

Biotech

NEWS

Newsletter of the Department of
Biotechnology, Government of India

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



Response

"The information provided about the academics and industry scenario is well described. The newsletter overall is very informative and it is definite that going forward, more and more valuable contribution and readership will be there from the Universities, research institutes and industry."

Dr. R Umashaankar
UAS, Bangalore

Reader's mail

I am very pleased to receive a copy of the re-launched Biotech News. The newsletter is very informative and aesthetically designed. The feature article by Ms. Kiran Mazumdar Shaw on "The promise of Indian Biotechnology" was excellent. Since the aim of the newsletter is to reach out to a large section of the society particularly students, it will be useful to add a section on 'Education' in which information about colleges, universities and institutions offering biotechnology courses may be provided. A rating of the courses offered by various educational institutions in the field of biotechnology and their profiles may also be done on an annual basis. This would be very useful for students aspiring to pursue a career in biotechnology. I compliment DBT for their initiative and look forward to receiving the forthcoming issues.

Dr. V. B. Mathur, Dean, Faculty of Wildlife Sciences, Wildlife Institute of India, Chandrabani, Dehradun (Uttaranchal)

Biotech News, the official newsletter of DBT can be a very useful media to disseminate pertinent information to those interested in the field of Biotechnology. I hope the publication reaches its entire target audience, so that biotechnology can play a pivotal role in meeting the demands of the society in relation to health, industrial products and food security. I wish all success to DBT in this new initiative.

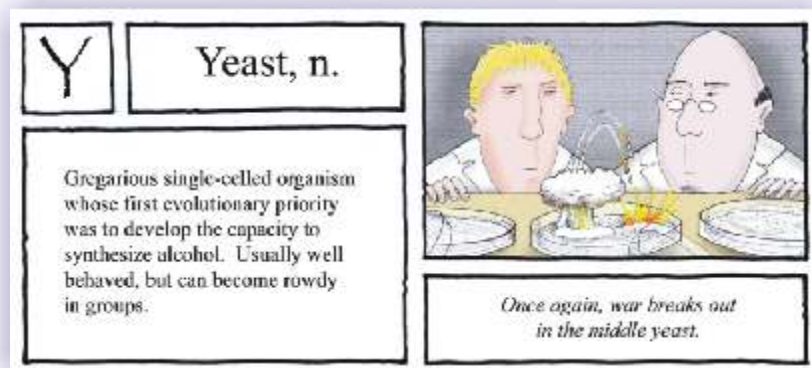
Dr. W. S. Lakra, Director, National Bureau of Fish Genetic Resources, Lucknow

The first issue of the BIOTECH NEWS published by DBT is a good start to capture the day-to-day developments in this vital field of research and its application. Biotechnology is well advanced in the developed countries and the society there has already been getting benefited from these advances. While world has already been enjoying the fruits of this revolution, India is yet to benefit fully from the same. Biotechnology has immense potential for the benefit of society (even more than IT). In India, dedicated government research Institutes headed by the scientific leaders are the fastest way to promote and implement the teachings and technologies of biotech. India cannot afford to lag behind in this sunrise sector of technology. The concerns raised about our preparedness in this context in the Biotech News issue at hand are most relevant and important. The information provided about the academic and industrial scenario is to the point. The newsletter overall is very informative and it is certain that going forward, more and more valuable contributions and readership will be there from the universities, research institutes and industry. The knowledge sharing and awareness campaign thus started will have a very timely and long lasting positive impact on the growth engines and the scientific and technological research in our country.

Dr. R Umashaankar, Professor, Department of Crop Physiology, University of Agricultural Sciences, Bangalore

It was a pleasure to receive and go through biotech news. The feature articles were excellent as they very succinctly described the potential and promise of biotechnology in a language and style that even non-specialists could appreciate. Tech-Update section was also very appealing for students. However, cross-references if provided will help young students to know more about the invention/discovery. I wish there were some student/child specific articles and suggest that the same may be incorporated in future issues. Another useful thing to do would be to have a Q&A section where a panel of distinguished scientists can answer questions asked by students on issues related to careers in biotechnology. In total a very decent beginning. And I look forward to receiving future issues.

Ms. Shobita Jauhari, PGT-Biotechnology, Mothers International School, Aurobindo Marg, New Delhi. ■



Application of Genomics & Proteomics to Vaccine Development

Deepak K. Kaushik & Devinder Sehgal, National Institute of Immunology, New Delhi, E-mail: devinder@nii.res.in



Feature

Infectious diseases are a major cause of morbidity and mortality worldwide. With every single day passing by, the problem seems to get aggravated with the development of antibiotic resistant strains amongst bacterial pathogens. The presence of multiple serotypes of a pathogen poses another problem of 'replacement' disease whereby the treatment of a disease against one serotype invites another serotype to become an active pathogen.

The pathogenic properties of a pathogen are attributed to the surface exposed proteins or carbohydrate moieties that also activate the host immune system to mount an active immune response. It is this response, which is responsible to evade the pathogen on its subsequent encounter with this pathogen. This forms the basis of the vaccine concept. A vaccine is a chemical or biological formulation that promises to protect the host against an infection by alerting the immune system of the host even before its encounter with the virulent strain.

Since its advent, vaccination has proved to be the best strategy to defend against numerous bacterial and viral pathogens. In-vitro grown pathogens have been used to develop killed, live attenuated, or subunit vaccines. In order to identify protective antigens, the pathogen is grown in laboratory conditions and then dissected into individual components. Each component is then tested for its ability to induce immunity. This approach is time-consuming and allows the identification of only those antigens, which can be purified in quantities suitable for vaccine testing. This conventional approach is highly time consuming and does not hold much promise to tackle uncultivable microbes. Till recently, this was the only way to identify a potential immunogen and develop a vaccine candidate.

The advent of recombinant DNA techniques has provided new tools for vaccine research. Specific antigens are selected on the basis of the immunological data from patients and, after their purification from the pathogen or from heterologous systems in which the corresponding genes have been cloned, the antigens are tested for safety and efficacy. The approach also has several limitations including the fact that immunogenic proteins are not necessarily protective antigens or, even if protective, the antigens cannot be used in vaccine

formulations because of sequence variability, difficulty in expression and/or purification, high production costs etc. Also, using this approach only a few antigens are analyzed simultaneously. Therefore, newer approaches are needed for the development of vaccines that are safer for human use and also effective in case of diseases for which the traditional approaches have failed.

Genomics and vaccine development

With the advent of whole-genome sequencing and advances in bioinformatics, the vaccinology field has seen a radical change, providing the opportunity for developing novel and improved vaccines. The genomic era offers exciting new opportunities for vaccine research, opportunities that are expected to shorten the time to develop a vaccine and also new virulent factors can be identified by searching for unknown genes that are co-regulated with known virulence genes. This approach involves an in silico analysis of the whole genome of a pathogen and subsequent selection of potent antigens by predicting peripherally located proteins. This approach, unlike conventional vaccinology, uses various bioinformatic tools in order to characterize the potential immunogen. It is not based on growing microorganisms but running algorithms to mine the genetic information of a pathogen.

