

MINISTRY OF SCIENCE AND TECHNOLOGY

DEMAND NO. 83

Department of Biotechnology

A. The Budget allocations, net of recoveries, are given below:

		<i>(In crores of Rupees)</i>								
Major Head	Budget 2005-2006			Revised 2005-2006			Budget 2006-2007			
	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	
Revenue	443.00	13.60	456.60	389.00	13.60	402.60	521.00	13.60	534.60	
Capital	2.00	...	2.00	...	...	...	...	...	...
Total	445.00	13.60	458.60	389.00	13.60	402.60	521.00	13.60	534.60	
1. Secretariat - Economic Services	3451	...	4.90	4.90	...	4.90	4.90	...	5.05	5.05
Other Scientific Research										
2. Assistance to Scientific Institutions/Professional Bodies										
2.01 National Institute of Immunology	3425	32.00	0.80	32.80	31.02	0.80	31.82	36.00	0.70	36.70
2.02 National Centre for Cell Science	3425	25.00	0.40	25.40	25.00	0.40	25.40	30.00	0.35	30.35
2.03 Centre for DNA Finger printing and Diagnostics	3425	20.00	...	20.00	20.00	...	20.00	28.00	...	28.00
2.04 National Brain Research Centre	3425	13.80	...	13.80	18.38	...	18.38	14.00	...	14.00
2.05 National Centre for Plant Genome Research	3425	12.70	...	12.70	10.20	...	10.20	12.00	...	12.00
2.06 Institute of Bioresources and Sustainable Development	3425	3.00	...	3.00	3.00	...	3.00	3.00	...	3.00
2.07 Institute of Life Sciences	3425	12.00	...	12.00	10.90	...	10.90	10.00	...	10.00
<i>Total</i>		118.50	1.20	119.70	118.50	1.20	119.70	133.00	1.05	134.05
3. Assistance to Other Scientific Bodies										
3.01 Human Resource Development	3425	18.50	...	18.50	17.50	...	17.50	28.00	...	28.00
3.02 Bioinformatics	3425	17.00	...	17.00	17.00	...	17.00	22.00	...	22.00
3.03 Biotech Facilities, Centres of Excellence and Programme Support	3425	45.00	...	45.00	27.00	...	27.00	62.00	...	62.00
3.04 Research and Development	3425	164.00	...	164.00	153.66	...	153.66	193.00	...	193.00
3.05 Biotechnology for Societal Development	3425	11.00	...	11.00	11.00	...	11.00	12.00	...	12.00
3.06 Bio-Process and Product Development	3425	16.00	...	16.00	16.00	...	16.00	20.00	...	20.00
<i>Total</i>		271.50	...	271.50	242.16	...	242.16	337.00	...	337.00
4. I&M Sector										
4.01 Assistance for Technology Incubators, Pilot Projects, Biotechnology Parks and Biotech Development Fund	3425	25.00	...	25.00	7.00	...	7.00	15.00	...	15.00
4.02 Public Private Partnership	3425	18.00	...	18.00	16.54	...	16.54	30.00	...	30.00
	7425	2.00	...	2.00	...	...	...	...	...	...
<i>Total</i>		20.00	...	20.00	16.54	...	16.54	30.00	...	30.00
5. International Cooperation	3425	10.00	...	10.00	4.80	...	4.80	6.00	...	6.00
6. International Centre for Genetic Engineering & Biotechnology	3425	...	7.50	7.50	...	7.50	7.50	...	7.50	7.50
Grand Total		445.00	13.60	458.60	389.00	13.60	402.60	521.00	13.60	534.60
C. Plan Outlay										
	Head of Dev	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total
Other Scientific Research	13425	445.00	...	445.00	389.00	...	389.00	521.00	...	521.00

1. **SECRETARIAT-ECONOMIC SERVICE:** provides for expenditure on the secretariat of the department.

