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YEAR END REVIEW: DEPARTMENT OF BIOTECHNOLOGY.

Relevant for: Science & Technology | Topic: Biotechnology, Genetics & Health related developments

Ministry of Science & Technology

Year End Review: Department of Biotechnology.

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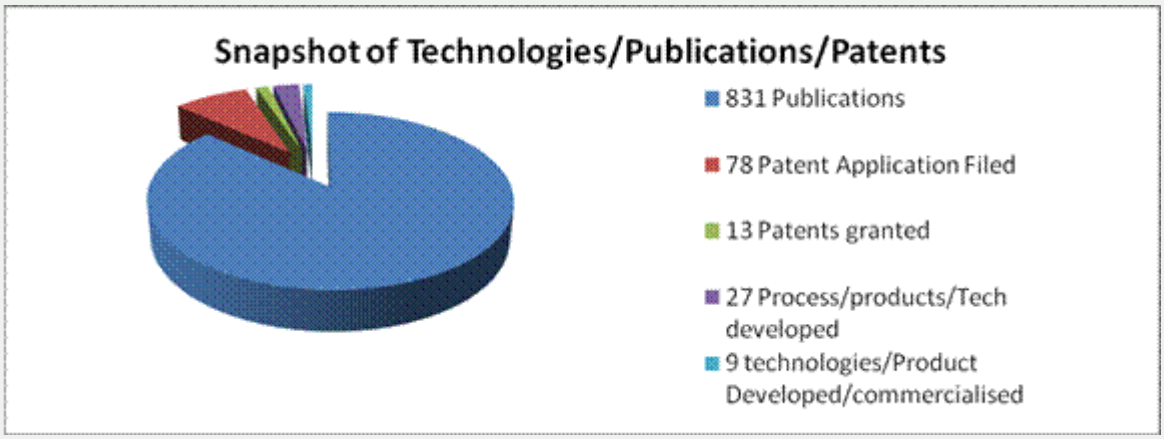
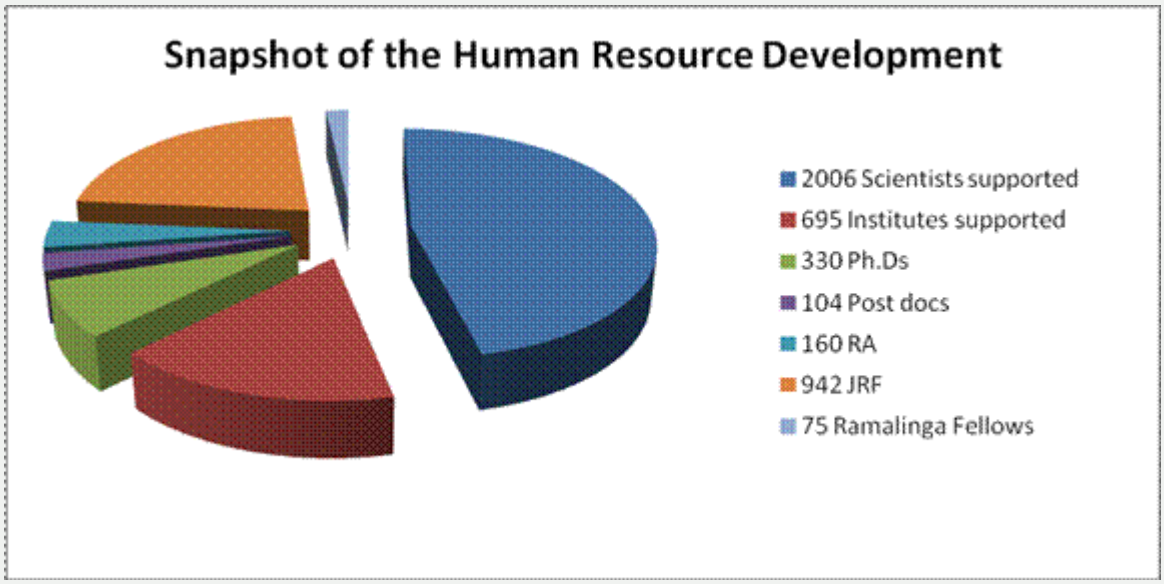
The year 2018 saw Department of Biotechnology, Ministry of Science and Technology pursue with increased vigour its vision of attaining new heights in biotechnology research, shaping biotechnology into a premier precision tool of the future for creation of wealth and ensuring social justice- especially for the poor. A Snapshot of achievements is placed below:





