventions such as ischemic pre-conditioning in which reperfusion is interrupted with brief coronary occlusions and reperfusion sequences are also gaining ground and are likely to be feasible as a clinical application to patients undergoing percutaneous coronary intervention for acute myocardial infarction.

### Nuclear Cardiology

Advances in the cellular and molecular biology of the cardiovascular system have helped to usher in a new modality in nuclear cardiology, namely, molecular imaging. Molecular imaging defined as in vivo characterization and measurement of biological processes (apoptosis, myocarditis, ischemia etc.) at the cellular and molecular level has originated with targeted nuclear imaging during the last two decades. Molecular imaging is an extremely powerful technique with a great potential to evaluate functional and physiological effects non-invasively, repeatedly, and quantitatively in an intact, living whole-body system. The range of possible applications of non-invasive molecular imaging techniques for definition of new biological processes and pathways has expanded tremendously, with the advent of both novel instrumentation and new targeted radiolabeled probes. The future may rest on development of targeted biological markers of physiological processes (i.e. VEGF receptors, integrins, etc.) and reporter gene technique to evaluate cardiac gene therapy.

Specific research areas that can be expected to benefit enormously include study of acute or chronic inflammatory processes, genetic expression of congenital cardiovascular malformations, and molecular and genetic processes associated with atherosclerotic plaque formation.

### Gene therapy

The past decade has been a period of high expectations for cardiovascular gene transfer. Progress in gene therapy is dependent on the understanding of the molecular basis of different cardiovascular diseases as well as on the development of efficient tools allowing delivery of therapeutic nucleic acid. The development of animal models for human cardiovascular diseases has been instrumental and rewarding in defining the biological efficacy of gene therapy approaches. Several genes have been confirmed to have therapeutic effects in CVD. Among them HO-1, VEGF, eNOS and iNOS emerge as important therapeutic molecules. Initial, clinical experiments of gene transfer of vascular endothelial

growth factor (VEGF) have revealed improved vascularization in patients with critical leg ischemia obviating the need for amputation. Nevertheless, significant technical hurdles remain for clinical translation of cardiovascular gene therapy. The rapid development of cloning procedures, transgenic technology, and efficient transfection protocols can expedite a lasting biological solution to many CVDs. Gene therapy is emerging as a strategy for treatment of restenosis after angioplasty, vascular by pass graft occlusion, certain types of cardiac arrhythmias and transplant coronary vasculopathy. The use of combinatorial gene therapy may be a rational way for CVDs, which have complex etiology and multifactorial pathogenesis.

### Cell therapy

Cell therapy for cardiac repair, one of the most exciting and promising developments in cardiovascular medicine is currently gaining a growing interest as a potential new means of improving the prognosis of patients with cardiac failure. The basic assumption is that left ventricular dysfunction is largely due to the loss of a critical number of cardiomyocytes and that it can be partly reversed by implantation of new contractile cells into the post infarction scars. Fetal myocytes, bone marrow cells and skeletal myocytes have all been transplanted into the hearts of animal models. Primarily for practical reasons, autologous skeletal myoblasts have been the first to undergo clinical trials, but the results have not been encouraging. Bone marrow stem cells such as endothelial progenitor cells are also generating a great deal of interest, particularly in patients with acute myocardial infarction, and are currently undergoing extensive clinical testing. However, critical issues, such as types of cells, ideal number of cells, route of delivery, timing and targets of delivery, still remain to be optimized to maximize the benefits of the cell therapy in vivo.

The recent development of molecular imaging techniques as discussed earlier offers great potential to address some of these issues by non invasively tracking the fate of the transplanted cells. Integration of cell imaging into studies of cardiac cell therapy holds great promise to facilitate further growth of the field towards a broadly clinically useful application. These innovations hold promise for treating or preventing end-stage organ failure. Cell therapy and tissue engineering of viable grafts with the potential to grow and remodel could provide prospective new solutions to the serious problems of organ donor shortage. Combining stem

*(Continued on page 13)*

“Advances in the cellular and molecular biology of the cardiovascular system have helped to usher in a new modality in nuclear cardiology, namely, molecular imaging”

# Central Food Technological Research Institute

Cheluvamba Mansion, Mysore-570 020, <http://www.cftri.com/>



## Profile

Food security is paramount to any nation that seeks to have its own place in the global order. Enhancing food production was identified by India as top most priority at the time of independence. Soon it also became clear that in addition to enhancing food production it is also important to enhance the level of food processing technology in the country to achieve national goals of eradicating hunger and ensuring nutrition to our citizens. This led to the setting up of the Central Food Technology Research Institute (CFTRI) in 1950, just three years after independence.

