

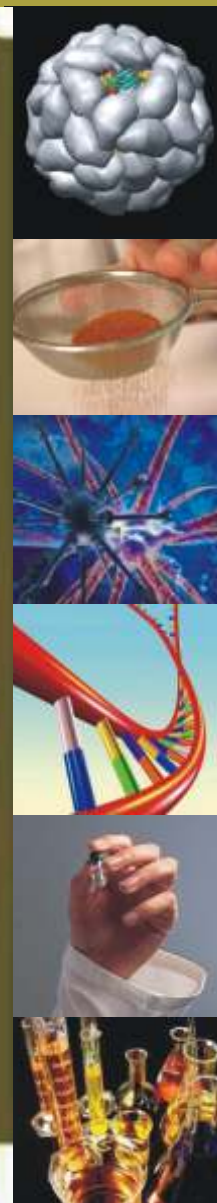
Biotech

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NEWS

Newsletter of the Department of
Biotechnology, Government of India

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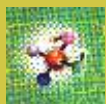


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Department of Biotechnology,
Ministry of Science and Technology,
Government of India



Reader's mail

Response

In times when the number of talented youngsters taking up science as a career is going down, biotechnology has emerged as a good bait for the promise it holds for a competitive, remunerative and satisfying profession. Biotechnology, as is envisioned, has potential to establish the image of the country as a global leader besides benefiting the civil society in many ways than can be discussed. The timely initiative of the DBT to have a mouthpiece in the form of Biotech News is a welcome step that will effectively network and empower the community of scientists, teachers, industrialists and rural beneficiaries to facilitate exchange of information and ideas. The newsletter has several up-to-date and indispensable sections. I would also recommend a 'forum' for the undergraduate students and rural societies to appraise the potential of biotechnology. The outreach of the newsletter to the scientists of the future is imperative. I would wish that every high school in the country gets a copy of this newsletter.

Dr. U. S. Agarwal , Reader, North-Eastern Hill University, Shillong-793 022

Biotechnology with its attendant instrumentalities is capable of providing appropriate tools for the sustainable development and utilization of natural resource base including forests. Sustainability of our forests in 21st century, will to a great extent depend upon the way we manage the Non-Timber Forest Products (NTFP). NTFPs constitute a critical lifeline to poor forest dwellers by providing sustenance and livelihoods. Due to recurrent availability, strong connections with socio-cultural milieu and industrial development potential that they behold, biotechnology can multiply the benefits/ commercial value associated with NTFPs. This will directly contribute to food, health and income security of the poorest of poor sections of our society. Interventions like marker assisted selection and DNA fingerprinting for improved genotypes, enhancing shelf life of harvested products and improved processing technologies are just a few examples of what Biotechnology can do in this context. One cannot however ignore the perceptions about risks associated. There is thus an urgent need to develop a code of conduct for maximizing the benefits and biosafety, and minimizing the risks involved. With suitable standards and guidelines and in conjunction with other components of the value chain, biotechnology can play a major role in meeting the ever increasing needs of an expanding population.

I congratulate Department of Biotechnology for its initiative to bring out Biotech News in its new format and frequency. I hope the newsletter continues to address the needs of the non-specialist audience, especially young students.

Dr. R C Sharma, IFS (Retd.), Former PCCF, Government of Chhattisgarh, Chunabhatti, Kolar Road, Bhopal. ■

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 two 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. From the next issue onwards, we will set aside space under 'Mail Box' to interact with our readers.

In order to ensure timely publication and distribution to readers, the responsibility of publication of Biotech News has been entrusted to the Ashoka Trust for Research in Ecology and the Environment (ATREE), a reputed research institution established in 1996 with head quarters at Bangalore and regional centres at Delhi and Kalimpong.

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.

S. Natesh
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Agricultural Biotechnology

Knocking off the yield barriers

K. K. Narayanan, Managing Director, Meta Helix Life Sciences & President, Association of Biotech-Led Enterprises (ABLE),
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Agriculture is the backbone of India's economy. Almost two-thirds of all employed people in this country are engaged in agriculture and related activities. Primary food production contributes to more than a fifth of our GDP and also to a sizeable portion of our exports. The past years show that any change in agricultural growth has a disproportionately higher impact on the growth of our economy. It is now therefore, widely acknowledged that a sharper focus on agricultural growth is the key to ensuring the higher overall growth rates needed to make India catch up with the developed countries of the world.

The trajectory of the growth of our economy, post independence, has been highly skewed away from rural development. This trend needs a correction to provide higher levels of gainful employment to the rural people. Improving the productivity of Indian agriculture will be crucial in boosting the rural economy of this country. Continued growth and development of our economy, and providing equal opportunities to all the citizens to benefit from economic and industrial development is going to be the key to ensuring our future security.

India has a large and diverse arable area. We have the largest acreages under many of the important crops. However, in spite of the impressive gains made during the green revolution years, the per unit area productivity level of most of these crops ranks amongst the lowest in the world. During the decades of the 70s and 80s, the productivity of our staple cereals grew by over three percent every year. This was largely due to the introduction of High Yielding Varieties (HYVs) of rice and wheat. It appears that the easy gains of the HYV technology have already been reaped.

History is a witness to the fact that infusion of new technologies has often resulted in dramatic increases in productivity of prominent agricultural crops. The science of genetics, and its application for crop improvement, is probably the single most important factor that helped us to belie the Malthusian predictions of hunger, famine and the consequent anarchy in many parts of the developing world. One should therefore, seriously consider technological options to overcome the post HYV yield barriers in agricultural production. In this context agricultural biotechnology stands

out as a very potent option, available today to us. One of the major contributions of agricultural biotechnology is the development of genetically altered crop varieties improved for various agronomic traits that lead to improved productivity and quality.

Genetically altered crop varieties came into large-scale cultivation in 1995-96 after more than a decade of careful testing for safety to humans and their habitat. From a little less than two million ha. in the first year of commercialization to almost 100 million ha. last year is a growth unprecedented for



any technology that agriculture has seen till date. This growth in acreage of genetically altered crops is ample testimony to the benefits it can confer. Insect-pest tolerance, herbicide tolerance and improved nutritional attributes are some of the desirable traits in the genetically altered crops that are in cultivation today. There have been many credible reports of decreased usage of harmful pesticides and herbicides as a consequence of the cultivation of pest tolerant and herbicide tolerant genetically altered crops. Some of the nutritionally enhanced crops, notably the β -carotene enriched rice and iron fortified rice, are of particular significance to an over populated country like ours, where malnutrition and under-nutrition are serious problems.

In 2002, India took a significant step towards the adoption of biotechnology as tool to boost agricultural productivity. of all



Feature

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Knocking off the yield barriers

Feature

Genetically altered cotton varieties, which carry the insecticidal protein gene from the soil bacterium, *Bacillus thuringiensis*, were approved for commercial cultivation. Since then the acreage under Bt cotton has grown rapidly to over three million acres in 2005 (Table 1). Between 2004 and 2005, the growth in India has been almost 160 percent, the fastest compared to any other part of the world!. In 2006, there are indications that more than 70 percent of all the hybrid cotton area in the country is covered by Bt-cotton. This growth in acreage is indicative of the real benefits that such a technology brings to the cotton farmer.