Now we focus on some of the major highlights of the major policy decisions, programs supported during the year as follows:

· Union Cabinet has approved “The DNA Technology (Use and Application) Regulation Bill, 2018”. The Bill has been formulated for the regulation of the use and application of

Deoxyribonucleic Acid (DNA) technology with the aim to establish the identity of certain category of persons including the victims, offenders, suspects, under trials, missing persons and unknown deceased persons and provides provision for establishment of a DNA Regulatory Board (DRB).

- India - UK Cancer Research Initiative launched in collaboration with Cancer Research UK (CRUK) focussing on affordability of cancer prevention and care, and the potential to make significant progress against cancer consequences. Both CRUK and the DBT will invest £5m (~47 Crores INR) each in this initiative.

- Ten years of Joint partnership of DBT-India Alliance was recently celebrated. *ThePresident of India, Shri Ram NathKovind***,** graced the event organized at VigyanBhavan, The Department of Biotechnology (DBT), in collaboration with the Wellcome Trust, is supporting a three-tier fellowship programme on biomedical research at post-doctoral level.

- 15 new skill development courses for Post Graduate Certificate/Diploma were implemented with an objective to provide high quality hands on training in tools and techniques in Medical Biotechnology, Agricultural Biotechnology and Computational Biology.
- Indo-US collaboration on Genome Engineering/ Editing launched to provide opportunity to brightest Indian students and scientists to gain exposure and access to world class research facilities in leading U.S. institutions through students internship, overseas fellowship and visiting professorship programmes.
- 1stClean Energy International Incubator has been set up under Mission Innovation. Startups from 23 participating EU countries can potentially come & incubate in India and likewise startups from this incubator can go to the partnering countries facilitating access to global opportunities.

- SAEN (Secondary Agriculture Entrepreneurial Network) was launched in 2018 which is led by The Punjab State Council &Technology (PSCST) and other partners, such as, National Agri Food Biotechnology Institution (NABI), Centre for Innovative and Applied Bioprocessing (CIAB) and BIRAC's BioNEST – Panjab University (BioNEST-PU). The project aims to promote new enterprises and to support existing industry in the secondary agriculture sector.

- A major Mission program on Antimicrobial Resistance (AMR) was launched in October, 2018 with the vision to develop indigenous and cost-effective therapies against AMR; categorization of AMR-specific pathogen priority list of India; establishment of Bio-repository for AMR-specific pathogens; and development of rapid and cost-effective diagnostic kits to identify AMR-specific pathogens.

- Accelerated Translational Grant for Commercialization (ATGC) was launched to encourage technological innovation by providing funding opportunities for fundamental research that is explicitly aimed towards application development.

- A new regional center, BIRAC Regional Bio-innovation Centre (BRBC) was established at Venture Centre, Pune. BRBC is mandated to be a high quality national resource center for regulatory guidance to startups, training of Incubator managers, etc. and to support and promote Entrepreneurship in Life Sciences.

- Cattle Genomics programme was launched to improve the germplasm of Indian Cattle breeds. The aim of this programme is to identify elite animal at an early stage and also to reduce the cost and time interval of breeding programme in future.

A brief Area wise achievements for the year 2018-19 are placed below:

Human Resource Development /Capacity Building

- 15 Scientists selected forNational Bioscience Award for Career Development; 9 scientists awarded Innovative Young Biotechnologist Award; 2 scientists supported for National Women Bio-scientist (Senior, Junior)Award for Biotech Product, Process Development and Commercialization; 2 outstanding scientists awarded Distinguished Biotechnology Research Professorship Award; 75 awardedRamalingaswamire-entry fellowship; 160 Research Associates supported; 942 JRF’s supported, 89 students supported under Biotechnology