The vision that drives the team at CFTRI has three major components: a) To be a model organisation for Scientific and Industrial Research and a path-setter in the shifting paradigm of self-financing Research and Development; b) To be a global Research and Development platform providing competitive Research and Development and excellent quality science based technical services in the area of Food Science and Technology and c) To be a vital source of Science & Technology for National Societal Missions for combining technology with a human face.

Over the last five decades, CFTRI has established itself as one of the largest R&D institutions devoted to Food Science & Technology in the country. An autonomous institution under the aegis of Council of Scientific & Industrial Research (CSIR), Govt. of India, CFTRI is affiliated to the United Nations University, Tokyo. The institute that also now has an ISO 9001:2000 and ISO 14001:2004 certification under its belt also accredited to NABL, Department of Science



*Fruit and Vegetable based products from CFTRI*

& Technology for chemical and biological testing.

Having established itself in the league premier institutions of the country CFTRI's efforts have centered around food

biotechnology, protein chemistry, nutraceuticals, traditional foods, food safety, food microbiology, biosensors, food engineering, food testing and analysis. The institute also has solid strengths in areas like food standards, cereal processing, baked products, fruit and vegetable processing, food packaging, food preservation, nutrition, bioactive molecule, food additives including spices and flavours. To



*Training session in progress in the International School of Milling Technology*

make sure that its efforts translate into real time activities on the ground CFTRI also has a full-fledged technology transfer and IP management departments facilitating industry-institute interactions. The IP portfolio at CFTRI has crossed 1000 marks with patents filed in both Indian and countries abroad. Over 400 processes and 2000 licensees within the country is an indicator of its capability and market presence in the country.

The dedicated core of scientists resident at CFTRI has been publishing over 100 research papers on an average annually in leading national and international journals. This generation of knowledge also enables the institute also undertake consultancy, sponsored and grant-in-aid projects from industries and government agencies.

The human talent at CFTRI is complimented by unique technological infrastructure that includes Nodal codex Food Analysis Laboratory, sophisticated central instruments facility, Genetically Modified Food Referral Facility and National Information Centre for Food Science.

The efforts from CFTRI which have made a strong impact in the food processing sector include processing tools like Mini Dhal Mill; Automatic Dosa, Idli and Chapati making machines, Dry maize milling plant, sugarcane de-skinning

“The IP portfolio at CFTRI has crossed 1000 marks with patents of both Indian and abroad countries. Over 400 processes and 2000 licensees within the country is an indicator of its capability and market presence in the country”





# Central Food Technological Research Institute

## Profile

“**T**hough more than 50 years old, CFTRI has a long journey that lies ahead. This is courtesy the burgeoning population coupled with fast changing socio-economic scenario of the country that has a direct impact on food habits and food processing needs.”

machine and pesticide detecting biosensors. In addition to food processing hardware mentioned above, CFTRI also has had considerable success in developing ready to market products. These include Amul (an infant food formulation using buffalo milk), Spirulina, natural colourants, high protein biscuits, spice oils, high protein hydrolysates, dehydrated coconut milk powder, malted weaning food supplements etc.

Capacity building has been identified by CFTRI as a factor critical to quality and success of its efforts. The institute has also been conducting a Masters degree in Food Science & Technology program affiliated to University of Mysore since 1965. The certificate course in Milling Technology for the benefit of Roller Flour Milling Industry is an industry-sponsored program benefiting the milling industry to a large extent. Apart from these regular programs, short-term courses for personnel from industry, R&D departments and government bodies are also conducted throughout the year. CFTRI has been a centre of excellence for doctoral and post-doctoral studies. Researchers from SAARC, ASEAN and African countries also carry out short-term and long-term projects under UN University programs.

In addition to offering formal courses, CFTRI also brings a clear focus on capacity building in the area of nutrition and food safety for the benefit of domestic export-oriented industries in the area of agro-food processing and networking with tiny and medium enterprises to reach out to the rural and tribal areas.