An important feature of agricultural biotechnology is that the improved traits are inherent in the seed, the primary input for agriculture. For most crops, the seed is the cheapest of all inputs and genetically altered seeds do not call for any modification in the cultural practices that the farmers are used to. Further, the cost of seed is linearly proportional to the size of the holding. Therefore any value addition that happens through the seed, as is the case with agricultural biotechnology, would be scale neutral. This is of special significance to a country like ours, where agriculture is fragmented and the average holding is very small.

One of the criticisms of the currently grown genetically altered crops is that it offers benefits only to the growers and not to the consumers. This argument may appeal to the western world where less than five percent of the population produces food while the rest are consumers. It must be remembered that in India, more than two thirds of the population is involved in food production and obviously is also the major consumer. By making production more efficient, agricultural biotechnology can reduce prices and improve quality. This may not make a significant impact in the western world where less than ten percent of one's earning is spent on food. But in India, as in other developing countries, proportion of income spent on food being much higher, agri-biotech can make a significant impact on the quality of life of the common man. Further, the more recent products of agricultural biotechnology, like more nutritious and healthy foods, directly address nutrition issues of the direct consumer.

Responsible use of biotechnology in Indian agriculture is an imperative for our future food, livelihood and economic security. While we have taken a few tentative steps in this direction, there is still a long way to go. In my opinion, there are two key initiatives that need to be taken to promote responsible agricultural biotechnology in this country, in which the DBT has

to play its pivotal role. These are, one, promoting innovative research and two, regulatory reforms.

Promoting innovative research

The availability of scientific talent in the field of agri biotechnology, combined with the low cost of innovation can significantly reduce the cost of product development. It is notable that many of the multinational corporations are setting up their own research centers here, if they do not have one already, or are partnering with local institutions for research and development of agricultural biotechnology products, not just for India but for the global market as well. In the context of a big agrarian economy like ours, the really big and long-term value is in developing products tailored to the needs of our agricultural sector. In the short-term, there is a limited, but significant opportunity for agricultural biotechnology research outsourcing. However, for the realization of this potential in any substantial measure, the rules and regulations governing the exchange of plant parts and tissues, and export of research material including seeds, needs to be clearly laid out. Further, the responsibilities and jurisdictional limits of various agencies, like the National Bureau of Plant Genetic Resources (NBPGR) and the Plant Protection/Quarantine Authority, which are involved in this process, should be very clearly delineated.

Country	Increase in area of biotech crops* (%)
USA	4.6
Argentina	5.5
Brazil	88.0
Canada	7.4
China	-1.0
Paraguay	50.0
India	160.0
South Africa	0.0
Uruguay	0.0
Australia	50.0

Table 1. Growth of area under Biotech Crops. (2004- 05).
Source: Clive James, 2005

We have many public institutions that have the required competence to develop genetically altered crop varieties using all the modern tools that plant biology has to offer. Yet, only a few useful products have been successfully commercialized by these institutes over the years. One reason for low le

“Responsible use of biotechnology in Indian agriculture is an imperative for our future food, livelihood and economic security. While we have taken a few tentative steps in this direction, there is still a long way to go.”



Knocking off the yield barriers

commercial success is a lack of product focus that often leads to wasteful dissipation of limited resources. While it is important to enhance funding for research and capacity building, there also must be a parallel thrust to focus efforts on products, or solutions to specific agricultural problems. There should also be a thrust on networking and meaningful collaborations between the public and private institutions. Support for applied research projects should be based on “outcome-oriented” reviews based on clearly laid out, measurable milestones.

In recent years, the private sector has made significant investments into agricultural biotechnology research. Such investments are now beginning to bear fruits. However, resource constraints, and the high risk perception, especially in value capture for agricultural biotechnologies in this country, have made the private sector take a rather cautious approach towards research. Innovative ideas, which are usually attended by a high risk of failure are often not pursued. There must be more government support directly to the private sector to mitigate the risks associated with such research projects so that the capacity and experience of the private sector is leveraged appropriately for development of novel products in agriculture. Initiatives of DBT like the SBIRI are welcome steps in this direction.

A key driver of technological innovation is an appropriate Intellectual Property (IP) protection system. It is high time the Plant Variety Protection and the Farmer's Rights Act of 2002, is effectively enforced. There is also a need for clarity on whether genes and such transgenic technologies can be protected under the new patenting regime.

Regulatory reforms

The testing and approval process for commercialization of transgenic crops, though continuously improving, is still prone to unreasonable delays and uncertainties. This directly adds to product development costs while indirectly stifling competition. The involvement of multiple agencies and multi-tier committees often leads to unnecessary delays and duplication of efforts. An example of this is agronomic performance testing in Large Scale Trials (LST) as well as the Indian Council of Agricultural Research (ICAR) trials. It can be argued that the regulatory testing should be limited to assessing the bio-safety and efficacy of the transgenic product. With increasing choices, it should be left to the farmer's wisdom to choose the variety that best suits his/her growing conditions. It must also be mentioned that while the regulatory bodies should continue to rely on scientific committees made of members drawn from different institutions, there is an urgent need to fill the glaring competence gap within the organizations themselves.

The proposed National Biotechnology Regulatory Authority (NBRA) as envisaged in the National Biotechnology Development Strategy prepared by DBT could be a single window agency to clear the commercialization of transgenic crops. Further, the implementation of certain policy changes in the regulatory process like gene/event based approval instead of the present variety/hybrid based approval will go a long way in avoiding unnecessary costs and generally in hastening the dissemination of approved technologies. We are going in the right direction, but there is still a long way to go if we have to be globally competitive in agriculture. ■

On the lighter side



Most scientists regarded the new streamlined peer-review process as “quite an improvement “



Silkworm biotechnology Poised for a big leap

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Cutting Edge

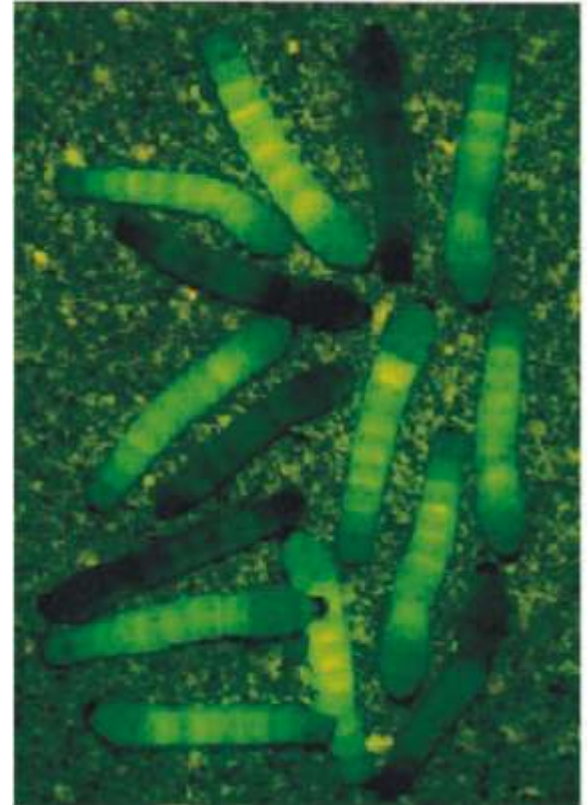
“Problems of diseases linked to quality of breeds, unhygienic conditions during rearing, low nutritive quality of leaf fed to silkworms, primitive silk technological conditions have kept sericulture in India economically unattractive.”