finishing school programme

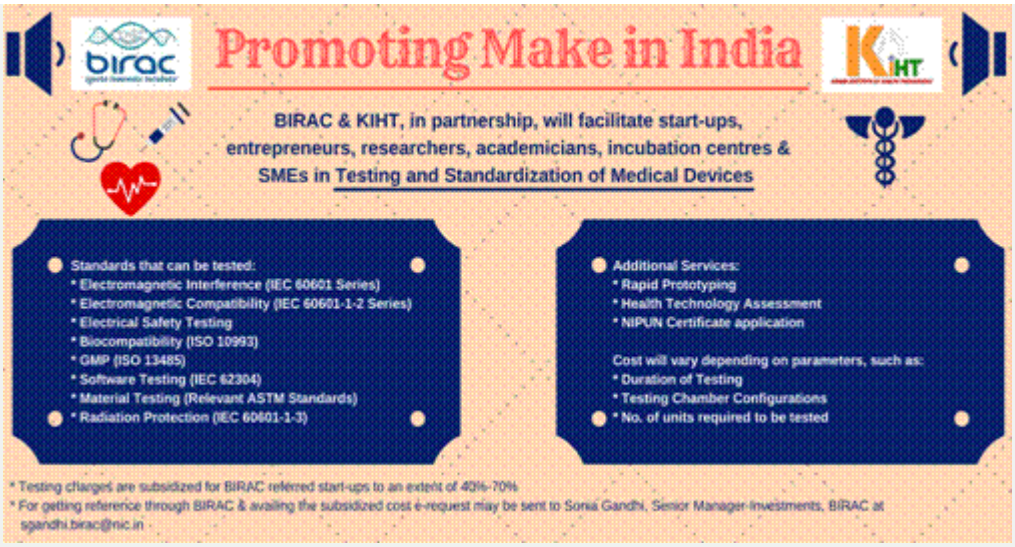
- "Bharat Boston Bioscience Beginning -B 4, Phase II" for two years was launched with a provision for 16 postdoctoral students to undergo training in Harvard University. 100 young students will also be trained in emerging technologies.

Devices, Implants, Make-in-India, Start-up India, Bioincubators (*in collaboration with BIRAC)*

- A facilitation cell (FIRST HUB) for start-ups and innovators at Biotechnology Industry Research Assistance Council (BIRAC) was set up.

- Under the Startup India initiative, the Department of Biotechnology has sanctioned a biocluster at Pune and BIRAC has supported additional 4 new Bio-incubators during 2018 through BioNEST scheme.

- With an aim to promote Make in India, BIRAC & KIHT (Kalam Institute of Health Technology) have collaborated to facilitate start-ups, entrepreneurs, researchers, academicians, incubation centres & SMEs in the area of Testing & Standardization of Medical Devices.



- BIRAC has established/ supported additional 5 new Bio-incubators during 2018 through BioNEST scheme adding an additional high end incubation space taking the total space to 3,91,849 sq. ft.


Affordable health care for a Swastha Bharat

· DBT's Indo-US Vaccine Action Programme (VAP) & the Vaccine Grand Challenge Programme (VGCP) scored high with achievements like the lowest cost Rotavirus vaccine which became part of the universal immunization programme& major strides towards vaccine for diseases like malaria & dengue. One out of every 6 children over the world receives vaccines manufactured in India.

· Vaccine for falciparum malaria is under toxicology assessment (JAIVAC 2) and vaccine for vivax malaria has completed phase I trial (JAIVAC1).

· A comprehensive program for prevention and control of sickle cell anemia and thalassemia has been initiated in phased manner starting with four districts of Odisha, namely Khorda, Sambalpur, Koraput (Aspirational district) and Balasore districts.

· Under BioDesignprogramme,two technologies namely “Intra-Osseous Device (Ozyn-D)” and a “Chest Tube Fixator and Sealing Device (PleuraGoh®)” were licensed to start-up companies- “M/s RCupe Lifesciences Pvt Ltd., Bangalore and M/S UNINO Healthcare Pvt. Ltd., Mumbai respectively.

- A diagnostic test for TB meningitis with nearly 100% sensitivity and about 91% specificity was developed jointly by AIIMS, New Delhi and THSTI, Faridabad.

- A comprehensive study in India titled “Dementia Science Programme: Incidence/ Prevalence/ Risk/ Intervention analysis of dementia and basic research thereof” was launched with an aim to provide reliable data regarding incidence, prevalence, biomarkers and risk and protective factors associated with the pathology of dementia.

