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Bioresearch ramps up in public labs

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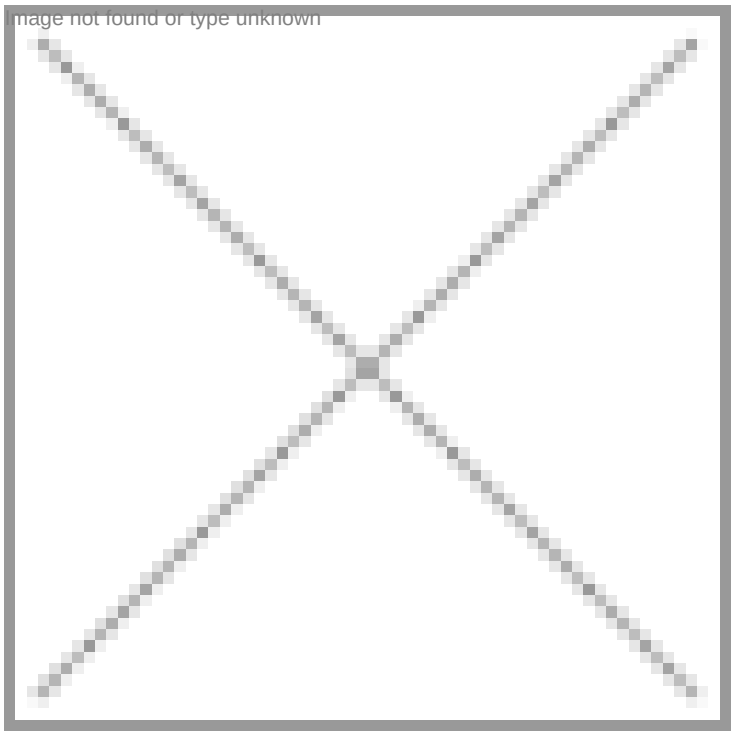

Bioresearch ramps up in public labs

Science and technology research in India is mostly government-sponsored. Over 85 percent of Indian scientific research currently happens in the public-funded laboratories which have been silently conducting excellent research.

India has a huge infrastructure and research network in place driven by nodal agencies like Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR) and the Department of Biotechnology (DBT). A number of institutes falling under these agencies have a focused research mandate in biotechnology and they have been doing excellent basic and applied research.

For instance, till 2002, about 45 technologies were transferred by DBT to the industry. During the last three years, nearly 20 more process transfers took place as a result of which about seven products have been launched in the market. Six transgenic crops (chick pea, groundnut, mustard, pigeonpea, rice and tomato) developed by agriresearch institutes like the ICRISAT, Hyderabad and IARI, New Delhi, were approved for limited field trials during last year.

The CSIR has over 200 patents in the area of biotechnology and it has been constantly among the top three in the list of Top 50 PCT filers brought out by the World Intellectual Property Organization (WIPO) for the developing countries. In fact it has maintained a 30-40 percent share of the US patents granted to Indians in India. Till March 2004, the total number of biotech patents filed through the DBT was 124 of which 13 have been granted. During 2004-05, the DBT received 17 patent applications for filing and during this period one US and 3 Indian patents were granted taking the total number of patents

granted so far to 17. The R&D spend of DBT alone on various projects was Rs 132.5 crore during 2004-05 and in the current year, the budget earmarked for research is Rs 164 crore.

The Research Hubs

DBT Centers of Excellence

DBT, the nodal biotech agency in the country has set up seven autonomous institutes in the frontier areas of modern biology over a period of time, which facilitate focused research. These are Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad; Institute of Bioresources and Sustainable Development (IBSD), Imphal; Institute of Life Sciences (ILS), Bhubaneswar; National Brain Research Centre (NBRC), Manesar; National Centre for Cell Science (NCCS), Pune; National Centre for Plant Genome Research (NCPGR), New Delhi; and National Institute of Immunology (NII), New Delhi.

The major research thrusts at NII, New Delhi are directed towards molecular design, host pathogen interactions and immune physiology. It has developed diagnostic kits for detection of pregnancy, typhoid, hepatitis B and amoebiasis. The institute has developed, validated, and transferred the technology of two pregnancy kits, typhoid, hepatitis B, amoebic liver abscess and intestinal amoebiasis kits to the industry. NII has filed three patents in India and one in PCT while the NBRC, Manesar, a relatively young institute, is focused on neuroscience research. Says Prof Vijayalakshmi Ravindranath, director, NBRC, "This is the first institute in India devoted to the development and promotion of basic neuroscience. NBRC is an 'Apex Coordination Center' for neuroscience research in India and the major research areas include computational neuroscience, system and cognitive neuroscience, stem cell research, developmental neurobiology and basic research towards understanding of neurological and psychiatric disorders".