The silkworm (*Bombyx mori*), domesticated for silk production for about 5000 years, is the most studied lepidopteran model system because of its rich repertoire of well characterized mutations and its economic importance. The long history of silkworm rearing for commercial purpose rendered its genetics the subject of considerable research interest resulting in careful collection, cataloguing and maintenance of various silkworm genetic stocks/strains of scientific and economic interest. Today, opportunities for genetic manipulation and study of the silkworm include availability of more than 400 visible mutations, 3,000 diverse silkworm strains, high density molecular linkage map, 428 Mb whole genome sequence, 1,60,000 expressed sequence tags (ESTs), and a well established transgenic system, which provide much needed molecular genetic resource for solving a broad range of basic biological problems, to generate potential applications in enhancing economy of silk production, to establish an expression system of biological molecules of human and biomedical importance, and to evolve novel strategies to control agriculture pests. The article presents in a nutshell the prospects of harnessing silkworm biotechnology research.

Biotechnology research in Indian sericulture

India is an important and a major sericulture country in the tropics. It has occupied a place of pride in global sericulture map being the homeland of all the four varieties of natural silks: mulberry, tasar, eri and muga. Six million people in India alone are involved in sericulture, which is very labour intensive and provides a key to improve local quality of life. However, the problems of diseases linked to quality of breeds, unhygienic conditions during rearing, low nutritive quality of leaf fed to silkworms and primitive silk technological conditions have kept sericulture in India economically unattractive. During the last three decades, silk production has benefited significantly from the application of genetic principles in the silkworm breeding programmes. Recent developments in application of DNA markers for strain characterization, construction of high density linkage maps, and understanding the genetics of viral resistance provide requisite tools that can expedite further silkworm improvement. Applying methods of crop improvement, genes affecting growth rate, yield and fibre quality, can be tagged with molecular markers for rapid construction of genetically improved strains. With the gradual

addition of molecular markers on the genetic map and the establishment of longer contigs in the whole genome sequence, these genetic linkage groups will facilitate the estimation of the marker density needed for map-based cloning, the ordering of genomic contigs, and the



Transgenic silkworms positive for GFP. Transformed larvae are fluorescent, as compared with non-transformed controls
(Source: Tamura et al., 2000 Nat. Biotech. Vol 18)

establishment of a complete physical map. In the years ahead, there is a need to develop silkworm varieties with higher yield potential, more importantly with higher yield stability and quality, combining the traditional breeding and modern biotechnological approaches.

Biotechnological prospects of silkworm transgenesis

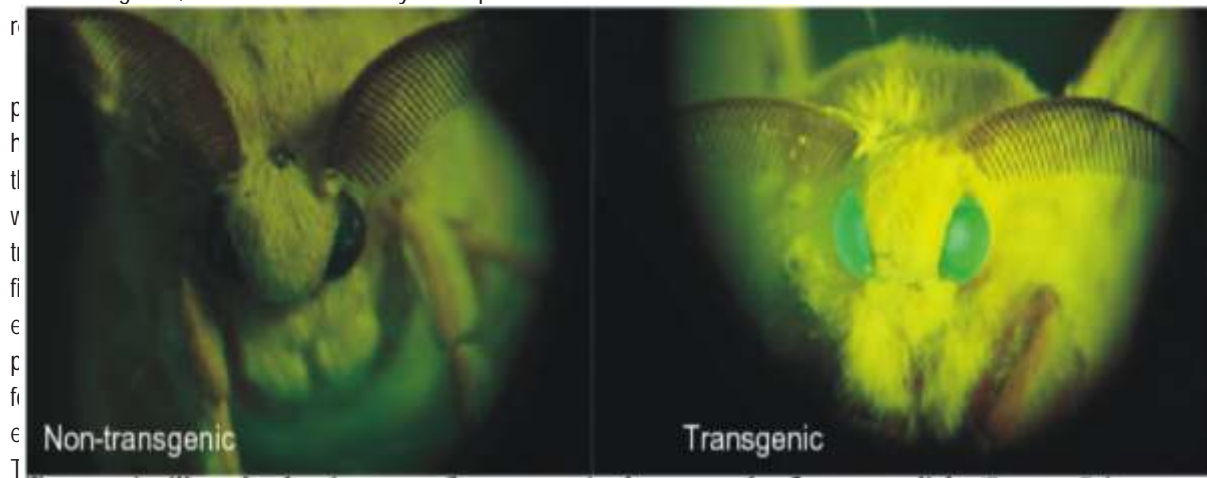
Attempts to generate transgenic silkworms started more than 10 years ago, but reaching the objective turned out to be an arduous task. Finally, the transposon piggyBac, which had been isolated from the moth *Trichoplusia ni* was found efficient for integrating the foreign genes into the silkworm genome. Transgenesis coupled with recently discovered techniques

Silkworm biotechnology: Poised for a big leap

like, RNA-interference (RNAi) and gene disruption can be efficiently used to elucidate the function of a gene. Efforts made to use these technologies in controlling diseases of silkworms are quite promising. Silkworm is infected by the most devastating virus *Bombyx mori* nucleopolyhedrovirus (BmNPV) resulting in >60% of the silkworm cocoon crop loss annually in India. Development of viral-resistant strains of the silkworm can substantially enhance economic benefits to farmers. By using transgenic silkworms that express double stranded RNA (dsRNA) which knockdown essential baculoviral genes, CDFD has successfully developed BmNPV

and thus manifests only in cocoons. These studies open up avenues for using transgenic silkworms for expression of biologically and pharmaceutically important proteins.

More exciting would be engineering silkworms by transforming with silk genes from wild silkworms such as muga and tasar, and also from spiders. The genes from these organisms may be put under silkworm fibroin promoter to express them only in silk glands and are exported normally like endogenous fibroin protein to produce 'Xenosilk', which has better qualities than natural silks.



fluorescent protein (DsRed) occurs in transgenic silkworms that carry transgenes with all the regulatory sequences of the fibrohexamerin gene in silk gland and DsRed. In such a transgenic silkworm, the recombinant protein could be recovered from the cocoon by simple and rapid soaking of the cocoon in aqueous solvent. In the transgenic silkworms, the recombinant protein expression is confined only to silk gland and thus manifests only in cocoons. These studies open up avenues for using transgenic silkworms for expression of biologically and pharmaceutically important proteins.