- Vitamin D deficiency (VDD) is prevalent globally and the data for last two decades suggests that it may be widespread in India as well. A call for proposals on “Vitamin D deficiency in India: Public Health Significance and interventions” was issued and the Department is in the process of implementing the selected projects to support research on the public health significance of VDD and potential interventions to address this malady.

Agriculture for doubling farmer’s income and food security

- New Wheat variety Unnat PBW343, resistant to leaf rust and stripe rust was developed by PAU, Ludhiana through marker assisted backcross breeding approach. This variety is an improved version of mega variety PBW343, has an average plant height of 100 cm, matures in about 155 days and has an average grain yield of 23.2 quintals per acre.

- Two bacterial blight resistant Basmati rice varieties Pusa Basmati 1728 and Pusa Basmati 1718 were developed and subsequently released by Central Variety Release committee after testing. Of these, Pusa Basmati 1728 is a replacement of Pusa Basmati 1401 and Pusa Basmati 1718 is replacement of Pusa Basmati 1121, which are together grown on almost 1.40 million ha. area currently. Since, both varieties were releasedrecently; the area under cultivation is likely to pick up in years to come.

- DBT-PGGF “Plant Genotyping and Genomics Facility” (PGGF) anchored at NIPGR, New

Delhi in PPP mode was established. This national facility is a “single-window service system” for advanced genomics technology services that could positively influence the Indian Seed industry.The “Facility” will have the potential to evolve into a “leading edge” genotyping service provider and a consulting facility that would have impact not only on agriculture in India, but could serve as a model on a global basis.

Animal Biotechnology

- A Program on Bovine Tuberculosis (bTB) was launched in collaboration with the Bill and Melinda Gates Foundation focusing on bTB surveillance for bTB prevalence, bTB control program through BCG vaccination, establishment of repository, and training of young scientists.

- A Pan India programme on canine health was launched to address major problems of Canine upkeep and maintenance in terms of health, nutrition and therapy etc., to prevent zoonotic infection through integration of human and veterinary medicine interface for addressing One Health concept in canine.

Clean Energy and Bioresource development

- The Hon’ble Minister Dr Harsh Vardhan, on 18th September 2018, announced the DBT-ICT Centre for Energy Biosciences, Mumbai’s new project on Next Generation Waste Treatment Technology platform comprising three novel technologies. A 1MLD capacity sewage water processing would be built to showcase the Next Generation Treatment Technology in an integrated manner.

- Biorestoration technology was developed for Mangrove habitats of Sundarban. Substantial progress has been made not only in understanding the community composition of mangroves in degraded and non-degraded habitats but also the stress factors impacting the mangrove in degraded sites in terms of osmolytes were identified.

- A Microbial Repository Centre (MRC) has been established at IBSD, Imphal with the aim to act as the nodal centre for deposit, preservation, maintenance and supply of microbial resources originated from the rich and unique ecological niches of North East (NE) India.

- Memorandum of Understanding (MoU) was signedwith International Energy Agency (IEA) on Enhancing Innovation for the Clean Energy Transition on August 30, 2018 in the presence of Dr. Harsh Vardhan, Hon’ble Minister of Science & Technology and Earth Sciences, Environment, Forest and Climate Change.

Societal Development Program

- To cater to aspirational districts programme of Government of India, the department has launched a new programme on “Rural Bioresource complex”. In the first phase, nine proposals institutions were awarded funding to address some of the pertinent issues related to health and nutrition, agriculture & allied areas using biotechnological tools, techniques and processes for bringing these aspirational districts in the mainstream.

International Collaborations

- The Department of Biotechnology has signed a Programme of Cooperation (POC) with Swedish Governmental Agency for Innovation Systems (Vinnova), Sweden The broad subject areas of cooperation under the Protocol shall be, but not limited to Circular and bio-based economy, including biomaterials; Health and life sciences including biomedical devices and Start-ups, incubators, test beds and bio clusters.

- Horizon 2020:The Department of Biotechnology has announced joint call for proposal under Horizon 2020 (biggest EU Research and Innovation programme). The goal is to ensure free flow of knowledge, expertise and enable public as well as private sector to work together towards delivering solutions to big challenges facing our society.

- Indo-Korea Collaboration in the area of Biotechnology and Bioeconomy: The Department of Biotechnology, Govt. of India and the Ministry of Science and ICT, Govt. of the Republic of Korea signed anMoU in the area of Biotechnology and Bioeconomy on 9th July, 2018 at New Delhi.