Several programs and algorithms are now available for biologists for genome mining. Once the correct genes are selected, they are expressed in a suitable expression system. They are purified and used to immunize animal models. The immunogenicity is checked by challenge experiments in appropriate animal models. Using this approach many novel vaccine candidates have been identified.

Some examples include the universal vaccine developed against Group B meningococcus, group B streptococcus, Bacillus anthracis and Chlamydiae.

Application of proteomics to vaccine development

For most bacterial pathogens, the proteins that are likely to induce a protective immune response are those localized on the cell surface. These proteins have the highest chances to

"With the advent of whole-genome sequencing and advances in bioinformatics, the vaccinology field has seen a radical change, providing the opportunity for developing novel and improved vaccine."



Application of Genomics & Proteomics to Vaccine Development

come into contact with the host immune system. Although the algorithms predicting protein localization from genome sequence are relatively advanced, they are still far from providing a real picture of the protein composition of the cell surface both in qualitative and quantitative terms. Also, *in silico* analysis is completely unable to predict membrane protein trafficking and the kinetics of protein appearance and disappearance from the cell surface.

In this second approach, surface-exposed antigens are selected experimentally through the characterization of protein fractions using proteomics techniques such as 2-D gel electrophoresis/mass spectrometry. With the advances in these protein separation techniques combined with genome sequencing, have made the elucidation of total protein components (proteome) of a given cellular population a feasible task. Using proteomics approach scientists have identified several potential immunogens from several

pathogens like Haemophilus influenzae and several group B meningococcal strains.

Sequence conservation and protein based combination vaccine

There are many pathogens for which the development of vaccine has been a challenge. It is due to the presence of several serotypes due to which there is constant threat for the occurrence of replacement diseases. For developing vaccines against such pathogens, using a combination of proteins having conserved sequences across various strains is a better strategy. Using these approaches one can mine the

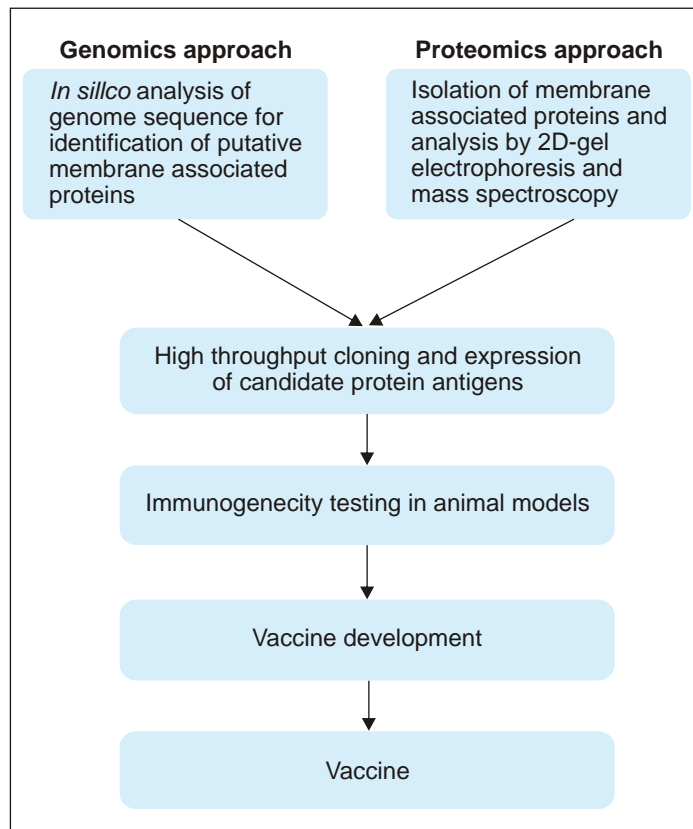
sequences of genes that code for such surface exposed proteins that are conserved across several serotypes. One such bacterial pathogen is Streptococcus pneumoniae.

This pathogen is responsible for high mortality rates among children below five years of age and immunocompromised host in developing countries today. There are more than 90 serotypes of this pathogen, which pose great hurdle in the development of a universal vaccine against this pathogen. 23-valent polysaccharide and 7-valent

glycoconjugate vaccines available to combat this pathogen have limitations. Therefore strategies are required to develop a vaccine that could cover all serotypes and that too within a short duration. This shall only be possible by combining several highly conserved immunogenic proteins. Genomics and proteomics provides effective tools to identify immunogenic proteins which might not have been identified using traditional approach.

Using these approaches, many novel antigens have been

discovered and are now being tested in clinical trials. Today, the genome-based approach is being used in vaccine development and is being applied to group B Streptococcus, meningococcus, Staphylococcus aureus and Chlamydiae. A universal vaccine for serogroup B meningococcus has recently been proposed and similar studies are being carried out involving various other pathogens including Hepatitis B, C and other viruses. The complementary approach using proteomics has proved to be highly effective in the development of new vaccine candidates and both these techniques offer to open up new frontiers in the field of vaccinology. ■



The Power of Proteomics

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Cutting Edge

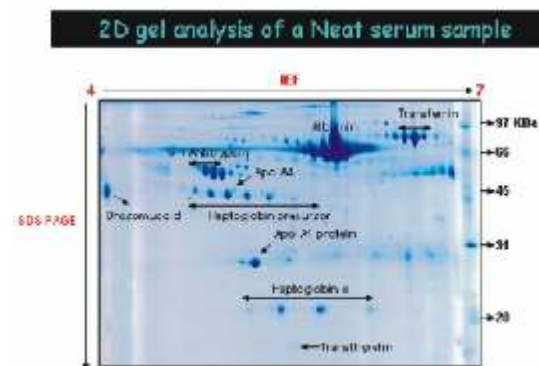
It was in Siena 2D Electrophoresis meeting in 1994 that the word Proteome was coined. The term Proteome initially was used to refer to total proteins of a cell or an organism. It means much more now. Proteomics today implies, systematic separation of proteins, quantification and determination of modification state, interaction partners, activity, sub-cellular localization and structure in a given cell type and at a particular time.

The transfer of information from genes to proteins is not linear. One gene-One enzyme concept is no longer valid. Indeed the increase in information content from gene to protein is exponential. And the analysis of this information is an emerging and exciting area of research. Apart from the fact that a single gene could give rise to several protein products by differential splicing at the level of transcripts and proteins, multitude of post-translational modifications (PTM) of proteins, makes the proteome a very complex entity. An additional feature, unique to the proteome, is the variable abundance of individual proteins. This characteristic is one of the most difficult issues to analyze, since in many cases there is no correlation between respective levels of mRNA and protein abundance. Because of this, high throughput proteome analysis techniques are as yet not as effective as in the case of genome analysis.

