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Medical Biology

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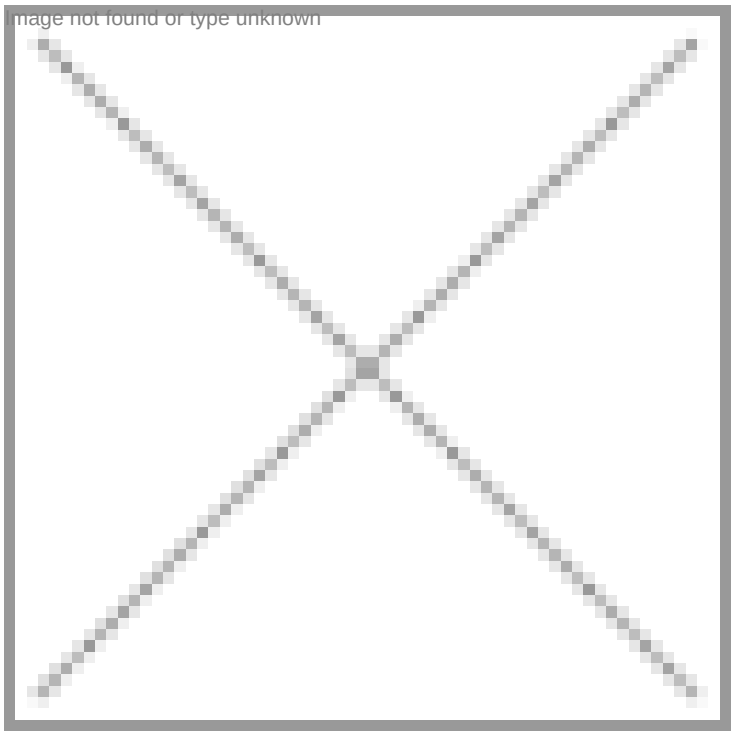

Medical Biology

In medical biology and biotechnology, the focus has been on new biology and product development. Active research is going on in genomics, proteomics, molecular basis of disease, pharmacogenomics, stem cell biology, nanobiotechnology and other frontier areas. The product development focus is on new generation vaccines, diagnostic kits and therapeutics. In the area of isolation and characterization of new therapeutic agents, about sixty medicinal plants have been screened for anti-cancer, anti-diabetic and immunomodulatory activity using in vitro bioscreens under a multi institutional program at Anna University, Chennai; NII; New Delhi and Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow. Thirty lead molecules including 12 anti-cancer, three anti-diabetic and 15 having immunomodulatory properties have been identified.

Various institutes have been doing R&D on cholera, tuberculosis, rabies, HIV, malaria, Japanese encephalitis vaccines among others. While the aim in diagnostic development efforts is to achieve real time performance and affordability.

Vaccines

An indigenous recombinant oral vaccine based on VA1.3 strain of V. cholerae has been developed at Institute of Microbial Technology (IMTECH), Chandigarh and National Institute of Cholera and Enteric Diseases (NICED), Kolkata. Its extended Phase-I/Phase-IIa clinical trials have been undertaken, while a new vaccine strain VA1.4 without the ampicilin marker has been prepared by IMTECH, Chandigarh and is currently undergoing toxicological studies. Simultaneously efforts are being made to develop newer vaccines for tuberculosis realizing the limiting potential of currently used BCG. At IISc, Bangalore,

recombinant forms of two promising candidate T-cell antigens of M. tuberculosis are being tested for immune response. And the results are looking promising. While a group at the University of Delhi, South Campus is working on recombinant approach for development of novel candidate vaccine/s against tuberculosis.