CFTRI has strived to be an active partner in executing various societal projects through the participation of government and voluntary agencies. Notable in this context are an integrated pilotscale fruit processing plant at Imphal, Manipur and a food processing pilot plant at Kanpur. Set up in association with Department of Scientific and Industrial Research, Department of Science and Technology, Govt. of India these demonstration units are of great demonstrational benefit to potential entrepreneurs interested in investing in

food-processing businesses.

A conscious effort at CFTRI has been to develop active linkages with other agencies and institutions in India and abroad that have a complimenting stake in food processing

sector. In addition to various ministries under Central and State Governments and other National Laboratories for pursuing topics of mutual interest, CFTRI has also reached out to cutting edge institutions in other countries and made its presence globally through its extensive networking in the frontier areas of food biotechnology



CFTRI developed Dosa making machine

with Indo-Swiss, Indo-Norway, IAEA (Vienna) and ACIAR (Australia) to name a few.

Though more than 50 years old, CFTRI has a long journey that lies ahead. This is courtesy the burgeoning population coupled with fast changing socio-economic scenario of the country that has a direct impact on food habits and food processing needs. The ongoing work at CFTRI aims to bring out a number of nutraceuticals with health beneficial bio-actives and phytochemicals from spices and plant sources including tea, mushrooms and underutilized cereals. Efforts are also underway in the area of pre- and probiotic cultures, bio-transformation for health oils, purification and characterization of peptides derived from oilseeds and dairy sources, and natural colours. Other areas of exploration are nutritive bakery products, ready-to-eat thermally processed traditional food formulations, automated and eco-friendly processes for traditional food processing.

The future plan of the institute is focussed towards ensuring food security and food safety of India's population that is expected to surpass that of China in a few decades from now. Value-addition to agro-bioresources for sustainable development is important in this context. This includes preservation of age-old traditions of traditional foods, automation in food manufacturing sector, byproducts utilisation, eco-friendly technologies, bioprocessing, nutrition and health foods. ■

# Creating a new flutter

## The Butterfly Park

Dr. Chandra Shekara Krishnappa, Associate Professor, Dept. of Entomology, University of Agricultural Sciences, Bangalore  
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One of the most influential scientific ideas to emerge towards the end of the 20th century was the need for conserving the rich tapestry of life or the 'biodiversity' on this planet. The motivation for conservation action was strongly influenced by the potential of biodiversity to contribute to human welfare. The discovery of several drugs from plants and animals strengthened the case for conservation. The isolation of the anti-cancer drug, Taxol from Pacific Yew tree, antibiotics like the 'magainin' from African frogs, anti-cancer drug from deep sea sponge, and a pain killer from the venom of a tropical snail, fuelled intensive 'bio-prospecting' or search for drugs and other metabolites.

A spurt of these discoveries clearly points to our poor appreciation of the 'value' of biodiversity, and the irony- a large part of biodiversity is being destroyed even before we realize our ignorance. A critical appraisal of the state-of-art in bioresource utilization and conservation in the country carried out by the National Bioresource Development Board (NBDB) identified insects as the next most important bioresource, after plants that had the potential to yield valuable dyes, enzymes, proteins, pain-killers and even drugs, and of course serve as food! This prompted an action plan for exploration, sustainable utilization, and conservation of insect resources, which constitute more than 70 per cent of all known organisms. Understandably, educational activities highlighting the importance of insects as bioresources were a major part of the plan and this triggered the whole idea of establishing a Butterfly Park to promote a greater appreciation for insects among the public. The prompt

expression of interest by the Government of Karnataka helped to create in Bangalore what is today a unique facility to enjoy, study and conserve the most colourful of all creatures, the butterfly.

### Driving dreams to reality

Based on a feasibility study conducted by University of Agricultural Sciences, Bangalore (UAS-B) the search for the site ended at the Bannerghatta Biological Park near Bangalore considering its potential for eco-tourism, ideal ecological conditions throughout the year, proximity to a national park and the logistical support of Zoo Authority of Karnataka (ZAK). With the task of selecting the site out of their way, the team of scientists from UAS-B and Zoo Authority of Karnataka (ZAK) got down to working out the details of the technical proposal while the Ashoka Trust for

Research in Ecology and the Environment (ATREE) took charge of the outlining the education and training component of the proposed butterfly park. The effort yielded result when NBDB committed itself to provide support of Rs. 3.8 Crores to turn this dream into a reality. Construction of the park began in March 2004 and completed in May 2005.