Transgenic silkworms expressing double strand RNA for essential baculoviral genes potentially transmit to humans since it is non-infectious to vertebrates and is confirmed safe. In addition, the proteinase inhibitors and biocapsule-like fat in silkworm bodies may increase stability of the recombinant proteins so that gastrointestinal degradation would not be a problem. Collectively these features make the silkworm an ideal expression and delivery package for producing oral vaccines. Several recombinant proteins, ranging from cytosolic enzymes to membrane-bound proteins, have been successfully produced in baculovirus-infected silkworm cells. However, there lies a major disadvantage in its truncated N-glycosylation pathway and inability to produce sialylated N-glycans. This is overcome by the development of engineered lepidopteran cell lines to mimic mammalian cell glycosylation of expressed proteins, baculovirus display strategies and the application of the virus as a mammalian-cell gene delivery vector. Novel vector design and cell engineering approaches will serve to further enhance the value of baculovirus technology.



“Development of viral-resistant strains of the silkworm can substantially enhance economic benefits to farmers. By using transgenic silkworms that express double stranded RNA (dsRNA) which knockdown essential baculoviral genes, CDFD has successfully developed BmNPV resistant silkworms.”



Silkworm biotechnology: Poised for a big leap

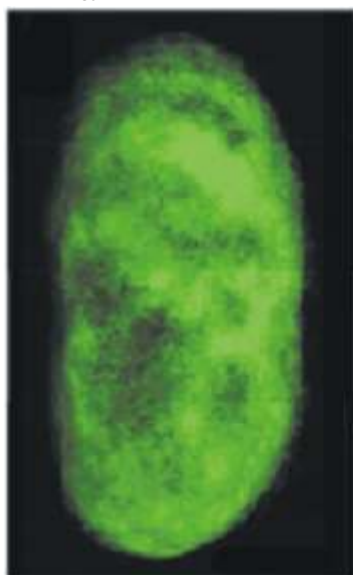
Cutting Edge

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Conclusions

The fruits of silkworm biotechnology are yet to be harvested. Development of viral resistant transgenic silkworms, availability of ubiquitously distributed markers and enormous genome sequence data, are likely to augment research activities focusing towards enhancing the economic value of silk production. Equally exciting is the potential application of the results of silkworm genomics research to other Lepidopterous insects, particularly heliothines and wild silkmoths, which represent the destructive and beneficial



Cocoon export of GFP
(Source: Tomita et al., 2002 Nat. Biotech. Vol 21)



DsRed fluorescent proteins.
(Source: Royer et al., 2005 Transgenic Res. Vol 14)

Silkworm biotechnology and Indian agriculture

It is estimated that one-third of the agriculture production is lost to insect pests, pathogens and weeds. Among these pests, Lepidoptera represent a diverse and important group. The control of agricultural pest populations is achieved mainly by the application of chemical pesticides. Genetic and genomic research repertoire of the silkworm can spin off genetic information as well as molecular biological tools to look for new targets for insecticides that are intrinsically selective and therefore potentially safer.

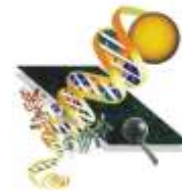
extremes of this large and diverse insect order. I have outlined only a few important silkworm biotechnological applications. There are many more. For example, sex-determining pathway genes are considered as important candidate genes in the context of lepidopteran pest management. The day would come when silkworm with six and odd silk genes having been knocked out and a transgene of our interest introduced under fibroin promoter to produce only recombinant protein in silk glands and subsequently secreted during spinning stage. Rearing houses would go for the lucrative production of different biomedical proteins. ■

Reach out to a broader constituency

Planning a meeting?!! Biotech News would be happy to publish news/announcements about forthcoming national / international seminars, symposia and conferences etc. on subjects related to biotechnology. Please send your emails detailing title of the event; date (s); venue; contact details etc. to: biotechnews@dbt.nic.in

Institute of Bioinformatics and Applied Biotechnology

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Profile

Established in year 2001 by the Government of Karnataka and the ICICI Bank Institute of Bioinformatics and Applied Biotechnology (IBAB) is one of the promising institutes of the country in the field of higher education in the broad area of life sciences and related disciplines. Being the first public-private partnership in the area of post-graduate life science education in India, IBAB is a unique institutional experiment that seems to be going strong right from the beginning.

Operating out of the attractively landscaped surroundings of the International Tech Park at Whitefield, Bangalore, the institute's current premises are spread over an area of 15,000 sq. ft. However, and given the fact that IBAB's requirements in this context are growing at a fast pace, the Government of Karnataka has already commenced the construction of IBAB's new and exclusive premises on a sprawling 7 acre plot within the prestigious Bangalore Biotech Park.

The mission of IBAB is to catalyze the growth of the biotech industry. IBAB strives to emerge as a globally recognized institution for R&D and higher learning in the field of bioinformatics and biotechnology. With a broad mandate of education, research and entrepreneurship in the field of

bioinformatics and biotechnology, IBAB offers a range of regular courses as well as a variety of short-term executive training programs as a part of its busy academic calendar. The main activities currently being pursued at IBAB to achieve its mandate include:

- Regular courses in Bio-Informatics and Biotechniques
- Short-term training programs, especially Executive Training Programs to upgrade the skills of in-service professionals in related industries.
- To provide incubation and other services to entrepreneurs and potential entrepreneurs. The institute helps its alumni who wish to start companies. In addition it offers services including incubation (hosting) to biotechnology entrepreneurs who have not had a previous connection to IBAB.

The long-term programs currently being offered by IBAB are:

PG Diploma in Bio-informatics (PGDB)

IBAB is currently admitting the 6th batch of students to the PGDB course. These students come from all over India, and from any area of science and technology (life sciences,

How did the idea of having a joint venture between the state govt. and the corporate sector in setting up the Institute of Bioinformatics and Applied Biotechnology emerge?

IBAB has been created after the successful IIIT-Bangalore model established by the Department of IT&BT, Government of Karnataka, joining hands with ICICI. It was created in response to the demand from the IT sector for much needed quality manpower. The Vision Group on Biotechnology, an advisory body to the Chief Minister of Karnataka, envisaged a similar model for Bioinformatics and Biotechnology, and thus was born IBAB in 2001. The Govt. of Karnataka has to be congratulated for creating this very forward-looking institution. Thanks to the Government of Karnataka, and the academic cluster and companies around Bangalore for their continuing support in shaping up the institute.

What are IBAB's strengths as a research institute and as an educational institution?

IBAB's strength as an educational institute is two-fold. First, it has great flexibility in what it teaches. Having been in the university system, I find this flexibility at IBAB very valuable. The course evolves with each batch, based on our own observations, on student feedback, changing trends in this growing subject matter and the needs of the industry. Bioinformatics is a highly multidisciplinary subject important for both academics and industry and demands varied expertise from several disciplines. Second, IBAB is uniquely placed to draw a large number of highly qualified visiting faculty from both academia and industry to offer to the students a very modern and up-to-date perspective in the subjects taught. Students are given broader training to prepare them for different kinds of opportunities including those at biotech. Today companies come to pick up our students even before the official placement starts. CEOs have time and again told us that they find IBAB students extremely well sensitized to the company environment.