Meanwhile scientists at IISc, Bangalore along with Indian Immunologicals Ltd, Hyderabad have developed the world's first combination Rabies vaccine for control of rabies in dogs. The vaccine was found to confer 100 percent protection in experimental animals. Indian Immunologicals Ltd will commercialize this vaccine after successful completion of multicentric animal trials and approval by regulatory authorities. Scientists at the NII, New Delhi have developed a vaccine based on Indian strain of Japanese Encephalitis Virus (JEV) and the technology has been transferred to Panacea Biotech Ltd, Delhi, for further testing and commercialization. A candidate DNA vaccine for JEV has also been developed by NII and experimental studies are presently under progress.

A prototype candidate vaccine for the HIV-I Subtype 'C' has been developed based on plasmid DNA and MVA (Modified Vaccinia Ankara) approaches at the All India Institute of Medical Sciences (AIIMS), New Delhi. The prototype vaccine is now ready for preclinical toxicological studies. Negotiations with an Indian industry are also in progress for GMP grade production of vaccinogens and to conduct human clinical trials.

Animal Healthcare: Vaccines and Diagnostics

In the area of animal biotechnology, R&D efforts are on for increasing the animal productivity, development of newer animal vaccines, diagnostics, molecular characterization of indigenous breeds of livestock and animal byproducts.

Commercialization of technology

Title of the technology	Institute where developed	Technologycommercialized by
JEV chex, a rapid detection kit for the	AIIMS, New Delhi	XCyton Diagnostics Limited
Japanese Encephalitis in human CSF and serum		
Liposomal Amphotericin-B for treatment of systemic mycosis and kala-azar	Department of Biochemistry, UDSC, New Delhi	Lifecare Innovations Pvt. Ltd, Gurgaon
Immunodiagnostic kits for detection of virus and bacteria in finfish and shellfish	Central Institute of Fisheries Education, Mumbai	Agrivet Farm Care Pvt. Ltd., Bangalore

The New Delhi based Jawaharlal Nehru University (JNU) developed a technology for the production of recombinant anthrax vaccine and transferred it to Panacea Biotech. An ELISA based diagnostic kit has been developed for monitoring the level of antibodies of Haemorrhagic septicaemia vaccinated animals at Haryana Agricultural Univeristy, Hissar. The kit has been validated as per OIE guidelines and tested at various centers. A blocking ELISA and multiplex PCR test has been developed for the characterization and diagnosis of bovine viral diarrhea virus isolates at HSADL, Bhopal. This has also been evaluated as per OIE guidelines. A strip test for the diagnosis of peste-des-petitis ruminant virus has been developed under a network project being implemented at TANUVAS, Chennai and IISc, Bangalore. The strip test is a single step user-friendly diagnostic kit.

Biofuels and Bioenergy

At IIT, New Delhi, active research on biofuels and bioenergy is being conducted and sweet sorghum juice and sorghum grains are being used as a raw material for ethanol production. Further work is on to develop complete technology package for transfer to industry. Simultaneously attempts are also being made to use different lignocellulosic raw materials for ethanol production. Another area being actively worked upon is the efficient utilization of lignocellulosic wastes. Studies have been taken up to construct novel recombinant cellulolytic bacteria for ethanol production from cellulosic material at Madurai Kamaraj University. Studies are also being conducted to improve upon cellulolytic fungi for cellulase production at Haryana Agriculture University, Hissar.

Meanwhile, NBRI, Lucknow has collected species of Pongamia pinnata, Madhuca indica and Salvadora oleoides from Rajasthan and Uttar Pradesh and analyzed for their oil content and fatty acid triglyceride composition. The transesterification of Pongamia oil at pilot scale has been done and one engine run has also been made. Diesel engine has also been tested using biodiesel. Presently the work on Mahua and process engineering for homogenous catalyst process is underway.