2. **ASSISTANCE TO SCIENTIFIC INSTITUTIONS / PROFESSIONAL BODIES:**

2.01 **National Institute of Immunology (NII), New Delhi:** It is proposed to initiate work on incubator laboratory facility at the second campus of the institute, besides continuation of the research against the various major areas of interest i.e. Infection & Immunity, Gene Regulation, Reproduction & Development and Molecular Design. An integrated UNESCO center may also make a beginning during the year.

2.02 **National Centre for Cell Science, Pune:** NCCS will have emphasis on development of new cell lines and will also continue to serve as National Reference Centre for various cell lines, tissue banking, cell products etc. storage and supply. Efforts will also be made towards organization of postgraduate courses, workshops, seminars/symposia and training programmes in the areas of tissue culture related efforts. R&D efforts will have focus in the areas of cell biology with major emphasis on translational stem cell biology; cancer biology; signal transduction; drug development; insect molecular biology; infection and immunity; chromatin architecture & gene regulation; drug discovery programme including genomics and proteomics; analysis of tumor suppression by p53 mediated regulation of SMAR1 in cancer; understanding the functional role of Dixin-1 in regulation of cell proliferation in neural cell lines. Studies will also be done to understand the role of T-cells and non T-cells with reference to leishmania infection and SATB-1 mediated dynamic organisation of chromatin at its genomic binding sites in HIV/AIDS infection process.

2.03 **Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad:** The new activities of CDFD include: improvised methodologies for high throughput STR based DNA fingerprinting; new diagnostics tools development; DNA fingerprinting of ethnic populations in India; computational biology of pathogenic mutations; host-parasite interactions during cellular signaling; setting up a Centre for molecular ecology and biodiversity; laboratory for plant genetic fingerprinting; sequencing of the Mycobacterium W; DNA Training Academy; High throughput genetic screening; genomics and proteomics of infectious pathogen; integrated approach to understand the biology of M. tuberculosis using genetic, immunological and structural aspects; genetics and epidemiology of Leptospirosis; HRD and manpower development.

2.04 **National Brain Research Centre (NBRC), Manesar:** The major areas that have been initially identified for research include computational neuroscience, system and cognitive neuroscience, stem cell research, developmental neurobiology and basic research towards understanding of neurological and psychiatric disorders and these would be strengthened and expanded. At all levels of brain organization, efforts will be directed at both understanding fundamental issues of brain function as well as understanding disease processes that have a huge effect on disease burden in developing societies.

2.05 **National Centre for Plant Genome Research, New Delhi:** It is proposed to take up construction of a hostel to accommodate 85 students.

Proposed areas of research for the next year will be:

Nutritional Genomics: The activities includes detailed yield, quality, molecular and safety analysis of AmA1⁺ potato;

development of regeneration and transformation protocols in rice, sweet potato and cassava for transfer of Ama1⁺ gene, molecular analysis of OXDC+ tomato transgenics and its trial; transformation of Lathyrus and spinach with OXDC gene.

Genome Structure: Development of EST-SSR markers to differentiate chickpea genetic resources and legume species related to chickpea; cloning and sequencing of size variant alleles of genes from different chickpea strains and legumes.

Functional Genomics: Construction of chickpea cDNA array and transcript profiling of compatible and incompatible chickpea; identification and characterization of genes that determine drought tolerance in chickpea; cloning, sequencing and functional analysis of CaDREB2 and CaCIPK6 genes of chickpea; The structural and regulatory genes concerned with the alkaloid biosynthesis will be examined for expression in variants of *Catharanthus roseus*. Isolation, cloning and characterization of a candidate gene α -mannosidase for use in transformation for delayed ripening

2.06 **Institute of Bioresources and Sustainable Development (IBSD), Imphal:** Two consultation meetings on integrated development of value-added products from turmeric and ginger, and conservation and sustainable utilization of microbial resources of North-East region were organized at ICAR Complex for NEH Region, Barapani, Meghalaya and IBSD, Imphal during April, 2005 and May, 2005, respectively mainly to identify the priorities of research for the institute and developing network projects in the region. As a follow-up of the above meetings network projects for the region are being developed. A genome club has been initiated under bioresources education programme of the institute. The genome club with the vision of "genetic literacy for all" will have its focus on recent developments in the field of biotechnology application on utilization of bioresources and its impact on human welfare. The bioresource database unit has been strengthened with new hardware and software alongwith subscription of e-journals for research communities of the region. The research infrastructure of the institute has been further strengthened.