IBAB's research endeavours are still very young as it needs to build up the critical mass respect to faculty. Nevertheless, research activities have resulted in a few publications in international journals. A few online bioinformatics tools and databases have also been developed. Diversity of expertise among the faculty is helping interdisciplinary nature of the research. These have enhanced the quality of the teaching programs. IBAB is particularly keen to develop its research programs in tune with the needs of the biotech-industry. Thus, there is emphasis on contract research/consultancy projects. A few such consultancy and contract research projects have been taken up by the IBAB faculty in the area of bioinformatics as well as biotechnology. We hope to see the research programs evolve in the years to come and to have an angle of industrial-applicability.

What is your vision for IBAB?

IBAB wishes to retain its strong place as the best educational institute by sustaining and enhancing the teaching program in response to changing needs. It intends to preserve an industry focus, both in terms of student placements and also, hopefully, in terms of industry-relevant



A Ph.D. from the Center of Advanced Study in Biophysics, University of Madras, Prof. N. Yathindra, has been the Director of IBAB for the last two years. Dr. Yathindra has made important contributions towards development of stereo-chemical principles governing nucleic acid conformations. Dr. Yathindra spoke to Biotech News about the current strengths and future road map of IBAB.



Institute of Bioinformatics and Applied Biotechnology

Profile

research in bioinformatics and biotechnology. Bioinformatics is an emergent area of research and has different connotations to different sets of researchers. Hopefully IBAB will carve out a few niches in the near future and morph into a research-intensive institute. Contrary to yester years when chemistry graduates going to companies was common, nowadays quality life science programs offer opportunities in companies that were not there a few years ago. For this sector, IBAB wishes to train professionals both in in silico and in experimental laboratory techniques. Although we are currently located in the International Tech Park, space has become a limiting factor in our growth. We hope to soon move into our permanent premises at the Biotech Park, which will allow us to grow our research labs and also our courses.

What has/have been the biggest challenge(s) in establishing IBAB and bringing it to this stature today?

To accomplish the goals mentioned above, assured and adequate annual funding is critical. IBAB solicits such support from any source, central and state governments, private sources and industry. Biotechnology is a discipline that cannot survive, let alone thrive, without such assured funding. IBAB is handicapped without enough faculty members. Lack of IBAB's own premises has been a concern which is being addressed by the Department of IT & BT, Government of Karnataka. Whereas there have been other challenges, all have been more solvable with the help of my colleagues and the support we get from the many academic institutions and companies within and outside Bangalore.

physics, chemistry, pharma, agriculture, medicine, any branch of engineering, etc.). The course comprises 12 months of coursework and 6 months internship. Internship may be in academic research labs or, more often, in industry.

Laboratory Course in Bio-techniques (LCBT)

The second PG Diploma course of IBAB, Laboratory Course in Biotechniques, was launched with the objective of providing rigorous laboratory skills in the general area of molecular biology. The institute is currently admitting the 4th batch of students to this program. Students with any life science background are admitted for a course that can either be lab-only (6 months) or lab-cum-research project (12 months). Although the course is largely lab oriented some aspects of theory are also covered.

The current intake of PGDB and LCBT programs is 40 and 10 respectively. With the new campus of IBAB providing the much needed additional facilities, the intake in both these programs is likely to increase by 10 each from next year onwards.

In addition to the above flagship programs, short term Executive Training Programs also form an important part of IBAB's activities. The short-term courses range from those specially designed for specific corporate sector organizations (e.g. Infosys, GE etc.) to those that are open to individual applicants with varying affiliations and from diverse professional backgrounds.

Due to active and dynamic linkages cultivated by IBAB with the industry, it is not a surprise that a large majority of students of both these courses get ready placements in various industrial organisations. A small number also moves on to join the academia as PhD scholars or Research Fellows with senior scientific professionals engaged in cutting edge work in the field of Bio-Informatics/Biotechnology.

IBAB is a founding member of the National Entrepreneurship Network (NEN) set up by the Wadhvani

Foundation, an NGO set up by NRI Dr. Romesh Wadhvani. The other co-founders of NEN are BITS-Pilani, Indian Institute of Management, Ahmedabad (IIM-A), Indian Institute of Technology, Mumbai (IIT-B) and the S. P. Jain Institute of Management and Research, Mumbai.

Given its criticality to life sciences research, IBAB has made special efforts to amass the required levels of competence in the area of Intellectual Property Rights and seeks to share the same with scientists and practitioners through various mediums. The first article on the subject, authored by Dr. Ritu Mehdiratta and Dr. Gayatri Saberwal is set to appear in Current Science soon.

IBAB's efforts have already begun to attract the attention of various important players in the biotech sector and this is evident from the support and encouragement that the institute has been receiving on various fronts and in many ways. In 2004, Biocon Limited endowed a Faculty Chair at IBAB. In 2006, Astra Zeneca Research Foundation, India endowed a Faculty Chair at IBAB in the field of Chem-informatics. The Government of Karnataka has endowed the Chief Minister's scholarship for the best male and female student. In addition, Millipore India has endowed two scholarships for women, Accelrys two scholarships and Sartorius India Pvt. Ltd one scholarship. Infosys Foundation has endowed two medals for best student and best all round student and an anonymous donor has endowed the Nabanita Ghosh scholarship for a trainee intern in bioinformatics. Several companies and individuals have also come forward to support the student entrepreneurship cell, Pracint, which organizes entrepreneurship-related events at Bangalore-Bio, the annual biotech business trade fair in Bangalore.

With only 5 years between now and the time IBAB was formally established, this young institution has just about begun its journey. If the milestones achieved in the past few years is any indication it is just a matter of time that IBAB acquires its destined place in the institutional landscape of Indian life sciences research and development. ■

"Being the first public-private partnership in the area of post-graduate life science education in India, IBAB is a unique institutional experiment that seems to be going strong right from the beginning."

Beyond the visuals

The Touch and Smell Garden

S. Rajalakshmi, N. Parasuraman and Ajay Parida
E-mail: ajay@mssrf.res.in

A questioning mind is the gift of childhood. Children are endowed with minds vibrant with inquiry on all subjects around them. This inquiry is the starting point for scientific thinking and analysis. The noted astronomer and science writer Carl Sagan said "every body starts out like a scientists and every child has the sense of wonder and awe". But some where on the way to adulthood, many children - particularly those with social and physical handicap- are pushed out from the world of questioning and exploration. We learn from the modern science of Genetics that there is an extra-ordinary unity in the make up of all humans. And hence, most of the inequities seen among them are created by the social, cultural, economic and political milieu. Science is fundamental to human progress and welfare. If science and technology have been instrumental in the past in enlarging the rich-poor divide, the challenge now is to enlist science and technology as allies in the movement for economic and gender equity.