The experimental approaches to proteome analysis can be divided into two distinct groups namely, top down and bottom-up proteomics. The classical two-dimensional (2D) separation of the given proteome followed by mass spectrometric identification of separated proteins is a top down approach. In this approach, the information regarding the proteins such as molecular weight, pI, PTM can also be used for supplementing the identification process. In the bottom-up approach, peptides of the whole proteome are generated by enzymatic digestion first (using a proteolytic enzyme such as trypsin). This peptide mix is pre fractionated chromatographically and then identified using Mass Spectrometry. The choice of the approach depends on the experimental design. There are advantages and disadvantages of both these approaches. Here we examine 2D gel based proteomics.

2D Electrophoresis evolved into a reproducible methodology, thanks to the efforts of a group of dedicated 2DE

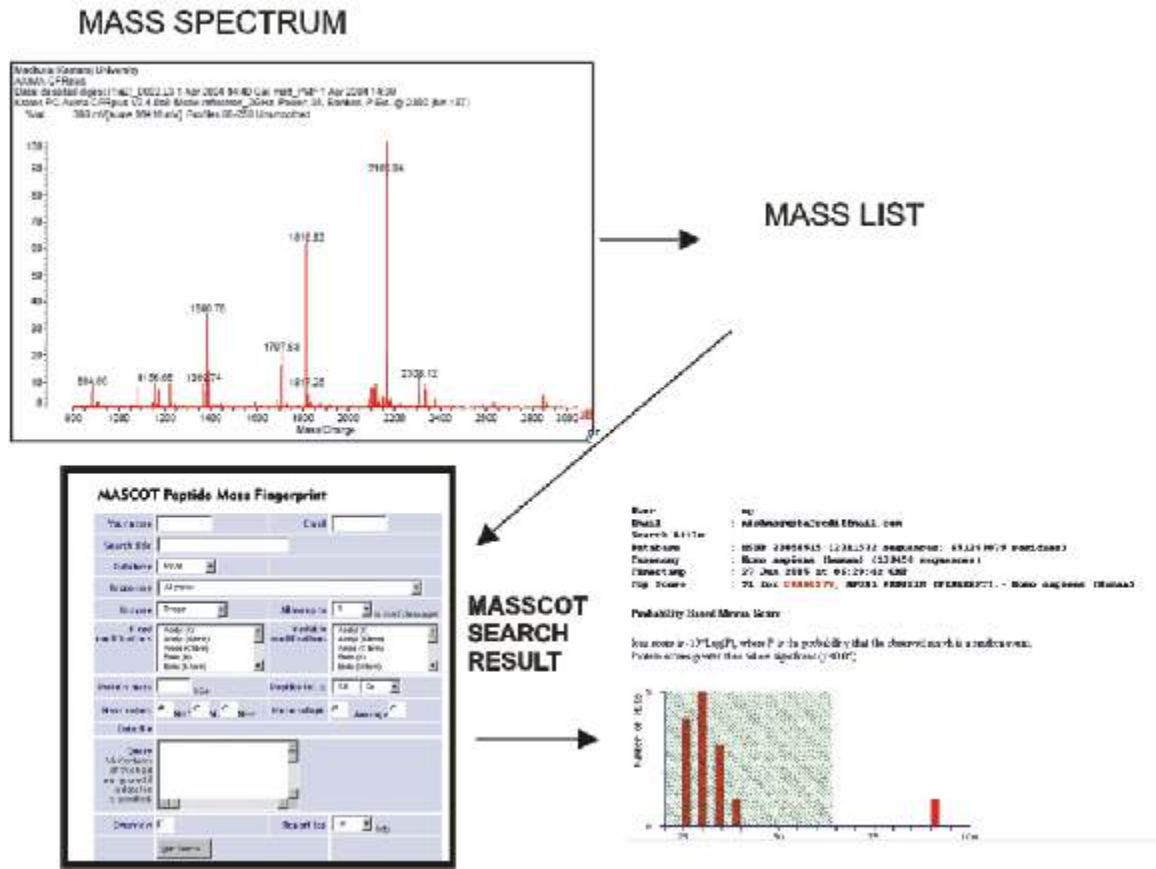
runners. The main problem faced by researchers using isoelectric focusing is the non-reproducibility of the pH gradient generated using carrier ampholytes. The introduction of immobilized pH gradient IEF strips largely eliminated this major problem. Coupled with increasingly sophisticated 2D gel analysis software one could easily produce reproducible gels with minimal effort. The commercial availability of a wide range of IPG strips, covering the entire pH range, is a boost to 2D analysis. Further, large format gels allow the separation of a large number of spots in a single gel and the gels run in multiple numbers, maintain reproducibility and minimize gel-to-gel variation. Good 2D analysis software helps in removing the background intensity, and one can easily overcome minor variations in spot location during the matching process using alignment option from the software.



In order to achieve separation of a large number of spots, several strategies can be used. Removal of highly abundant proteins allows loading of more proteins leading to separation and detection of low abundance proteins. Sub-cellular fractionation is a non-intrusive method for reducing the complexity of the proteins. Separation of membrane fractions from cytoplasmic fractions helps in handling the complexity as well as identification of this special group of proteins in the subsequent stages. There are several other prefractionation strategies utilizing one or more properties to group proteins of similar nature and to reduce the complexity of lysate. One such strategy is solution isoelectric focusing, which is very promising as a prefractionation strategy. Coupled with narrow range IPG strips, the zoom gels can resolve about 15,000 proteins as of now.

"The experimental approaches to proteome analysis can be divided into two distinct groups namely, top down and bottom-up proteomics."

“Protein identification is mainly based on mass spectrometry of peptides generated by enzymatic digestion of gel-separated proteins.”



Detection of proteins is an important step in 2D analysis. Sensitivity is still a major problem. The sensitive staining methods using silver, such as ammoniacal silver staining, are not compatible with mass spectrometric identification. There are several silver staining methods which are modified to make them compatible with mass spectrometry. A recent publication showed that ammoniacal silver staining can also be modified to make it compatible with mass spectrometry. In spite of all these developments fluorescent staining is a method of choice since this staining does not interfere with mass spectrometry. The modified colloidal coomassie blue staining, also called “blue silver staining” is less expensive but is not as sensitive as the silver based and fluorescent stains. In our experience, the effectiveness of mass spectrometry is considerably reduced if stained proteins are used when compared to unstained proteins.

Protein identification is mainly based on mass spectrometry of peptides generated by enzymatic digestion of gel-separated proteins. There are two major approaches, one using Electro Spray Ionization (ESI) and the other is Matrix Assisted Laser Desorption Ionisation (MALDI). MALDI as a

method is user friendly and fast and in addition, today one can even get a bench top MALDI machine at an affordable cost. In this article I will focus only on the use of MALDI in proteome identification. The flow of experimental set up is given in the figure above.

The four main steps after the separation of protein on one/ two dimensional gels are:

1. In-gel digestion of proteins

The spots cut out from the gels are dehydrated and incubated with trypsin or other suitable proteolytic enzyme. Care must be taken to use good quality enzyme since the auto digest products of the enzyme will interfere with the identification process.