Microbial and Industrial Biotechnology

Various research institutes are developing novel products and processes and generating R&D leads for utilization by various biotech industries. Some important leads being worked upon are: high Gibberellic acid production has been achieved from a selected Gibberella fujikuroi mutant at NCL, Pune; work is in progress towards development of process for mass production of targeted delivery of antigens through nanoparticles using sendai virus system at University of Delhi; CFTRI, Mysore is working on production of lipoxygenase and human platelet aggregation inhibitor through fungal fermentation; at JNU, New Delhi, recombinant asparginase has been purified directly from the culture medium using a rapid two-step purification strategy; NCL, Pune is working towards assessing effectiveness of cellulase treatment in bio finishing of denim at a pilot scale; a solvent tolerant strain of Pseudomonas aeruginosa has been isolated at IIT, New Delhi, which produces extracellular protease and lipase, both exceptionally stable in presence of wide range of organic solvents at high concentrations and the pilot scale reactor for a novel high cell density process for dairy wastewater treatment has been designed and fabricated at IIT, New Delhi and installed at DMS, New Delhi.

Agricultural Biotechnology

In the area of agribiotech research, the Delhi University is pursuing studies on production and characterization of osmotic stress tolerant transgenic plants of Brassica juncea. IARI and NCPGR are jointly working on development of molecular marker based linkage map for chickpea. The NCPGR has also developed nutritionally enriched potato lines by transfer of Ama1 gene of Amaranthus. The transgenic potatoes accumulate proteins in large amounts with considerable increase in the amount of essential amino acids. To remediate oxalate toxicity in vegetables and grain crops, transgenic tomato have been developed using OXDC gene, which have very low content of oxalate and tolerant to fungal infection. Both these crops are under field trial. A high artemisinin content and high leaf yielding variety of Artemisia annua cv Jeevanraksha has been developed by CIMAP and technology transferred for commercialization.

Technologies assigned for transfer

Title of the technology	Institute where developed
Urokinase production in hollow fiber reactor	IIT, Delhi.
Alkaline protease for leather processing	NCl, Pune and CLRI, Chennai
Cellulase for textile industry	NCL, Pune.
Technology for lipase production	University of Delhi, South Campus
A method for rapid detection of AflatoxinB1 using ELISA	NCB, Kolkata
PCR based diagnostics assay for bovine tuberculosis	New Delhi Department of Biotechnology, AIIMS,
Vi-conjugate typhoid candidate vaccine	AIIMS, New Delhi

Source: DBT

Six institutes namely IARI, New Delhi; ARI, Pune; DWR, Karnal; PAU, Ludhiana, CCS University, Meerut and NCL, Pune are participating in a network research project on wheat quality breeding. Similarly another multi-institutional project on gene expression profiling during flower and seed development and functional validation of identified genes is being implemented at five institutions namely, UDSC, New Delhi; DRR, Hyderabad; Osmania University, Hyderabad; IISc, Bangalore and MKU, Madurai.

Meanwhile, the University of Delhi, South campus, and IARI have spearheaded the Indian initiative for International rice genome sequencing project and have fulfilled the Indian commitment to the project for 2004.

A number of universities and institutes are working in the area of biofertilizers.

The University of Hyderabad, MS University Baroda, National Research Centre for Plant Biotechnology, IARI; UAS Dharwad, BARC Mumbai, UDSC, PERI are working on development of transgenic microorganisms (Azotobactor, Rhizobium, Pseudomonads, Cyanobacteria, Azospirillum, AM fungi) with high efficiency for nitrogen fixation, and phosphate solubilization are in progress.

Many programs are currently running to control major weeds and pest diseases of important crops, vegetables, plants and to increase their productivity through various biocontrol agents. For example, at RRL, Jammu, in-vitro production of Steinernema carpocapsae on semi-solid state has been standardized and methodology for cottage scale production has been up scaled. The virulence of the material was found to be very good. Fermentation based mass production technology for production of nematode S. carpocapsae is also being standardized. At IIPR, Kanpur, entomopathogenic nematodes (EPN) have been used as a tool of biological control for lepidopteran borer complex infesting pigeonpea. At IARI, New Delhi, characterization of potential biopesticide molecules from fungal biocontrol agents is being carried out.