A scientifically tempered nation cannot be built without sustaining and fostering scientific inquiry among children. Therefore, MSSRF initiated a programme called "Every Child A Scientist" (ECAS) in 2001. This programme has evolved in its scope, content and reaches. Establishment of a Touch and Smell Garden, with the support from National Bioresource Board (NBDB) of the Department of Biotechnology, is an initiative especially for the visually challenged people.

Touch and Smell Garden at MSSRF is a unique endeavor to enrich the visually impaired children with the knowledge on the plant biodiversity. The technological support available to these children today is not capable to give them a feeling on biodiversity and its relevance to human life. India has about 10 million blind children, which is the largest any country has. While the development of Braille script marked a revolutionary step in the education of visually impaired, there is nothing to compensate for the loss they suffer from their inability in experiencing the beauty of nature abounding with

biodiversity. The Touch and Smell Garden is established to help the visually impaired children experience the joy of Nature by the senses 'touch and smell' as information is provided to them in Braille. The garden has aromatic, coarse leaved, medicinal and thorn less plants of economic importance.

This garden created and maintained at the MSSRF with support from the NBDB, stands testimony to an inclusive society. It redefines the term 'barrier free environment' for the disabled. With thoughtful landscape designing and a selected range of shrubs and herbs, the Touch & Smell Garden turns a botanical excursion into an experience in tactile and sensory perception.

A sensual road map

The concept is simple and only requires a particular way of looking at things, as it were. At the Touch & Smell Garden, we have been constantly innovating to ensure that the visually impaired are not denied the joys of discovering nature. It is very much possible for them - instead of emphasis on the 'visual' aspects of a typical garden, like flowers and ferns, we focus on aromatic plants and those that have leaves that are distinct to 'touch'. This makes the garden more relevant, enjoyable and educative for the visually impaired visitors.

Five identical blocks, with an arch of jasmine at the entrance, are accessed by specially selected tiles. The tiles are carefully chosen as they are patterned with a specific purpose in mind - the chequered tiles are the principal pathways. At every corner, embedded soft marble pebbles indicate change in direction. Small sized pebbles indicate the presence of a Braille board. These strategically placed Braille boards give additional explanation on how to navigate, plus details on the plants themselves. This way, the layout becomes a tactile route map. Once the instructions are given at the time of entering the garden, independent mobility for the visually impaired is ensured, within the garden. At the Touch &



Kaleidoscope

" If science and technology have been instrumental in the past in enlarging the rich-poor divide, the challenge now is to enlist science and technology as allies in the movement for economic and gender equity. "

" The Touch and Smell Garden is established to help the visually impaired children experience the joy of Nature by the senses 'touch and smell' as information is provided to them in Braille. "



Beyond the visuals The Touch and Smell Garden

At MSSRF, children from different schools visit every week and learn about the plants and biodiversity. The plant beds are mainly aromatic in the garden. Although Chennai's omnipresent heat and scanty rainfall makes it a difficult place to sustain a garden, the problem is overcome by choosing species that grow well here. Fragrant, coarse-leaved, medicinal and thornless plants of economic importance have been selected and nurtured. Many of the species have been chosen from the sacred groves or kovilkadugal of Tamil Nadu. The groves are a unique form of biodiversity conservation, and are real examples of the Indian tradition of conserving the ecology as a natural heritage. These trees provide the necessary canopy and shade for the delicate aromatic herbs.

The feedback from children and visually challenged youth has been very encouraging. K. Ramalingam, a visually impaired postgraduate student of Tamil from Chennai's Presidency College discovered how rosemary was popular as herbal tea besides learning about the use of *Maranta arundinacea* in making arrowroot biscuits and porridge and



said, "I am familiar with many of these smells from my village, but rarely are there opportunities to observe greenery in the city. This is a most pleasant place."

G. Manoharan, a doctoral scholar of literature on a trip with an NGO that funds and supports his education, "Did you notice how the geraniums smell just like Medimix (India's largest selling Ayurvedic toilet soap)? I feel if we come here regularly, our eyes will be cooled therapeutically."

MSSRF also has information in an audio format besides the Braille boards wherein additional details and information are provided in the form of audio cassettes. Also, a computer equipped with Braille software and an Embosser helps students take back their own learnings from the garden and the software helps both normal and visually impaired to communicate amongst themselves. 'Seed albums' with a few

seeds and information in Braille opens another dimension to learning biodiversity. Regular workshops for teachers and heads of schools and NGOs working for the blind are held to orient and train them to develop similar facilities at their campus.

The responses from the children have been nothing short of ecstatic. Some of them have suggested that their biology class be held in the garden, some others want to start a similar garden in their school, and still others wish to become scientists to serve the visually impaired.



A new aquatic plants' section is an additional inspiration. Water adds an extra dimension to the senses. There are lilies, lotus and *Eichhornia* species in specially constructed water tanks built exclusively for the visually impaired. The children are extremely thrilled with this addition as they are now able to feel and touch a lotus leaf, which they would otherwise not have an opportunity to do. This new section was created after suggestions from the children.

The information provided in the Garden forms the theme for Quiz and elocution competitions that are held periodically. It also serves as an opportunity to assess the success in imparting knowledge on biodiversity and conservation to the garden's young visitors. ■



"The responses from the children have been nothing short of ecstatic. Some of them have suggested that their biology class be held in the garden, some others want to start a similar garden in their school, and still others wish to become scientists to serve the visually impaired."



New Steps Forward

Tech Update

Immunotherapy for control of disease

For the infectious diseases, the current treatment is pathogen-targeted. Using Leishmania infection as a model, a team of researchers led by Dr. Bhaskar Saha at NCCS, Pune has observed that immune response is not a steady-state phenomenon rather it appears in phases.

The phases are regulated with the changing load of the persistent antigen (s) and the immune response at each phase influencing the following phase. Therefore, the treatment should be in a phase-specific manner.

Studies indicate that during the initial phase of anti-leishmanial immune response, IL-2 induces IL-10 that suppresses the host-protective functions of T cells in the effector phase. In concurrence, IL-2 and IL-10 neutralization at different time-points after the infection demonstrates their distinct roles in these two phases respectively. These findings establish kinetic modulation of ongoing immune responses as a principle of a rational, phase-specific Immunotherapy which can also be applied to the modulation of other infections and non-infectious disease.

This finding has been accepted for publication in the forthcoming issue of Journal of Immunology.