2. Extraction of peptides, desalting, mixing with appropriate matrix and spotting

The use of appropriate matrix is a critical factor. The matrix suitable for the ionization of whole proteins may not be suitable for ionization of peptides. There are, in addition,

National Brain Research Center

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Profile

It was on December 16th, 2003 that Dr. A P J Abdul Kalam, Hon'ble President of India dedicated the National Brain Research Center (NBRC) to the service of science, nation and humanity. In a short span of 3 years, NBRC has emerged as a premier, one of its kind institute in the field of neuroscience. The idea of NBRC can be traced to as early as 14th November, 1997 when the intent to establish the same was announced. It took almost a couple of years' time for that idea to materialise and it was only on June 14th, 1999 that NBRC was registered as an autonomous society under the Department of Biotechnology, Government of India. Set up on the demand of, and in consultation with the neuroscience professionals of the country, the mandate given to NBRC was simple!: bring together the best brains in the field of neuroscience to understand the complexities of, well, the brain itself!

To achieve this mandate NBRC pursues basic research to understand brain function in health and disease, generating trained human resources with capability to carry out interdisciplinary research in neuroscience. One important pincer is in the direction of promoting neuroscience in India through effective and purpose oriented networking among various institutions active in this field across the country.

With its impressive slew of experts from varied fields such as mathematics, physics and computer science, (of course, all in addition to life sciences) in its team, NBRC functions as a comprehensive brain research facility. It has been envisaged as a novel set up of its kind in having a comprehensive complement of intramural as well as extramural responsibilities. A cohesive unit where a highly integrated multidisciplinary team of scientists works to pursue objectives and address complex problems in neuroscience that are beyond the capacities of individual investigators. In order to promote human resource development in this critical area in an interdisciplinary manner, NBRC was accorded the status of Deemed University by the Ministry of Human Resource Development in May 2002. Today, NBRC offers an integrated M.Sc.-Ph.D. programme in Neuroscience which includes a rigorous one year course work.

Operating on the philosophy that 'a scientific institution should not exist in isolation but share with others', NBRC is very well networked with a large number of national and international institutes. In addition to being networked on the Virtual Private

Network of the Department of Biotechnology, NBRC has setup its own network with institutions across the country. Currently 47 centres throughout India are linked to NBRC. On one hand this networking is aimed and helps to prevent unnecessary duplication of work and facilities. On the other hand, it facilitates sharing of expertise and available infrastructure for mutual benefit. This mutual handholding is important since major achievements in neuroscience are today being made by bringing together scientists working in different disciplines into main stream neuroscience and brain research programs.

In addition to networking with institutions within the country, NBRC also has cemented several international collaborations for its various research initiatives. MoU's have been signed with various international institutes like the National Institute of Mental Health, USA; Pavlov Institute, St Petersburg; RIKEN Brain Science Institute, Japan; Italian National Research Council, Italy; Montreal Neurological Institute, Canada and Howard Florey Institute, Australia.

It has to be recognised that neuroscience as a discipline is still in its nascent stage, not just in India but across the globe. Causes of several age-related neuro-degenerative disorders such as Parkinson's disease or psychiatric disorders like Attention Deficit Disorder (ADHD) & Schizophrenia and many other ailments are still a mystery. Finding cures to these diseases is a major challenge facing humanity today. To unravel these mysteries and to overwhelm these challenges requires a concerted multidisciplinary effort involving professionals from the cutting edge of different fields of science. Realising this need, NBRC has set up a Digital Library that provides the Indian neuroscience research community instant access to as many as 393 online journals in addition to, references, papers, full text articles and copies of reprints of relevant literature in the electronic mode.

Obviously the journey from an idea to the reality of a full-fledged institute has not exactly been a cakewalk. NBRC has had its fair share of challenges and the biggest of these has been to get the best talent in the field. Yet, over the years the centre has witnessed an increasing talent pool of scientists from different disciplines which is complemented by a growing community of bright students. It is this team of professionals that has brought NBRC to its current status and that too in such a short span of time.

"The mandate given to NBRC was simple!: bring together the best brains in the field of neuroscience to understand the complexities of, well, the brain itself!"

"NBRC has had its fair share of challenges and the biggest of these has been to get the best talent in the field."



National Brain Research Center

Set up on a sprawling 38 acres in Manesar, Gurgaon (a breezy 40 minutes drive on the state of the art NH-8) NBRC provides professionals with just the right environment for pursuing their goals. The lush green campus outside only adds to the state-of-the-art technological infrastructure that rests inside. With its technical infrastructure and a competent team of professionals, NBRC is all set to scale even higher peaks and leave its distinct mark in the field of neuroscience.

The vision that NBRC holds is to not only grow into a world-class institute for brain research but also create a vibrant, active neuroscience community by catalysing the overall growth of this discipline in the country. The expected benefit from this initiative would be the generation of skilled manpower in this frontier area of science. This initiative would also help Indian neuroscientists to participate in global research efforts as equal partners. The knowledge base generated from these efforts would help diagnostic tools and therapeutic strategies for treatment of brain-related disorders.



The Animal Facility Building of NBRC, which meets all the national and international standards.

The unique role of NBRC is to act as a node with linkages to other centres carrying out neuroscience research in the country. Acting in effect as the "hub of the wheel" rather than the wheel itself. A wheel that has left several milestones behind, but knows that it still has miles to go. ■



A Ph. D. in Biochemistry from Mysore University, Dr. Vijaylakshmi Ravindranath is the Founder Director of the National Brain Research Centre, Manesar. Dr. Ravindranath's research has centered on identifying the factors involved in differential drug response, often seen in patients with mental illnesses. She has also been studying the molecular mechanisms underlying the pathogenesis of neurodegenerative disorders such as Parkinson's disease and motor neuron disease. A winner of the prestigious S. S. Bhatnagar Award for Medical Sciences (1996), Dr. Ravindranath spoke to Biotech News about her vision for NBRC.

How did the idea of having an institute devoted to Brain Research or Neuroscience emerge?

Neuroscience is today the last enigma in terms of biological understanding; while much has been done on other fronts of life sciences, human brain still remains a mystery. This inspite of the fact that a third of the deaths in this world are caused by brain disorders. Though there are good clinical facilities in the country but there has been no initiative focused on brain research and this was the driving force behind establishing the National Brain Research Centre.

What are NBRC's strengths as a research institute?

NBRC is the only facility in the country which is devoted to brain research. NBRC has world class infrastructure on the one hand and a veteran inter-disciplinary team of scientists that has professionals ranging from engineers and clinicians to psychologists, on the other. It is on account of this infrastructure and expert team that in a span of merely 3-years since its inception, the Centre has earned the status of a Deemed University.

What is your vision for NBRC?

The effort to understand the structure, function, and development of the brain in health and disease represents one of the great scientific challenges of the 21st century. Some remarkable developments occurred in the physical sciences in the 20th century. However, it is now anticipated that the major contributions in science would come from biology in general and neuroscience in particular in the new millennium.