- Indo-Japan Collaboration: A collaborative research centre called DAICENTER, an expansion of joint DBT-AIST International lab (DAILAB) at AIST, Tsukuba was formally launched at AIST, Tsukuba, Japan. Also, the SISTER DAILAB at Osaka Centre (South Japan) was inaugurated.

- Recognizing innovation as the cornerstone of the collaboration the *Department of Biotechnology, Ministry of Science & Technology, Govt. of India has signed MoU with Innovaatiorahoituskeskus Business Finland (Business Finland)* to cooperate based on their mutual interest with Biotechnology Industry Research Assistance Council (BIRAC), the Public Sector Enterprise of the Department of Biotechnology (DBT), for funding and implementing ambitious industry-led innovative and transnational projects

- Under Indo-Philippines collaboration on training of women farmers, 35 Women farmers from 7 states attendedtraining programme on “Advance in Rice Production for Women farmers” across India. Four women farmers were from the Aspirational Districts of Karnataka (Raipur) and Assam (Darrang). In the Phase II of the programme, eight women farmers out of 35 farmers will undergo advanced training at Los Banos, Philippines.

- The Department in collaboration with European Union (EU) announced the EU-India call on “Next Generation Influenza Vaccine to protect citizens worldwide” on 26th July, 2018. Both The European Commission (EC) through the EU funding programme for research and innovation under 'Horizon 2020' programme and DBT have committed equal contribution of EUR 15 million under the said call.

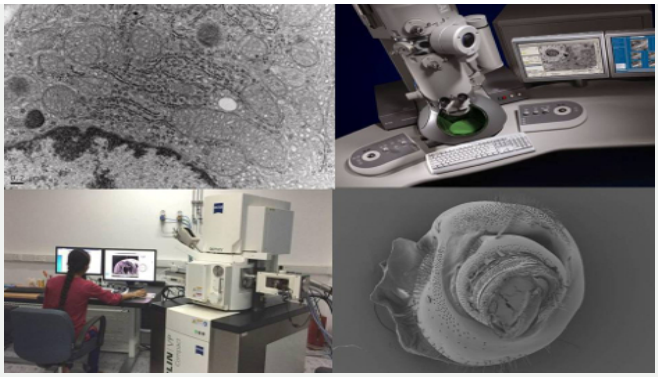
Autonomous Institutions

16 Autonomous Institutions are functioning under the aegis of the Department of Biotechnology. These institutions are pursuing basic, discovery and translational research in line with the National missions in the areas of Agriculture Biotechnology, Animal Biotechnology and health, Medical Biotechnology, Clean energy and Bioresourse development, Secondary Agriculture etc. The institutions also have a mandate of human resource development and societal outreach. Some of the achievements during the year are given below:

- Medical Genetics Department at the Nizam’s Institute of Medical Sciences (NIMS), Hyderabad, is functional through aMoU with CDFD (Center for DNA Fingerprinting and Diagnostics), Hyderabad to provide services to patients with genetic disorders as well as for training and research. In collaboration with Nizam’s Institute of Medical Sciences, CDFD conducts a DNB fellowship in Medical Genetics.Two students have completed this training and five students are presently enrolled in the course.CDFD has developed a biocontrol strategy for Bacterial leaf blight (BLB), a serious disease of rice caused by the bacterium Xanthomonasoryzae. The biocontrol agent is a signaling molecule diffusible signal factor, whichcan be applied directly on the leaves.CDFD has published 64 research articles and supported 8 PhDs as well as 6 Postdocs

- Institute of Life Sciences, Bhubaneshwar through transcriptome analyses has identified several transcription factors with differential expression to salinity and drought stress in P*hragmiteskarka, an invasive plant species. ILS developed twenty-seven useful plant expression vectors coupled to recombinant promoters for boosting agricultural production under stress conditions. A recombinant construct was also developed as a whole cell biosensor for the detection of arsenic in drinking water.ILS transferred two technologies, filed 2 patents, obtained 2 patents, published 55 research articles and supported 30 PhD students*