The research areas being pursued at CDFD, Hyderabad include genetics, epidemiology and diagnostics of childhood blindness; cancer biology and metastasis of HPV induced cervical cancer; structural and functional genomics of Mycobacterium tuberculosis; silkworm genome sequencing partnership at the global level; sequencing of the Mycobacterium W and computational biology. The NCPGR, New Delhi carries out research related to the nutritional, structural, and functional genomics aspects of various plant systems with the ultimate goal to manipulate plant genes to breed improved varieties of crop plants. The Centre is currently engaged in plant genomic research with focus on structural and functional genomics for crops like chickpea, catharanthus, potato, tomato, lathyrus, rice, sweet potato, and cassava.

The NCCS serves as a National Cell Repository for cell lines and hybridomas and has supplied 1017 cell lines to 163 scientific institutes in India during the last year. It is involved in cell biology, cancer biology, immunology, diabetes, signal transduction, and gene regulation research. During the last few years, the NCCS has drawn special attention towards stem cell research in India. In the stem cell biology area, it has generated stable embryonic cell clones, which have the potential for neural cell lineage. The institute has obtained two US patents and filed applications for six more patents.

CSIR Institutes

With a network of 38 laboratories and 39 regional centers, the Council for Scientific and Industrial Research (CSIR) is one of the premier scientific industrial research and development organizations in the country.

About eleven CSIR institutions namely the Institute of Genomics and Integrative Biology (IGIB), Delhi; Centre for Cellular and Molecular Biology (CCMB), Hyderabad; Central Drug Research Institute (CDRI), Lucknow; Central Food Technological Research Institute (CFTRI), Mysore; Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow; Institute of Himalayan Bioresource Technology (IHBT), Palampur; Indian Institute of Chemical Biology (IICB), Kolkata; Institute of Microbial Technology (IMT), Chandigarh; Industrial Toxicology Research Centre (ITRC), Lucknow; National Botanical Research Institute (NBRI), Lucknow; and Regional Research Laboratory, Jammu (RRL-Jammu) have been carrying out focused research in biological sciences.

Five other institutes namely, Central Leather Research Institute (CLRI), Chennai; Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar; National Chemical Laboratory (NCL), Pune; National Environmental Engineering Research Institute (NEERI), Nagpur and National Institute of Oceanography (NIO) also carry out valuable biosciences research.

The development of "BioSuite", a bioinformatics software and "Sudoterb", a new molecule for the treatment of tuberculosis are some of the recent CSIR success stories under the NMITLI scheme. Agri biotechnology, genetic manipulation of microbes, molecular genetics, control of gene expressions and recombinant DNA products are some of the important areas of research in this wide spectrum of institutes. For example, IMTECH, Chandigarh a constituent laboratory of CSIR, carries focused R&D programs in four broad areas of microbial biotechnology: molecular biology and microbial genetics; protein science and engineering; fermentation technology and applied microbiology; and cell biology and immunology.

According to Dr Girish Sahni, director IMTECH, "The institute has an International Depository Authority (IDA) facility and has a collection of 10,000 microbes and more than 13500 cultures have been supplied to the academic and research institutes and the industry. Our Microbial Type Culture Collection holds 70 cultures for IDA deposit, 96 for filing national patents and nine under safe deposit."

Elaborating on the achievements of the institute, Dr Sahni said, "Some of our selected achievements include:

â€¢ A rapid easy and sensitive means of screening steroidal agonists and a function based assay system for detection of mutation in a steroid receptor gene that impairs normal receptor function

â€¢ A novel method to discover functions of genes, able to confer only subtle or difficult- to-screen phenotypes to yeast

â€¢ Studies on the structural elements in streptokinse (SK) that confer the high affinity to this protein for human plasminogen

â€¢ A new, protein-engineered version of streptokinase with improved clot specificity

â€¢ An ABC transporter that could be responsible for multidrug resistance in mycobacteria".

"Several of our process technologies have been commercialized and the most successful of them is a branded Natural Streptokinase product, 'STPase'. The other know-hows commercialized are: Energy Efficient Alcohol Technology and a vaccine prediction software tool 'Vaxipred'," he added.