This is just the third year of NBRC's existence and there are many milestones yet to be crossed. Neuroscience is an emerging field and has a big market, but there is much research to be done. A reflection of this is the fact that except for infections, there is no cure for any brain disorder. NBRC and its network of institutions seeks to understand how the human brain performs complex functions such as learning, memory, the linking of mind and behavior with brain, as also serious health-related issues.

What has been the biggest challenge in establishing NBRC and bringing it to this stature today?

Needless to say that establishing a centre of this scale was a daunting task even in terms of logistics. But we could do that with constant support from DBT. The next challenge was to get hold of the best of talent in the field to join and contribute to the mission of NBRC. We have been fortunate enough to have a committed pool of scientists who have constantly endeavored towards taking NBRC to new heights.



From labs to the market

Shrimps get a helping hand

In a small but elegant ceremony on 28th June, 2006, Dr. P.K Abdul Aziz, Honorable Vice chancellor of Cochin University of Science and Technology (CUSAT) handed over the technology transfer agreement for “*Bioreactors for Nitrifying Water in Closed System Hatcheries of Penaeids and Non-Penaeid Prawns*” to Oriental Aquamarine Biotech, India (P) Ltd., (a cochin based aquaculture firm). The technology will help augment production of organically produced shrimp seed of internationally acceptable quality.



Dr. P.K. Abdul Aziz hands over the agreement to Shri Mohan Kandaswamy, M.D., Oriental Aquamarine Biotech India (P) Ltd., Coimbatore, transferring the bio reactors technology. Also in the picture Dr. I.S. Bright Singh, the inventor.

Apart from a one-time transfer fee of Rs. 15 lakh, the university will also receive a royalty for a period of 5 years.

The technology, that has since been patented, was developed under the leadership of Dr. I. S. Bright Singh, Reader, Department of Marine Biology and Coordinator of the National Centre for Aquatic Animal Health Centre (NCAAHC) with Dr. Rosamma Philip, Senior Lecturer (Microbiology), Department of Marine Biology, Microbiology and Biochemistry, School of Marine Science, Cochin University of Science and Technology. Their efforts were supported by a grant from Department of Biotechnology to National Centre for Aquatic Animal Health Centre.

Taking a shot at Typhoid

Surveillance studies conducted by AIIMS in slum clusters of Delhi have indicated that peak incidence of typhoid amongst young children matches the same in adults in terms of severity. With rising multi drug resistance the disease has become difficult as well as more expensive to treat. Efficacious vaccines help control increasing morbidity and mortality thereby reducing pressure on healthcare systems.



Dr Poornima Sharma of BCIL handing over technology license agreement for Conjugate Typhoid Vaccine to Dr. P. Tiwari, M.D., USV Ltd in the presence of Dr. M.K. Bhan, Secretary, DBT and Prof. Jakob John (CMC, Vellore).

A new conjugate typhoid vaccine developed by a team of AIIMS scientists (Dr. B.L. Jaikhan, Dr. M. K. Bhan, Dr. Ramesh Kumar, Dr. Sanjukta Sengupta and Dr. Shabirul Haque) has shown promising results in animal studies in terms of inducing T-Cell dependent immune response. In this effort supported by DBT, this vaccine has been developed by conjugation of Vi capsular polysaccharide of *Salmonella typhi* to recombinant carrier protein obtained by the same organism.

This vaccine is effective even in children below 2 years of age and hence has a higher potential to prevent typhoid fever more effectively. Also, it can be administered with other vaccines used in routine childhood immunization programs.

The technology for the new vaccine has now been transferred to M/s USV Limited through a license agreement to upscale, manufacture (cGMP grade) and conduct pre-clinical toxicological studies/human clinical trials for this novel conjugate typhoid vaccine. ■

“This vaccine may be effective even in children below 2 years of age and hence has a higher potential to prevent typhoid fever more effectively.”



Vacation Program on Bioresources Focus on the Generation Next

Manoj Dabas & Anamika Gambhir,
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Kaleidoscope

"At the end of the day the battle to save biodiversity and sustain bio-resources will not be won in laboratories or corridors of power. If at all, it will be won in the minds of the people..."

Despite all the technological development and scientific discoveries in the last few centuries, human existence is still as much founded on the bedrock of biodiversity as it was in pre-historic times. Biodiversity makes available a myriad of goods and services critical for human survival on planet earth. Yet, it is the same biodiversity that we most often take for granted. Biodiversity and bio-resources are today under grave threats from over exploitation and unsustainable management. Indeed a large number of agencies are engaged in finding technological and managerial answers to the question of how we can better manage our biological heritage.



However important these efforts may be, and indeed they are, at the end of the day the battle to save biodiversity and sustain bio-resources will not be won in laboratories or corridors of power. If at all, it will be won in the minds of the people. It is hence critical that we create a broader constituency of support for efforts to safeguard and augment our biological heritage if we are serious about passing on a richer and more vibrant planet Earth to the generations ahead of us. And when it comes to absorbing a message well delivered, there is no better deal than young children in formative years of their lives. It was this back-of-the-envelope logic that led the National Bio-resource Development Board (NBDB) to support about half a dozen programs called Vacation Program on Bio-Resources (VPBRs as they are now called in short) in different parts of the country in the summer of 2002. And given the response and feedback that VPBRs generated, there has been no looking back.

A typical vacation program is of 4 weeks duration, has about 30 participants and most importantly, is residential. The objective of each VPBR is to expose the participants to the grandeur and mystique of the world of bio-resources and also make them aware of the threats and challenges that seek to undermine them, much to the peril of humanity.

The trick is to select a band of bright young students and activate their curiosity about the world around them by exposing them to core concepts of, and leading experts on various facets of the biotic world. This is supplemented by hands on project activities, visits to premier scientific

institutions and laboratories in vicinity of the program locations. "The design of a VPBR is such that you learn about something new on a black board one day and the next day you would probably be seeing or doing it in a big laboratory in the company of someone really topnotch in that particular subject. While that is wonderful, equally moving is the fact that in a VPBR you start the 4-week program with 30 strangers and part with 30 lifetime associates when the program ends" says Divya Pathak, Carmel Convent School, New Delhi who participated in a VPBR last summer.

Participants of a VPBR do hands on projects, design science based models, develop web pages, interact with rural communities as much as they do with top of the line scientists. Evenings are spent in watching educational films or preparing for a skit to highlight an issue related to bio-resources or just amaze up during a lecture or a field trip during the day.

Vacation Program on Bioresources

Focus on the Generation Next



debating with each other on issues that came up during a lecture or a field trip during the day.

Every year VPBRs create a new, enlightened brigade of roving lifetime ambassadors who share and articulate the concern for bio-resources in various walks of life. VPBRs also benefit the participants by exposing them to the wide variety of



careers that have something or the other to do with bio-resources. It is not a mere coincidence that participants are essentially the students who have just appeared in high school (Xth) examinations and are on the verge of making important choices about their career trajectories and professional goals. "I have had students returning after attending the Vacation Program on Bio-resources and informing me of a change in their plans about choice of subjects in 11th class after having consulted their parents" echoes Ms. Gayatri Ramachandran of St. Columbas School, New Delhi.