- National CryoEM Facility was operationalised in inaugurated in Institute for Stem Cell Science & Regenerative Medicine (inStem), Bangalore. The facility is equipped with a 300 kV Transmission Electron Microscope (TEM) that is capable of high-resolution structure determination of macromolecules in solution as well as *in situ* in cells by tomography. InStem filed 4 patents, published 26 research articles and supported 60 PhD students



National CryoEM Facility in Institute for Stem Cell Science & Regenerative Medicine (inStem), Bangalore

- Centre for Chemical Biology & Therapeutics established in inStem recently completed the first phase of the development of Bractoppin, a drug-like inhibitor of phosphopeptide recognition by the human BRCA1 tandem (t)BRCT domain, which selectively inhibits substrate binding with nanomolar potency *in vitro*.

- International Center for Genetic Engineering and Biotechnology(ICGEB), Delhi developed transgenic lines with significant tolerance for two broad-spectrum systemic herbicides glyphosate and sulfonylurea without introducing any foreign gene into the crop plant.ICGEB transferred dengue diagnostic technology to an Indian company and is successfully commercialized. ICGEB developed two processes, filed 2 patents, obtained 1 international patent, published 100 research articles and supported 9 PhD students.

- ICGEB developed high yielding rice through silencing of one of the specific cytokinin oxidase, making it possible to obtain “More grains per plant”. Another breakthrough achieved lately is the development of multiple abiotic and biotic stress tolerant rice, through the manipulation of glyoxalase pathway, which show minimum yield penalty under stress conditions

- Regional Centre for Biotechnology (RCB), Faridabad, with a mandate to provide a platform for biotechnology education, training, and research at the interface of multiple disciplines launched PhD programme in Bioinformatics and also operationalised Advanced Technology

Platform Centre. RCB through partnership with European Synchroton Radiation Facility (ESRF) in France has imparted training to 200 researchers on advanced beamline for research purpose. RCB filed 2 patents, published 28 research articles and supported 8 PhD students.

- National Agri-Food Biotechnology Institute (NABI), Mohali has demonstrated proof of concept in Banana for the feasibility of carrying out CRISPR based genome editing. This technology is being exploited to develop traits in Banana as well as in crops like wheat, rice and Lathyrus.NABI has developed oligosaccharides-based natural fruit coating that enhances the shelf-life of fruits and vegetables. The technology has dual advantages, first it utilizes the agriculture waste and second it can replace the shellac, a coating material that is obtained from an insect. NABI developed two technologies, commercialised one product, transferred one technology, filed 2 patents, published 26 research articles and supported 4 PhD students and 5 Postdocs.

Application of edible coating material to reduce post-harvest losses. Images of un-

coated apples (A) and coated with 1% WP-SAOP (WP: wheat straw polysaccharide, SAOP: stearic acid-oat bran polysaccharide esters) composite coating formulation (B) during 30-45 days storage at 22°C and 65% relative humidity.

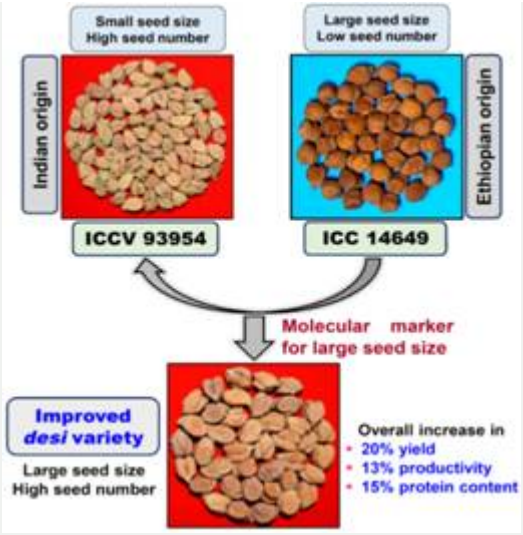
- National Center for Cell Science (NCCS) identified a novel mechanism to rejuvenate aged stem cells from older donors identified which could lead to improvement of outcome of stem cell transplantation (SCT)-based therapeutic approaches for disorders like leukemia, lymphoma, and aplastic anaemia. Serving as a national repository of animal cell culture, NCCS supplied 8086 cell lines to research/academic organizationsPan-India. NCCS published 51 research articles, filed 8 patents, obtained 8 patents and supported 26 PhD's