The garden which is now functional, has following broad objectives to pursue; a) to enhance our understanding of some of the key research issues related to butterflies as the "flagship" insect species; b) offer insights into the basic biology, life history and conservation needs of butterflies to students and scientists; c) to utilize butterflies as a model system for environmental education and



A view of the landscaped garden in the butterfly conservatory



A cascading waterfall that creates a cool environment for the butterflies to rest during the warmer hours.



### Kaleidoscope

"One of the most influential scientific ideas to emerge towards the end of the 20th century was the need for conserving the rich tapestry of life the 'biodiversity' on this planet"



"A large part of biodiversity is being destroyed even before we realize our ignorance"



## Creating a new flutter The Butterfly Park

### Kaleidoscope



“With its host plant garden spread over 10 acres Butterfly Park at Banerghatta is the first in the country with a comprehensive array of a garden, a conservatory, a museum, a research lab and an educational centre”



conservation; d) to explore the role of conservation activities in enhancing livelihood of rural communities and e) help in the conservation of a few endangered species of butterflies.

Spread over an area of 7.5 acres and comprising of a butterfly garden, a butterfly conservatory, a museum with a multi-media training centre and a curio shop the park is one of its kind in the country. The plan included a 'butterfly trail' over a five acre garden that would lead to an innovatively designed three-domed structure housing the conservatory, museum and the multi-media centre. The first of these, with a

butterflies, their growth, development, reproduction, and their evolution.

There are many butterfly parks in the world, each with its own appeal and reach. The Butterfly Park at Banerghatta is however unique in many ways. With its host plant garden spread over 10 acres, Butterfly Park at Banerghatta is the first in the country with a comprehensive array of a garden, a conservatory, a museum, a research lab and an educational centre. It also has a distinction of being country's largest landscaped garden under a polycarbonate roof besides the fact that of being the only butterfly park in the country with a



*The museum dioramas depicting the story of butterflies.*

transparent polycarbonate roof, was designed as the 'butterfly conservatory' with a landscaped garden. The huge dome shaped structure with 10,500 sq feet of landscaped garden would provide all possible habitat requirements including host plants and house butterflies throughout the year. The conservatory leads into a museum that will provide information on through dioramas depicting various facets of the life of butterflies and computer kiosks.

The 10500 sq feet conservatory at the butterfly park boasts of different microhabitats, a waterfall and a brook complementing the largest landscaped garden under a roof in the country. The captive breeding unit of the park raised more than 41,000 butterflies of 18 species between 2004 and 2006 to standardize the rearing methods that were later released in the butterfly conservatory for trial runs to check out the habitat conditions for butterflies. Museum and a multimedia centre at the park includes graphics, dioramas, live exhibits, butterflies

captive breeding programme for all butterflies on display.

The design of the park also keeps the energy and water efficiency in sharp focus. electricity is not used for either heating or cooling the butterfly enclosure and rearing units. Rainwater harvesting implemented on the entire park area. Solar power has been harnessed for providing backup power and external lighting. Rainwater harvesting engineering has been applied across the entire park area.

The Butterfly Park will not merely exhibit butterflies for curious tourists seeking novelty but serve as a hub to actively promote environmental education, research and even explore ways of utilizing butterflies resources for enhancing rural livelihoods. Butterfly Park at Banerghatta is not only a new jewel in crown of Bangalore, it perhaps is the first of its kind in the world that integrates tourism, education, research and rural livelihood options under one roof. ■



# Prospects of Biotechnology in Cardiology...

(Continued from page 8)

cell therapy with gene therapy is also likely to increase therapeutic options for the future.

## The Indian perspective

Disturbingly, developments in molecular cardiology elsewhere in the world have not had its impact in our country to an appreciable extent. Various reasons have contributed to the delay in the application of molecular biology techniques in cardiology in India. Two important reasons are (i) the lack of trained personnel who understand physiological, pharmacological and pathological aspects of cardiovascular diseases and are also skilled in molecular biological techniques and tools for genetic studies and (ii) the absence of a center where people can get trained in the discipline of molecular cardiology. Thirdly, even for individual scientists or clinical cardiologists who would desire to seek help in employing molecular biology techniques in investigating cardiovascular problems (including tools of molecular epidemiology) or explore new ideas in targeting molecular processes that are causal to disease states or apply recombinant DNA techniques to develop drugs or try gene transfer, there are no centers exclusively having expertise in these areas, which would provide help to them. This is in contrast to disciplines like infectious diseases, neurological sciences and cancer biology. The necessity for an initiative to evolve a multi-institutional program in cardiovascular biotechnology is obvious given the high prevalence and predicted increase in incidence of cardiovascular diseases in our country.