About the future technology pipeline at IMTECH, he said, "In the future one of our technologies on the production of Recombinant Streptokinase and the other on Clot Specific Streptokinase are expected to be launched soon. We plan to commercialize an immunodiagnostic technology and an oral recombinant cholera vaccine as well. We have an ongoing program on generating more efficient strains of yeast, which would incorporate properties of floculation, thermo- and osmotolerant, etc. This is an on going program wherein several yeast strains with improved properties have been designed and patented. Many distilleries have shown interest in them." The total research budget for 2004-2005 for IMTECH, Chandigarh was Rs.1365 lakh, the allocation of which was done project-wise.

Likewise, CDRI, Lucknow, a pioneer in biomedical research, is working on many projects related to the development of new drugs and diagnostics.
According to Dr CM Gupta, Director, CDRI, "In the area of biotechnology we are presently working on the molecular biology of malaria, tuberculosis and leishmania pathogens for developing drug targets; structural and computational analysis of candidate drug molecules; fermentation technology related to development of drugs, drug intermediates, enzymes, amino acids and biotransformation products." The institute has developed diagnostic vaccines like PCR-based diagnostic probe for leishmaniasis, direct agglutination test (DAT) for leishmaniasis, LDH-based diagnosis of malaria, PCR based diagnostic probe for tuberculosis, and is currently developing a cholera vaccine.

ICAR

The ICAR promotes science and technology programs in agricultural research and education and carries out research directly through ICAR institutes and national research centers, project directorates and also in association with the State Agricultural Universities (SAUs) through the all India coordinated research project systems. While, the ICMR formulates, coordinates and promotes biomedical research in India. Its network consists of 21 Permanent research institutes/centers (national institutes) located in different parts of India and six regional medical centers.

Autonomous institutes

Some other autonomous institutes like the International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi, Indian Institute of Science (IISc), Bangalore, The Energy and Resource Institute (TERI), New Delhi, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad have made important contributions in the biotechnology domain.

The ICGEB, New Delhi is an independent inter-governmental organization under the UN system. According to Dr VS Chauhan, director, ICGEB, "We are looking into both human health and agriculture related plant biotechnology. With nine research groups working here, the main mandate is to do research and training in biotechnology and genetic engineering for the member countries and the developing world."

About the work happening at the Center, he said, "We are working towards development of malaria vaccine closely with industry and funding from the Department of Biotechnology (DBT) and MVI. We are also working towards development of Dengue diagnostic kit. Plant groups are working towards development of transgenic cotton, biotic and abiotic stress resistance plants and biopesticides. We are also concentrating on development of plant transformation system." "We have developed an HCV diagnostic kit jointly with AIIMS, New Delhi and the technology has been transferred to XCyton and marketed by GSK. This is now available in the market. We have also developed a biopesticidal formulation along with PDKV, Akola and the technology has been given to Nirmal Seeds, Pachora." The Centre has filed for three new patent applications and extended three patents to PCT.

Transgenic crops developed by Indian research institutes approved for conducting limited field trials in 2004

Crop	Institute	Transgene
Chickpea	ICRISAT, Hyderabad	cry1Ac and cry1Ab
Groundnut	ICRISAT, Hyderabad	coat protein of IPCV
Mustard	IARI, New Delhi	Osmotin, b-carotenoidsbarnase & barstar
	TERI,New Delhi	
	UDSC, New Delhi	
Pigeonpea	ICRISAT, Hyderabad	cry1Ab + SBTI
Rice	IMSSRF, Chennai	cytosolic Cu/ Zn SOD
	Osmania University, Hyderabad	gene from mangrove species Avicennia marina gna gene
Tomato	IARI, New Delhi	Osmotin

Source: DBT

Research Developments

The Indian Institute of Science, Bangalore, a premier research institute has developed over 20 potential leads available for product and process development in the areas of agriculture (genetically engineered plants), healthcare (vaccines and diagnostics) and drug development, which are being pursued by the institute. Some of its significant achievements include studies on characteristics of a non-activating voltage dependent potassium channel, high-level expression of glycoprotein hormones in Pichia and interactions of monoclonal antibodies with hCG. During the year, IISc scientists made 200 publications in national and international journals and five patents were filed.

A lot of basic and applied research is currently happening in the government-funded labs. Some of the recent research work, technologies developed, transferred and being perfected for transfer in the various areas is being profiled here.