Role of viral complement proteins in immune evasion

The complement system is an ancient mechanism of immunological defense evolved to perform surveillance and protect the host from all the pathogenic non-self targets including viruses. Thus, to combat host responses and also succeed as pathogens, along with other immune evasion mechanisms, viruses must develop principles to elude the host complement system. Consistent with this premise genome sequencing has revealed that poxviruses and herpesviruses encode for complement regulators. A team of scientists headed by Dr. Arvind Sahu at NCCS, Pune is working towards unraveling molecular mechanisms underlying the interaction between host's complement proteins and complement regulators of vaccinia virus, Herpesvirus saimiri (HVS) and Kaposi's sarcoma-associated herpesvirus (HHV-8). Recent studies on the functional characterizations of the complement regulator of HVS indicate that it encodes a potent inhibitor of complement, which possesses regulatory activities similar to human complement regulator CD35 such as factor I cofactor activities and decay-accelerating activities. Site-directed mutagenesis revealed that its residue R118 contribute significantly to its factor I cofactor activities (Singh et al., 2006, J. Biol. Chem., In press). These data indicate that the complement regulator encoded by HVS allows HVS to evade the host complement attack. ■



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News and Happenings

News Desk

Joining hands with Tunisia

The Joint Working Group meeting for India-Tunisia bilateral co-operation was held at Tunis during 11-14th September, 2006 under the framework of the Indian-Tunisian agreement of cooperation in Science & Technology and as a follow up to the visit of Hon'ble Minister of Science and Technology and Earth Sciences Mr. Kapil Sibal to Tunisia in April, 2006.

The Indian delegation consisting of Mr. U.N. Behera, Joint Secretary, DBT; Prof. C. Durga Rao, Indian Institute of Science, Bangalore; Dr. Yogesh S. Souche, National Centre for Cell Sciences, Pune and Dr. Meenakshi Munshi, DBT. The delegation visited several research institutes, universities and industrial establishments across Tunisia including Pasteur Institute, Tunis; Technopark at Sidi Thabet, National Institute of Research and Physico-chemical Analysis and National School of Veterinary Medicine at Tunis, Faculty of Medicine, Sfax; Centre of Biotechnology, Sfax. The delegation also interacted with a large number of Tunisian scientists from different sectors. Apart from discussing a broad range issues of common interest, a joint workshop focusing on Medical Biotechnology was held at Sfax. It was decided to develop joint R&D projects on molecular epidemiology of selected



Mr. U. N. Behera, Joint Secretary DBT & Mr. Rachid Ghrir, Director General, SRCD, Govt. of Tunisia signing the program of cooperation in Biotechnology.

Mr. O. P. Gupta, Indian Ambassador to Tunisia & Prof. Taieb Hadhri, Minister for Scientific Research and Competency Development also in the picture.

infectious diseases; high throughput genotyping in tuberculosis; immunological investigations and evaluation of vaccine candidates for leishmaniasis; emerging and drug resistant pathogens; control of animal diseases; genetic disorders and extraction and characterization of bioactive molecules from natural substances such as plants, venoms and toxins. It was decided to invite joint project proposals from scientists from both the countries by March, 2007 and also to hold a joint workshop on Agricultural Biotechnology in India in mid 2007.

During the visit of the delegation the Program of Cooperation between the Republic of India and Tunisia in field

of Biotechnology was also formalized. The agreement for this purpose was signed by Mr. Rachid Ghrir, Director General, Scientific Research and Competency Development, Republic of Tunisia and Mr. U.N. Behera, Joint Secretary, DBT, Government of India on 14th September, 2006 in the august presence of Prof. Taieb Hadhri, Minister of Scientific Research and Competency Development, Tunisia and Mr. O.P. Gupta, Indian Ambassador to Tunisia.

INDO-US meeting on Indian Health Science and Technology Initiative

DBT and Indo-US Science and Technology Forum joined hands to organize an expert group meeting to discuss the long-term vision & plan for education and research in the field of bioengineering. Held at Delhi on August 17-18, 2006, this meeting was a follow up of the visit of a high level delegation to Harvard-MIT division of Health Science and Technology



(L-R) Mr. U. N. Behera, Joint Secretary, DBT; Dr. M. K. Bhan, Secretary, DBT; Dr. Martha Gray, MIT/Harvard, Division of Health Science & Technology; Dr. R. A. Mashelkar, DG-CSIR;

Speaker at the extreme right: Dr. T. Ramasami, Secretary, DST

(HST), USA. Seven leading overseas experts and about 25 Indian scientists participated in this meeting.

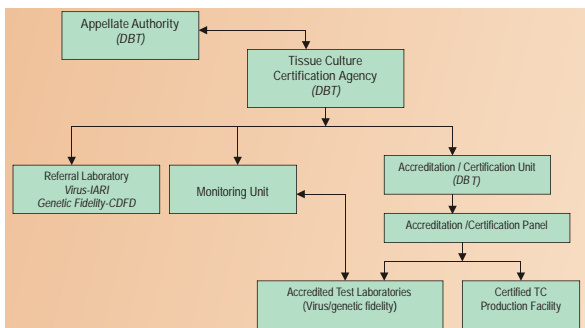
The participants at the meeting highlighted the need for a more dynamic interface between disciplines like basic science, biology, medicine, engineering and the industry. The meeting deliberated on the parameters of appropriate international partnerships, and a road map for setting up a Health Science and Technology (HST) institute in India to facilitate this interface.

The goals of the proposed institution would be: a) to create a culture of innovation in basic and applied research; b) to provide undergraduate and post-graduate education and training; c) to serve as an incubator to generate ideas; d) to attract talented young graduates from engineering and medical disciplines and e) to promote collaborative partnerships between institutes and industries.



National Certification System for Tissue Culture Plants (NCS-TCP)

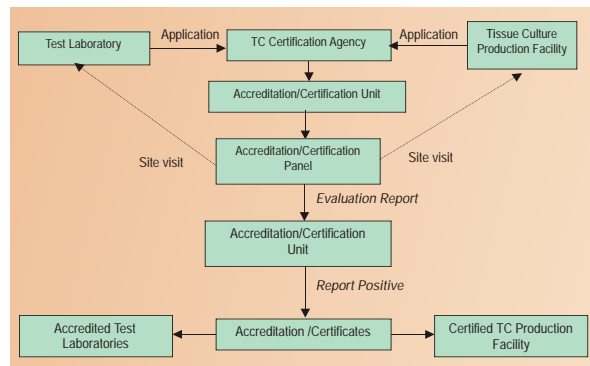
Plant Tissue Culture Technology offers great promise for the production of genetic fidelity planting material on account of disease free and true to type plants produced through micro-propagation techniques. The need for a certification programme for the tissue culture plants is imperative since inadvertent micro-propagation of virus infected plants will not only result in poor stand, but also in undesirable spread of viruses wherever such plants are grown. Also, failure to use prescribed standard protocols will result in variations in the plants produced. The most deleterious variants in tissue culture raised plants are those that effect yield, genetic fidelity



and carry infection of viruses, which are difficult to diagnose. This is an area of great concern, and requires a well-structured system be put in place to provide support to the tissue culture industry for the commercialization of tested virus free, high genetic fidelity planting material.