## Conclusion

The impact of advances in biotechnology in cardiology today is truly astounding. Molecular cardiology though in its infancy, today, is set on the right track. With cautious and prudent integration of the data generated by genetics, genomics and proteomics, cardiology is anticipated to take extraordinary strides, saving the lives of scores of patients afflicted with cardiovascular ailments. With handy information on arrays of genes, proteins, and metabolites, a personalized cardiovascular medicine for individual patients is envisaged within the next decade, as based on specific risk assessment and expected response to therapy. Nano technology based tiny "tools" for effective disease diagnosis as well as improved drug delivery, and cell replacement and gene therapy could be witnessed in the near future. The molecular imaging techniques might be routinely used to assess outcomes of clinical trials or in diagnosis, prognostication, and evaluation of therapeutic interventions. But for all this to be achieved, much greater attention must be given to the translation of the research outcomes into medical practice. The best way to ensure that research findings do not remain locked in the laboratory walls, is to frame a staunch and congenial interface, where research personnel, biotech entrepreneurs and cardiovascular clinicians could join hands to endeavor together towards a common dream. Given the projected increase in morbidity and mortality from cardiovascular disease in India during the next decade, biotech companies can view at multi-crore markets in cardiology in the near future. ■



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## Smallpox to Stem Cells ...

(Continued from page 5)

Bone marrow of a heart patient and inject them into the patient's heart area during surgery for a myocardial infarct, generate heart muscle cells and heal the patient. Based on encouraging results obtained in a trial using forty patients, a controlled multi-centre trial is currently on for the cardiomyocyte therapy of MI patients using autologous (same body source), bone marrow derived MSCs.

Successful use of bone marrow derived hematopoietic stem cells in treating severely anaemic patients has been going on for some time in India, well before the current excitement on stem cells. Here, the so-obtained hematopoietic cells are expanded in the laboratory to the desired numbers and administered to the patient. There has also been a report of the use of such autologous hematopoietic stem cells to treat rats suffering from retinal degeneration in their eyes. Administration of these cells intra-vitrially into the animal has been reported to have generated the desired blood vessel formation. No human experiments have yet been conducted in this connection.

When in 1998 it was reported that the limbus of the eye (the ring-like area surrounding the cornea, abutting the conjunctiva) harbours ASCs, an ophthalmologist harvested them, cultured them to generate the corneal epithelia and transplanted them on a few patients whose corneas were damaged due to chemical or fire burns. Significant restoration of vision was reported. Encouraged by this proof-of-principle, we at our institute initiated this therapy on needy patients in 2001 with success. To date, this limbal stem cell based therapy has restored eye sight in significant measure to over three hundred patients at our centre. Currently, this therapeutic

measure is being followed in a few other ophthalmic centres in India.

When disease affects one person the doctor fights to win over it and cure the sick person. When disease affects a large number, the fight turns into a battle or even a war. Family doctors engage in fights while public health people engage in wars. The family doctor is concerned with incidence while the public health people are concerned with prevalence. Scale matters here and thus information becomes vital. The branch of science that provides such information is Epidemiology. It gives us data on how many are affected, where all in a given area is the illness prevalent, what appear to be the factors associated with the prevalent illness, and so on. It was information of this kind that helped India roll back childhood blindness, cataract of the eye lens, goitre, and more recently polio. Epidemiology also told us which geographical location in India is polio still prevalent in. Information of this kind is vital to fight a war and win it. Sadly, the field of epidemiology has become weak in India over the last decade or two, at a time when translational medicine is ascendant. We need to correct this weakness and fast.