"VPBRs have a flip side too", argues Dr. R L Srivastava, IFS (Director, Arid Forest Research Institute, Jodhpur), "They give a chance to scientific professionals to get out of their all-important labs and interact with the generation next. Such interactions are necessary to bring back science as a preferred career option among the vast number of choices available to youngsters. It is one thing to talk to 100 fellow scientists for a day, but holding attention of 30 restless youngsters for an hour is a different ballgame altogether."

Till date 41 VPBRs have been conducted by DBT in collaboration with following institutions:

Centre for Environment Education, Ahmedabad
Wildlife Institute of India, Dehradun
Institute of Himalayan Bio-resources Technology (IHBT), Palampur
M.S. Swaminathan Research Foundation, Chennai
National Museum of Natural History, New Delhi
National Facility for Marine Cyanobacteria (NFMC), Tiruchirappalli
National Botanical Research Institute, Lucknow
Centre of Advanced Study in Marine Biology, Chennai

Bombay Natural History Society, Mumbai
Environment Protection Training and Research Institute, Hyderabad
Gujarat Council of Science City, Ahmedabad
Department of Environmental Sciences, University of Pune, Pune
Bharathidasan University, Tiruchirapalli
Loyola Institute of Frontier Energy, Loyola College, Chennai
School of Studies in Zoology, Jiwaji University, Gwalior
College of Agriculture & Plant Biotechnology Centre, Bikaner
Bharati Vidyapeeth Institute of Env. Education and Research, Pune
Thiagaraja College, Madurai
Regional Research Station, Rewari, Haryana
PSG College of Technology, Coimbatore
Salim Ali Centre for Ornithology and Natural History, Coimbatore
St. John's College, Palayamkottai, Tamil Nadu
Ashoka Trust for Research in Ecology and the Environment, New Delhi
Alagappa University, Karaikudi
Shri AMM Murugappa Chettiar Research Center (MCRC), Chennai
College of Agriculture, Vellayani, Thiruvananthapuram
Agricultural College and Research Institute, Madurai
Ashoka Trust for Research in Ecology and the Environment, Bangalore

In the words of Mr. R. S. Rana, Principal, Kendriya Vidyalaya, Hindon, Ghaziabad (U.P.) "Just one such program for the entire NCR region is much too less and we sure can have more of them to give eager students a chance and get a glimpse of possibilities that bio-resources and biotechnology signify. We sure need to multiply the number of VPBRs run every year".

NBDB has set the ball rolling and established beyond doubt that there is a tremendous hunger for such knowledge-based programs provided they are designed and executed professionally. 1100 participants in VPBRs since 2002 is a good start. It is hoped that with the success of VPBRs, more agencies in the country will come forward and design similar



initiatives. There is already evidence of that happening. Indeed this is just one, but a very important way to enable the country's generation-next to take India to its rightful place in the hierarchy of the knowledge powers of the world. ■

"It is one thing to talk to 100 fellow scientists for a day, but holding attention of 30 restless youngsters for an hour is a different ballgame altogether..."

R.L. Srivastava
Director, Arid Forest
Research Institute,
Jodhpur



News and Happenings

News Desk

Biotechnology goes rural

Prof. V. L. Chopra, Member, Planning Commission inaugurated the Rural Bio-Resource Complex (RBRC) set up by DBT at Tubagere Hobli, Bangalore Rural District in Karnataka. Dr C Chennigappa, Hon'ble Minister for Forest, Ecology and Environment, Government of Karnataka was the chief guest at the simple but elegant ceremony held on June 9th, 2006. Also present were Dr. N Sheelvantar, Vice Chancellor, University of Agricultural Sciences and Dr. S Natesh, Sr. Adviser, DBT.

RBRC is the only initiative of its kind in entire south India and is one among the 5 RBRCs funded by DBT in different parts of the country. In his inaugural address, Prof. Chopra underlined his concern at the difficulties and distress faced by farmers in



Lighting the lamp

(L-R): Dr. S. Natesh, Dr. C. Chennigappa, Dr. V. L. Chopra & Dr. N. Sheelvantar

the country due to low prices of farm produce, which to a significant extent can be attributed to the lack of organised marketing systems and infrastructure. He expressed hope that RBRC will become a model (and replicable) mechanism to provide the farmers with necessary market linkages thereby enhancing rural livelihoods.

In his keynote speech, the Chief Guest Mr. Chennigappa stressed upon the importance of forestry in preservation of environment for present and future generations. Dr. S Natesh, Senior Adviser, DBT gave an overview of the RBRC project to the assembled dignitaries that included farmers, local leaders from zilla and taluk level institutions, in addition to scientists and officials of various agencies and departments.

Jeev Sampada: The Digital Bioresource Inventory

Can't figure out where does one find Sal forests in India! Can't guess which plants have therapeutic properties to cure Asthama!! At a loss to understand why you do not find deodar

trees in Karnataka? Have a heart!, help is just a mouse click away!

"Jeev Sampada" the first-ever digitised inventory of India's splendidly diverse bioresources was released by Mr. Kapil Sibal, Hon'ble Minister for Science & Technology and Ocean Development on the occasion of the 4th meeting of the National Bio-Resource Development Board on 25th July at New Delhi.

Jeev Sampada can be accessed by anyone who has a Windows based PC and a set of 9 Jeev Sampada CD's. Spread across 9 CDs and adding upto 7 GB (gigabytes) of data, Jeev Sampada is the largest database on bio-resources of India. One click of the mouse and Jeev Sampada opens a door to data on 39000 species in addition to images and maps. The icing-on-the-cake is an interactive data retrieval system. If that is not enough!, one can pour over 10 modules on taxonomy distribution, uses, chemical composition, economic potential and other literature on 2,700 medicinal and



The Honorable Minister releasing the Jeev Sampada CD pack in the presence of Dr. M. S. Swaminathan & Dr. M. K. Bhan

economically important plants, 9,000 species of animals, 17,000 microbes and 7,000 marine organisms. Over 400 scientists from 150 centres across the country worked together to complete this enormous task. This initiative was led by Dr. K N Ganeshiah of the University of Agricultural Sciences, Bangalore.

The potential users of Jeeva Sampada are also as diverse as India's bio-resources and include, just to name a few, students, teachers, ecologists, conservation-biologists, foresters, policy makers, patent offices and the common man. It can be hoped that Jeev Sampada will help create a more informed and a more empowered civil society. It will also enable policy makers to access ready and update information on bio-resources for a more well informed decision making in a sphere that is getting increasingly critical and more complex with each passing day.

"Difficulties and distress faced by farmers in the country due to low prices of farm produce, which to a significant extent can be attributed to the lack of organised marketing systems and infrastructure."