Mandated to do so by a notification of Ministry of Agriculture dated March 10, 2006 DBT has developed a National Certification System for Tissue Culture Plants (NCS-TCP) with a clear structure (Fig. 1):

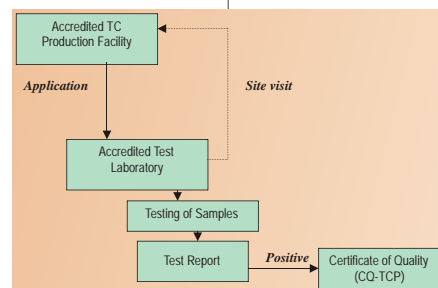
DBT is responsible for implementing the National Certification System for Tissue Culture Plants (NCS-TCP) in the country. An Accreditation Unit (AU) is being set-up for undertaking accreditation of test laboratories for virus and



genetic fidelity and also certification of tissue culture production facilities, based on the established guidelines and criteria. Accredited Test Laboratories (ATL) will test the sample and give the certificates of quality based on the test reports to those samples that meet the criteria. Referral Laboratories en

have been identified for carrying out confirmatory tests, if required, and also for developing standard protocols, maintenance of referral material, training etc. The Certification Agency is overall responsible for developing standard tests, production protocols/guidelines and manuals.

A Tissue Culture Production Center will have to apply for certification of tissue culture material with the nearest ATL. Only certified production facilities will be eligible to register for certification of material. Standards/Guidelines for production of Tissue Culture material are currently being prepared for different crops as per requirements, by DBT in consultation with scientists/institutes, working in the area. ATL will issue the certificates only if tissue culture material is produced in conformity with these notified guidelines.



The NCS-TCP is expected to be operational shortly. Further Information on NCS-TCP along with detailed guidelines is available on the DBT website www.dbtindia.nic.in and related link site is www.dbtmicropropagation.nic.in.

Brainstorming meeting on "Cardiovascular Devices and Implants"

Biomaterials and medical devices have made an important contribution to modern health care. Biomaterials are being used for permanent implantations (heart valves, total joint replacement, dental restoration, intraocular lenses), long-term applications (fracture fixation devices, contact lenses, removable dental prostheses, hemodialysis systems) and transient applications (needles for vaccination, wound healing devices, cardiopulmonary bypass and cardiac assist systems). The global market of medical devices is presently estimated to be US\$ 150 billion, with USA accounting for 45% and Europe 35%. Worldwide organ replacement therapies utilizing standard devices consume 8 % of medical spending, or approximately \$350 billion per year. The current market in India for medical devices is estimated at Rs.7000 crores and that for the medical instrumentation sectors Rs.5000 crores, with a growth rate of 15% per year. But unfortunately, 85% of this demand is currently met by imports.

In order to discuss various aspects of "Cardiovascular Devices and Implants", a brainstorming meeting was organized by DBT on 29th July, 2006 at the Indian Institute of Technology, Chennai. The deliberations at meeting focused on needs and opportunities in cardiovascular devices and implants and barriers to indigenous innovation in this sector, promotion of locally developed devices and implants in International markets etc. The participants of the meeting were a unique group comprising of scientists, clinicians, engineers and industry representatives. It was felt by the group that a focused strategy is required to highlight the need for development of indigenous devices and implants. It was also suggested that the devices or implants developed by other countries be validated in the country before use. ■

"The current market in India for medical devices is estimated at Rs.7000 crores and that for the medical instrumentation sectors Rs.5000 crores, with a growth rate of 15% per year. But unfortunately, 85% of this demand is currently met by imports. //

Call for Proposals

Apiculture Biotechnology

DBT envisages developing a network program which will look at the biotechnological interventions that can contribute to better understanding of Honey Bee as a species and improvement in quality of honey and associate products. The priority areas identified in this context are:

- a) Genetic Diversity of all species of honey bees, including non Apis species.
- B) Pollination studies,
- c) Development of breeding techniques/mass rearing of honey bees:
- d) Honey products: Value addition, Certification, Standardization of protocols quality assessment, enhancing production of by-products such as propolis, royal jelly, bees wax, venom, bee pollen etc.
- e) Development of molecular markers, Screening of population for specific traits (disease and pest resistance, yield & quality, role in pollination, foraging & hygiene behaviour etc.)

Last date of submission 31st October, 2006.

For more details, visit: www.dbtindia.gov.in

Biotech Product and Process Development

The Department of Biotechnology, Ministry of Science & Technology invites project proposals from Indian scientists in the area of "Biotech Product and Process Development" for implementation during the 11th Five Year Plan (2007-2012). Multi-centric and multi-investigator proposals will be encouraged with proper milestones, time schedule and defined role of individual institutes/centres based on their expertise.

Priority areas identified for this call for proposals are:

- a) Biotransformation to make bioproducts like amino acids, antibiotics, drug intermediates, esters and chiral products, hyaluronic acid, COQ-10 etc. cheap and cost effective
- b) Optimization of vaccine production
- c) Optimization of bioethanol production from cellulose/hemicellulose agro/ wastes
- d) Reactor Engineering and improvement in Membrane Separation Technologies for recovery of proteins and biomolecules and other recombinant DNA products where recovery is a problem.
- e) Optimization of the production and application of industrially important enzymes through solid state fermentation and submerged fermentation
- f) Development of Biotechnology tools for management of environmental problems: Some of the identified areas for result-oriented, time bound multi-institutional, multi-Disciplinary mission mode projects with programme support for a period of 3 years are:
 - a) Drug delivery system for therapeutics/biomolecules
 - b) Development of novel molecules for eradication of TB
 - c) rDNA and molecular biology
 - d) Perfection of technology for production and purification of asparaginase

Besides the above identified areas, proposals with novel/innovative ideas for product related discovery science and product development will also be considered.

Last date of submission 31st October, 2006.

For more details, visit: www.dbtindia.gov.in

Forthcoming Events

- 1) Indo-US symposium of genetic disorders: Focus Hemoglobinopathies, Venue: Varanasi, Convenor: Prof. Rajiva Raman, Oct 29-31, 2006, Deptt. of Zoology, BHU, Varanasi, E-mail: raman@bhu.ac.in
- 2) 7th Asia Pacific Marine Biotechnology Conference, Venue: Cochin, Convenor: Dr. Shanta Achuthankutty, Nov 02-05, 2006, Biological Oceanography Division, National Institute of Oceanography, Dona Paula, Goa
- 3) International Workshop on "Pediatric Urology", Venue: AIIMS, New Delhi, Convener: Prof D.K. Gupta, Nov 16-17, 2006, All India Institute of Medical Sciences, New Delhi
- 4) International Symposium on "Overexpression: Systems and Challenges", Venue: Hyderabad, Convenor: Dr. A. K. Prasad, Nov 26-28, 2006, Biotechnology Society of India, CCMB, Hyderabad
- 5) Asia Pacific Conference on plant Tissue culture and Agribiotechnology, 28 January-1 February, 2007, Kuala Lumpur, Malaysia
- 6) National Workshop on "Application of Molecular tools in Animal science research", Venue: Tiruchirappalli, TamilNadu, Convenor: Dr. G. Archunan, Dec 05-21, 2006, Department of Animal Science, School of Life Sciences, Bharathidasan University, Tiruchirappalli-620024
- 7) International Conference on design of Biomaterials (BIND-06), Convenor: Dr. Dharendra S. Katti, Venue: Kanpur, December 08-11, 2006, IIT, Kanpur jointly with Society for Biomaterials & Artificial Organ-India (SBAOI)



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