2.07 **Institute of Life Sciences, Bhubaneswar:** It is proposed to build the Animal House facility which is a mandatory requirement for undertaking the research programmes. The research laboratories are also to be modified and renovated to meet the needs of the increased research faculty. A Research Scholars hostel is also proposed since the institute is now attracting research students from across the country. The research programmes would continue on molecular biology of aging, infectious diseases such as cholera, malaria and filariasis; bioresource development, conservation and utilization; stress biology and molecular microbiology-plant microbe interaction and microbial prospecting. The research programmes in environmental biotechnology include: salt tolerance in plants; proline accumulation under abiotic stress.

3. **ASSISTANCE TO OTHER SCIENTIFIC SCHEMES:**

3.01 **Human Resource Development:** Human Resource Development activities have been strengthened, new programme (DBT-JRF Programme) has been started under which 100 JRFs are selected through all India competitive examination (Biotechnology Eligibility Test – BET) conducted by University

of Pune. In the current financial Year the following 6 new courses have been supported:

- Ø M.V.Sc. Animal Biotechnology
- Ø M.Sc. Agriculture Biotechnology
- Ø M.Sc. Environmental Biotechnology
- Ø M.Sc. Biotechnology

During 2006-07, about 6 new specialized courses in Biotechnology, will be supported. In addition Teachers Training, Technician Training and Summer Training programmes will be initiated.

3.02. Bioinformatics: Fifty more institutions/Universities/Colleges are to be supported in the line of Sub-DICs. In addition, it is proposed to connect the institutions with broadband connectivity. This will act as a catalyst in facilitating research and teaching in life sciences and biotechnology. Three more Super computing facilities will be established similar to the one at IIT, Delhi established by the DBT. The Department has instituted a Bioinformatics National Certification (BNIC) Examination to be held from last year onwards for catering to the growing needs for the trained manpower in Bioinformatics, setting standards and for quality improvement in the Human Resource Development programmes in Bioinformatics. The University of Pune, is administering this examination every year with an objective to evaluate the Bioinformatics knowledge & skillset of the students. The qualifying candidates will be awarded a certificate. Bioinformatics research emphasis will be given to individual diseases hereditary and others by combining Bioinformatics with wet lab. Focus also would be given for target and lead identification for in-silicon drug development. An International Conference on Bioinformatics (In Cob 2006), will be organized this year.

3.03 Biotech facilities, Centres of Excellence & Programme Support: Establishing Centres of Excellence has received special attention during the year to achieve reengineering of central institute for greater innovation and focus. Centres on priority theme areas are being supported around senior team leaders in existing universities/departments. In addition, programme support for special multidisciplinary areas is also being provided.

The following five Programme Support have been sanctioned by the department during 2005-06, so far: i) Research on Cancer Biology and Therapeutics at Indian Institute of Science, Bangalore; ii) Research on industrially important non-conventional yeasts at Indian Institute of Science, Bangalore; iii) Development of drought tolerant crop varieties by biotechnological approaches at University of Agricultural Sciences, Bangalore and International Centre for Genetic Engineering & Biotechnology, New Delhi; iv) Characterization and validation of the mangrove genes in transgenic rice systems for biotic stress tolerance at M.S. Swaminathan Research Foundation, Chennai and v) Development of technologies for therapeutic proteins at Institute of Microbial Technology, Chandigarh.