Dr V.L. Chopra
Member, Planning
Commission



4th Meeting of National Bio-Resource Development Board, New Delhi

4th meeting of the National Bio-resource Development Board (NBDB), Department of Biotechnology was held on 25th July, 2006 in New Delhi under the Chairmanship of Hon'ble Minister Science & Technology & Ocean Development, Shri Kapil Sibal. Prof. M.S. Swaminathan, Chairman, National Commission on Farmers, Prof. A.K. Sharma, Chairman, Steering Committee of NBDB, Dr. M.K. Bhan, Secretary, DBT and senior representatives from Ministry of Finance, Department of Science & Technology, Ministry of Environment & Forests, Department of Space, CSIR, ICAR, Department of Ocean Development and other senior experts were present.



NBDB Board members, principal investigators and DBT officials along with Honorable Minister

Set up in 1999 under the aegis of DBT, the vision of NBDB is to ensure development and sustainable utilization of bio-resources for nutritional, environmental and livelihood security. The mission of NBDB is to evolve a broad policy framework for accelerated R&D for development and sustainable utilization of bio-resources and an effective plan of action for economic prosperity of the nation through bio-resources using modern scientific tools.

Several initiatives have been launched under the aegis of NBDB since its inception. These can be broadly put into 3 categories: a) prospecting for genes and molecules; b) resource based programmes and c) capacity building. NBDB supported initiatives efforts have led to development of large number of botanical pesticides, bio-fertilizers and enzymes. Resource based programmes on sugarcane, coffee, jute and lac have been taken up. Five Rural Bioresource Complexes have been established for providing income as well as employment generation opportunities through bioresources with improved technology packages and clear market linkages. The first Butterfly Park of the country has been established at Banerghatta National Park, Bangalore which serves as an integrated centre for research, education and rural livelihoods.

Under capacity building major initiatives have been Bio-resource Gardens for the visually challenged and Vacation Programs on Bio-resources (VPBR's) for school children. More than 1100 school children have participated till date in VPBR's conducted in different parts of the country.

Speaking at the inaugural session of the meeting, Mr. Sibal underscored the need for sustainable management of bioresources and urged the members of the NBDB to consider the idea of making NBDB an autonomous institution. "The Board needs to have a separate identity. It needs to be provided with not only more funds to step up its activities but also a specific budgetary allocation for the next five years so that it could draw up a road map for better utilisation of country's bio-resources. This is the right time as the 11th Five Year Plan is being finalised" the minister opined.

In his address Dr. M S Swaminathan stressed upon the need to add value to bioresources "by linking them to the national missions in agriculture, food, health and employment generation".

During the 11th plan, NBDB seeks to concentrate on digitized inventorization, characterisation and conservation of bioresources of the country; informatics network on bioresources; sustainable utilization of bioresources for food & nutritional security and environmental safety; improving socio-economic and livelihood security through bio-resource related processes and products; infrastructure strengthening and capacity building.

Biodiversity Map Atlas released

Mr. Kapil Sibal, Hon'ble Minister for S&T and OD, released the Map Atlas generated under the project "Biodiversity characterization using remote sensing" on the occasion of the 4th Meeting of the National Bioresources Development Board on 25th July. The project under which the Map Atlas was created has been jointly implemented by Department of Biotechnology & Department of Space. As a part of the Phase 1 of the project, geo-spatial biodiversity data was generated for the North Eastern Himalayas, Western Himalayas, Western Ghats and Andaman and Nicobar Islands. Under Phase II of the study Eastern Ghats, Central India and Mangrove regions have been covered, 80% of the country's forest cover has been mapped. Over 58 scientists from 32 institutes have been involved in this exercise. This is the first extensive exercise conducted at different scales for different density of forest cover. The uniqueness of the study lies in the availability of location specific information for more than 5000 plant species. In the words of Dr. S Natesh, Sr. Adviser, DBT "as India attempts to record and protect its biodiversity, the library set up with inputs from secondary sources for available information in community and research bodies would be accessible to all."

"Add value to bioresources by linking them to the national missions in agriculture, food, health and employment generation."

Dr M.S. Swaminathan
Chairman, National
Commission on Farmers



News and Happenings

DBT-UNESCO join hands to set up Centre for Education and Training in Biotechnology

DBT and UNESCO signed a Memorandum of Understanding to set up a Regional Centre for Education and Training in Frontier Areas of Biotechnology (RECENTFAB). The MoU was signed by Dr. M.K.Bhan, Secretary, DBT on behalf of the Government of India and Dr. M.Nalecz, Director, Division of Basic and Engineering Sciences on behalf of UNESCO. The center will be funded by India and other UNESCO member countries in the Asian region.

While education and training shall be the main mandate of RECENTFAB, to achieve excellence it will have a strong focus



Dr. M.Nalecz, & M. K. Bhan signing the MoU in the presence of Shri Kapil Sibal

on research. This would entail focused research programs in cutting edge areas of biotechnology like nano-biotechnology, stem cell research, biosensors, agriculture biotechnology, environmental biotechnology, regulatory policies, bioethical and bio-safety issues. International partnerships will be central to RECENTFAB's approach to achieve global standards in its technology development work.

RECENTFAB would offer fellowships at post-graduate as well as doctoral level to enable international students to pursue studies and research in various areas of biotechnology at the center. Short-term training programs for teachers in biotechnology would also be conducted.

Set to come up in Delhi or one of its suburbs, two or three alternate sites are being evaluated for developing the required facilities and infrastructure for the proposed centre.

Symposium on "Molecular Genetics in Medicine"

Department of Haematology, Christian Medical College, Vellore organised a symposium on "Molecular Genetics in Medicine" on July 14-15, 2006. Organised under the aegis of DBT supported Training Center for Molecular Genetics in Haematological Disorders, the objective of the symposium was to expose postgraduate students from various medical disciplines to the field of genetics and its importance for medical science.

Conducted under the leadership of Prof. Mammen Chandy, the symposium received overwhelming response with more

than 135 PG students registering for the same. During the deliberations there were lectures on concepts and application of genetics from leading experts across the country. The subjects touched upon were pharmacogenetics, gene therapy, stem cell research, societal and ethical issues related to genetics and hands on training in laboratory techniques in molecular genetics.

DBT explores Canada

A two-member DBT delegation comprising of Dr. M.K. Bhan, Secretary and Dr. S. Natesh, Senior Advisor visited Canada during 27 May-3 June 2006 to explore possibilities of bilateral cooperation in the field of biotechnology. They were joined by Dr. N.S. Tiwana, Executive Director, Punjab State Council for Science and Technology, Chandigarh and Dr. S.S. Marwaha, CEO, Punjab Biotechnology Park, Chandigarh as representatives of the Government of Punjab.

Apart from interacting with more than 100 professionals in various positions, the delegation also visited a broad range of Canadian agencies and institutions active in the field of biotechnology. These included Agriculture & Agrifood, Canada; National Research Council, Canada; Plant Biotechnology Institute, Saskatoon; Veterinary & Infectious Disease



L-R: Dr. S. Natesh; Dr. Kuty K Kartha; Director General, Plant Biotechnology Institute, Saskatoon; Dr. M. K. Bhan, Secretary, DBT; Dr. S.S. Marwaha, Director (Biotech) PSCST; Dr. N. S. Tiwana, Executive Director (PSCST) & Dr. G. (Raj) Selvaraj, Plant Biotechnology Institute, Saskatoon

Development Organization, Saskatoon; Montreal Neurological Institute, Montreal; Laval Technopole, Montreal; Institute of Biodiagnostics, Ottawa; Canadian Light Source, Saskatoon; Agwest Bio, Saskatoon; and Proteins, Starch & Oil, Saskatoon.