Epidemiology is an informational science, one that helps us in the war against diseases prevalent. Information is a weapon; to be informed is to be armed. To be armed is to be enabled in the battle against the enemy. India has successfully fought and conquered smallpox. It is close to winning over leprosy, polio and goitre. In order that we win other prevalent and emerging diseases, we need translational medicine and public health. The record so far is encouraging and gives us hope and confidence for the future. ■

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# Call for Proposals

## Integrated Masters & Doctorate Program in Nutritional Science or Food Science and Technology

The Department of Biotechnology invites Letters of Intent/ preliminary concept proposals from institutions interested in initiating a planning process leading to the introduction of an Integrated Masters and Doctorate programme in (i) Nutritional Sciences or ii) Food Science & technology and for making this possible, to establish a department or centre either by creation of a new facility or by restructuring or expanding an existing department or centre. Preference would be given to universities; agriculture/medical technology institutions with sound scientific background and track record as evidenced by recent publication lists. Interested institutions may submit Letters of Intent for initiation of Nutritional Sciences or Food Science & Technology departments or both.

The specific goal is to establish above departments/centers with well-developed academic and research programmes through flexible support so as to: (i) produce adequate human resource in this area; (ii) expand scientist density and develop faculty research capability; (iii) enhance research infrastructure and (iv) pursue practical but ambitious research goals through short and long term program based funding

Last date of submission January 1st, 2007.

For more details, visit: <http://www.dbtindia.nic.in>

## Joint Proposals Under Indo-Finnish Collaboration in Biotechnology

The Department of Biotechnology (DBT), Government of India and Research Council for Biosciences and Environment (RCBE), Academy of Finland solicit proposals under the INDO-FINNISH collaboration in Biotechnology.

The call aims at promoting the cooperation in the fields in which strong international plant science capability exists in both countries, and improving the technological knowledge in the recently established area of the system biology. These key areas in plant (including trees) and crop biotechnology research recognised by DBT and RCBE are:

- 1) Improving the capability of plants to stand stress, concentrating on biotic and abiotic stress

- 2) Collaboration in the methodology, especially in genomic, proteomic and transformation techniques.

The decision on the projects to be funded will be jointly made by DBT and Academy of Finland. Each partner will receive funding from the financing organisation of its own country. The funding period is three years. A mid-term follow-up will be organised to review progress and explore areas of future cooperation. The joint applications submitted should include researchers/research groups from both countries.

Last date of submission January 31, 2006.

For more details, visit: <http://www.dbtindia.nic.in>

## Centres for Bioprospecting

National Bioresource Development Board invites proposals for setting up Center(s) for Bioprospecting which would be responsible for screening, characterisation, and functional validation of novel bioprospected genes, molecules, etc. Leads generated from ongoing projects should form the basis for study and activities related to scale-up, application and product development should be linked with industrial partners. Any laboratory from public sector institute, universities, government funded national institutes, non-profit organisations having demonstrated expertise in bioprospecting can apply.

Last date of submission December 31, 2006.

For more details, visit: <http://www.dbtindia.gov.in>

## Bio-Energy and Bio-Fuels

DBT invites proposals in the following identified priority areas in the BioEnergy and Bio-Fuels:

1. R&D for improvement of Jatropha
2. Bio-ethanol production from cellulosic biomass

Scientists working in Universities/Research Institutions/NGO's and industries and holding a permanent position as well as having experience in the area with sufficient leads under ongoing research activities can apply.

Last date of submission December 31, 2006.

For more details, about program priorities and to download application format please visit: <http://www.dbtindia.gov.in>

# Forthcoming Events

1) Regional Workshop on Principles of Biosafety Research for the Release of Genetically Engineered Crops", Venue: Khartoum, Sudan: Eisa Ibrahim El Gaali, Feb. 4-9, 2007, Ministry of Science and Technology, Khartoum, Sudan, E-mail: [elgaali@hotmail.com](mailto:elgaali@hotmail.com)

2) Workshop on "Biomedical Applications of High Energy Ion Beams", Venue: Trieste, Italy: Claudio Tuniz, Feb. 12-16, 2007, ICTP, Trieste, Italy, E-mail: [ctuniz@ictp.it](mailto:ctuniz@ictp.it)

3) First Annual Meeting of SCRFI and International Conference in Stem Cell Research, Venue: Hotel Royal Orchid, Airport Road, Bangalore 29 Jan.-1 Feb., 2007, Deptt. of Biotechnology of Govt. of India, E-mail: [info@scfri.org](mailto:info@scfri.org), Web: [www.scfri.org](http://www.scfri.org)



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