3.04 Research & Development: In Crop Biotechnology, emphasis would be given on projects for development of suitable crops resistant to pests and diseases, tolerant to salinity and drought and their nutritional enhancement. Projects on generation of tungro virus-resistance, development of shoot and fruit borer resistant transgenic brinjal varieties, development of

effective molecular markers for breeding in pulses, oilseeds and fodder crops, multi-site evaluation of transgenic mustard hybrid based on barnase barstar system, would be taken up. As State Agricultural Universities (SAUs) play a vital role in the product oriented research programmes, research programmes would be supported in new selected SAUs. Few selected agricultural universities would be provided programme support for centres of excellence in agricultural biotechnology.

The basic and strategic research related to gene discovery, allele mining, expressing profiling for selected traits/ validation would be given due importance. A plant gene resource facility would be set up at NCPGR, New Delhi for storage and distribution of cloned plant genes.

Under medical biotechnology, new programmes will be implemented on HIV/AIDS with emphasis on immunobiology, pathogenesis, molecular typing and newer approaches for vaccine development. Infrastructure facilities will be developed for biorepository, transgenic animals, cancer cell lines etc. New programmes will be formulated on autoimmune diseases, cardiovascular disease and clinical trial network programmes for cancer therapeutics will be initiated. Infrastructure facilities will be strengthened and a new Centre of Excellence on Stem Cell Biology will be established. Large scale production of mesenchymal stem cells under cGMP conditions will be achieved through public-private partnership. Clinical trials will be undertaken for employing stem cells in diseases such as spinal cord injury, orthopaedics, limb ischemia etc.

Programmes in other areas of biofertilizer, biopesticides, bioresources, plant, environment will continue to receive support on identified priority areas. Under Basic science, special interest is being laid on nanobiotechnology and other cutting edge technologies of RNAi, microarray etc. Bioengineering for biodevices is a high priority area for which the road map has been developed and programmes are being supported.

3.05 Biotechnology for Societal Development: The department is supporting projects to benefit SC/ST, women and rural people through training and demonstration programmes in various income and employment generating activities. These projects are being funded in the areas viz. biofertilizers, biopesticides, sericulture, aquaculture, mushroom cultivation, bee keeping, spirulina production, organic farming, vermicomposting, floriculture, animal husbandry, cultivation of medicinal and other economically important plants, bio-waste utilization and solid waste management, marine bio-resources utilization (cultivation of seaweeds and cultivation of aquatic organisms etc.), value added products, products from forest produce, herbal product development including screening of genetic disorders among the tribal communities etc. The projects are being supported at universities, national labs & institutions, Krishi Vigyan Kendras, voluntary and non-government organizations etc.

To have a long-lasting impact and sustainability of the programme, the department has taken new initiatives by providing support to 'Rural Bioresource Complexes (RBC)' in a holistic manner with a basket of technologies along with supporting market linkages. The department has funded five RBCs at State Agriculture Universities namely University of Agricultural Sciences (UAS), Bangalore; Marathwada Agricultural University (MAU), Parbhani; Haryana Agricultural University (HAU), Hisar and G.B. Pant University of Agriculture and Technology (GBPUA&T), Pant Nagar; Orissa University of

Agriculture & Technology (OUAT), Bhubaneswar. More RBCs are being planned for benefiting target population to benefit larger population in terms of income and employment generation through technology demonstration, dissemination, training and extension activities.

3.06 Bioprocess and Product Development: Under Food and Nutrition area, the thrust would be to develop multi-Institutional network programmes in the area of nutraceuticals, nutrient supplements, probiotics, food enzymes and additives using indigenous raw materials. Assessment of the micronutrient fortified "Ultra-Rice" in terms of stability, shelf life, bio-availability and efficacy and their biological impact in addressing nutrition deficiencies would be undertaken. Taking into account the beneficial role of Zinc supplementation in child health, particularly for the treatment of diarrhea in developing countries, technology diffusion of dispersible Zinc tablets would be initiated, through WHO, with whom DBT has already initiated action for signing of a MOU with the technology developers.