Speaking to Biotech News, the members of the delegations pointed at some prominent conclusions drawable from the Canadian experience. Specifically: a) It is vital to have a balanced development of the basic, translational and product development capacity; b) Research institutions, to be actively engaged in innovation, should not be built in isolation. Innovation clusters are essential for promoting enterprise.; c) Clustering does not mean mere co-location. d) Small and medium sector biotech companies are a major source of innovation; however, they require not only risk capital but also scientific mentorship. e) There is a large and perceptible gap



often referred to as “the valley of death” between the research lab and the rough and tumble of the market place. Interface agencies and mechanisms are essential to bring innovation partners together.

The visit also helped uncover several collaborative possibilities and fathom the level of institutional interest in the f



Dr. N. Lee Pengilli, College of Pharmacy & Nutrition, University of Saskatchewan explaining various recipes from flax to the delegation from India.

same. For instance: Agriculture and Agri-Food Canada (AAFC) has expressed willingness to sign a MOU with DBT specifically for collaboration in agriculture biotechnology and food sciences and environmental stewardship. The draft MOU is now under study. National Research Council, Canada is keen to explore possibilities of collaboration in the areas of vaccines, health and wellness, especially functional foods and nutraceuticals. Plant Breeding Institute, Saskatoon will be willing to look at collaborations in the areas of genomics, plant metabolic engineering and plant-based medicine. The PBI is also likely to provide expertise and technical help in the setting up of the Institute of Agri-food Technology proposed to be set up as an autonomous institute of DBT in Punjab as part of an agri-food cluster. The University of Saskatchewan has shown interest in collaborating with Indian Universities on a 4-year integrated degree programme (2 years in India + 2 years in Canada) in the area of food sciences. Agwest Bio an association of agri-food industries in Canada was upbeat about collaborating with Indian counterparts. The possibility of creating an Indo-Canada Biotech Forum was also discussed. ■

Have an interesting thought? Share it with Biotech News!

Biotech News invites crisp write-ups (not exceeding 250 words) outlining your thoughts on education, innovation, commercialization and other related issues in life sciences and biotechnology. Every writeup selected for publication will get the author an honorarium of Rs.1000/-.

So what are you waiting for? Pick up your pen and get cracking!!

Email your write-up to biotechnews@dbt.nic.in

The Power of Proteomics (Continued from page 6)

several matrix enhancers which also help in better ionization and suppression of matrix adducts. Standard peptides should also be spotted, for calibration, as close as possible to the actual spot. We use close external method of spotting. The use of internal standards, at times, masks the real peaks and hence this method may not be useful. In addition, if the trypsin used for digestion is good, one may not find any auto digest products.

3. MALDI Analysis

Though fairly straight forward, it is important that one knows about the instrument to a certain extent. Care is needed in the calibration of the instrument, laser power and resolution used for analysis.

4. Peptide mass list analysis using search engine

In the final step, the list of peaks is filtered to remove the contaminating keratin peaks. Removal of these peaks will improve the score. One should also use more than one

database for identification purpose. MASCOT is the most common search tool, but Protein Prospector also has a good search tool. The interpretation of the results from these search tools is fairly simple and good online help is also available for each of the tools.

Peptide mass fingerprint is the most commonly used identification method. However, the availability of MS/MS data of the selected peptides will help further in the identification process. There are other options, such as drivatisations using SPITC, which allows one to look at the 'y' ions alone. Apart from the analysis of unmodified peptides one can also identify post-translational modifications such as glycosylations and phosphorylations in MALDI.

Both 2D and MALDI are now being used as very sensitive quantitative tools for discovering minute variations at expression level. This article explains the effectiveness of the analytical methods used in proteomics. The applications of proteome analysis, particularly in biomarker discovery and clinical proteomics, have immense commercial potential. ■

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

[Http://www.biotechnews.gov.in](http://www.biotechnews.gov.in)

Call for Proposals

Stem cell research

DBT invites proposals for research on stem cells. Proposal can be for basic research, pre-clinical studies (employing stem cells in animal models of various diseases) and Phase-I clinical trial where proof of concept has been established through animal studies. Multi-centric and multi-investigator proposals will be encouraged so long as role of various partners is clearly defined with milestones/time schedules.

Proposals can also be submitted for "Centre of Excellence" for establishment of core facility or infrastructure to handle stem cells.

Request for support for short/long training or fellowships in stem cell research in overseas institutions will also be considered. The applicants must be holding a permanent position in the institute/hospital in India.

To know more about priority research areas, timelines and other details please visit: www.dbtindia.gov.in or www.dbtindia.nic.in.

Indo-German joint call for research proposals in biotechnology

Proposals are invited for consideration under the INDO-GERMAN S&T COOPERATION AGREEMENT (Special arrangement in Biotechnology). The purpose of the programme is to stimulate new collaborations, e.g. the preparation of joint projects under national funding programmes. The programme facilitates bilateral cooperation in biotechnology between the scientific communities of India and Germany by way of joint research projects, bilateral workshops/seminar, exchange visits of scientists, scientific delegations and composite (scientific and industrial) delegation. Priority areas identified for this particular request for proposals are:

- Microbial Biotechnology
- Bioprocess Engineering
- Structural Biology
- Development of cellular systems to rapidly screen pharmacological and therapeutic substances.

- New applications for bacterial enzymes
- New cell culture techniques

Scientists/faculty members working in regular capacity in Universities, national R&D Laboratories/ Institutes and private R&D institutes can apply under this programme.

For full details regarding the call for proposals please visit DBT web-site : www.dbtindia.nic.in

Associateship for young scientists: 2006-07 (for specialised training in niche areas of biotechnology)

To further augment the level of scientific excellence in the country, Department of Biotechnology applications are invited from young Indian nationals for specialized training in cutting-edge biotechnology in overseas research institutions/laboratories. The niche areas identified for this purpose are:

- Medical genetics
- Stem cell research
- Nano-biotechnology
- Transgenic animal models
- Agricultural Biotechnology
- Bio-engineering (tissue engineering, biosensors, biomaterials, medical devices, and implants)
- Seri-biotechnology.

Applicants should hold regular/ permanent positions in a government recognized research and academic institution / university and be actively engaged in research in the niche areas mentioned above. They should also be below the age of 40 (at the time of the application).

The fellowship provides for to & fro economy class airfare, a stipend of US \$ 2400 per month and a one-time preparatory allowance of Rs. 12,000.

For full details regarding the programme and the application procedure please visit: www.dbtindia.nic.in

Recent Publications by Department of Biotechnology