4. I & M SECTOR:

4.01 Biotech Parks and Incubators: Apart from implementation of projects of Biotechnology Park at Lucknow, Uttar Pradesh and Biotechnology Incubation Centre at Shapoorji Pallonji Biotech Park, Hyderabad, Andhra Pradesh, four new projects were approved for setting up of biotech incubation / pilot plant facilities at Punjab, Himachal Pradesh, Karnataka and Kerala. The details of the new proposals are: Biotech Incubation Centre and common instrumentation facilities at Biotech Park at Bangalore, Karnataka; bioprocessing and scale up facility, micro-propagation facility, plant extraction facility, analytical laboratory facility and utility support & design engineering and project supervision at Kochi, Kerala; common extraction facility for medicinal and aromatic plants and agro/food testing and certification facility near Chandigarh, Punjab; tissue culture hardening facilities, cultivation of temperate aromatic plants using biotechnological interventions, pilot cultivation of selected high value medicinal plants and post-harvest management of biofresh fruit project and technology aided food processing at Solan, Himachal Pradesh. Other projects from West Bengal and Orissa are under consideration.

4.02 Public Private partnership: SMALL BUSINESS INNOVATION RESEARCH INITIATIVE (SBIRI): With the aim to encourage public-private-partnership in biotech sector the department has launched the new scheme "Small Business Innovation Research Initiative (SBIRI)" during 2005. The SBIRI aims to strengthen those existing private industrial units whose product development is based on in-house innovative R&D; create opportunities for starting new technology-based or knowledge-based businesses by science entrepreneurs; stimulate technological innovation; use private industries as a source of innovation and enhancing greater public-private

partnerships, and increase product commercialization in public-private sector derived from Government funded R&D. The SBIRI scheme will operate in two phases. Under SBIRI Phase – I highly innovative, early stage, pre-proof-of-concept research will be supported. Under SBIRI Phase – II, the funding will be provided for late development and commercialization of innovative research leads. The key objectives of the scheme are to provide support for early stage, pre-proof-of-concept research in biotechnology by industry, to support late stage development and commercialisation of new indigenous technologies particularly those related to societal needs in the healthcare, food and nutrition, agriculture and other sectors, to nurture and mentor innovative and emerging technologies/entrepreneurs, to assist new enterprises to forge appropriate linkages with academia and government.

5. International Cooperation: International Cooperation programme are continuing with 21 countries under bilateral cooperation. Bilateral Collaboration with Denmark, Finland and UK have been strengthened with joint call for proposals issued for the countries respectively. Ongoing programmes with US, FRG and other countries are being pursued. Indo-US collaborative programme have been initiated in agriculture. A new agreement on vision research has been signed with NIH, USA. Regional Centre for Education and Training in Biotechnology is to be set up under the auspices of UNESCO.

6. International Centre for Genetic Engineering and Biotechnology: ICGEB has been established with two components one in New Delhi and the other in Trieste, Italy with the objective of bringing the fruits of modern biotechnology to the developing countries. Intensive scientific research is performed in a total of six groups viz. malaria, virology, immunology, recombinant gene products, plant molecular biology and insect resistance. In addition to research, there are several trainings and other schemes such as post-doctoral and Ph.D programmes as well as organisation of training courses and symposia. DBT provides the host country contribution towards ICGEB, New Delhi Centre. The research work in the area of Hepatitis, malaria, recombinant gene product, plant molecular biology, plant resistance and plant transformation is continuing. ICGEB had transferred technologies for HIV-I and HIV-II diagnostic kits, Hepatitis C diagnostic kit, Hepatitis B vaccines, erythropoietin, alpha-interferon, genome interferon, human growth hormone and granulocyte colony stimulating factor. ICGEB continued its efforts in promoting biotechnology and genetic engineering research in the member countries. Two technologies were transferred and seven patents were filed. The manpower-training programme continued at the centre with five training courses conducted in the field of malaria, plant transformation, recombinant gene products, virology and bioinformatics.