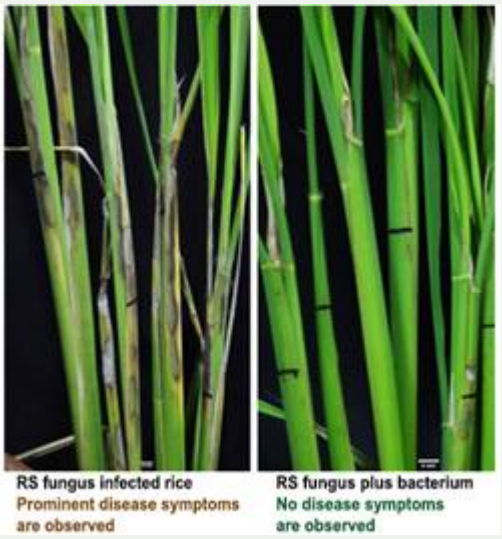
- Center of innovative and Applied Bioprocessing (CIAB) developed a scale up processfor production of rose oxide value added citronella oil, atitania-based catalyst for large-scale isomerization of glucose to fructose, a method for isolation of lignin from lignocellulosic biomass in acidic deep eutectic solvent through organic solvent extraction. CIAB has transferred 2 technologies on enzyme based process for rare sugar and a whey based beverage and developed 7 processes/ technologies, filed 7 patents and published 21 research articles.

- National Institute of Animal Biotechnology (NIAB), Hyderabad through high throughput siRNA screening identified host proteins supporting the invasion and intracellular multiplication of Brucella. Two immune-dominant protein antigens (BM-5 and BM-7) of Brucella are being used at NIAB to develop ELISA based diagnostics. NIAB published 12 research articles and supported 29 PhD students.

- Under MILAN (Meeting of Indian Livestock farmers and Agriculturists with NIAB scientists) programme, NIAB scientists have reached-out to 18 states including eight states of North-Eastern region for addressal of problems in goat rearing as there is high neonatal mortality and death of pigs in mass due to viral infections like swine fever, Porcine reproductive and respiratory syndrome virus (PRRS).

- National Institute of Plant Genome Research (NIPGR), Delhi has discovered a novel bacterium that can reside inside rice plants and can eat the *Rhizoctoniasolani*(RS) fungus, a causative pathogen that causes serious sheath blight disease of rice. A novel secreted protein that is used by the bacterium to kill the RS fungus has also been identified. NIPGR developed high yielding variety of chickpea with enhanced yield and increased protein content compared to the parent line through molecular breeding approach. NIPGR has filed 6 patent applications, published 81 research articles, supported 134 PhD students and 66 Postdocs.





- Institute of Bioresources and Sustainable Development (IBSD), Imphal has established Orchid cultivation units in the rural areas of Manipur for demonstration and training of farmers and unemployed youths. Till date, 950 farmers and unemployed youths have been

trained in orchids bio-entrepreneurship programme. IBSD published 46 research articles

- IBSD has a North East Microbial Repository, which has a total collection of 27466 microbial cultures originated from various ecological niches such as fresh water lakes, traditionally fermented foods, caves, hotsprings, high altitude, low temperature mountains, forest area, plant endophytes etc. A total of 15000 cultures have been characterized by IBSD.

- National Institute of Immunology (NII), Delhi has identified novel cellular factors affecting the replication of HIV within cells and a novel DNAase from *Streptococcus pneumonia* crucial for bacterial survival. Phase II clinical trials of a dendritic cell-based vaccine targeting SPAG9 are currently underway in patients of cervical cancer, in collaboration with the Cancer Institute, Chennai. NII transferredtechnology to Industry for the large-scale refolding of recombinant insulin, filed 10 patents and published 94 research articles.
- Translational Health Science and Technology Institute (THSTI), Faridabadstarted collaborative project with Bioneeds India Private Ltd. and NCCS, Pune for developing method of treatment of HIV infection and another collaborative project with Premium Serum for the development of aptamer based TB diagnostics. THSTI developed 11 technologies, transferred one technology to industry, filed 11 patents, obtained 1 patent, published 35 research articles and supported 3 PhD students.

- National Brain Research Centre (NBRC) has identified receptors (host protein) in neurons, which facilitates the entry of Japanese Encephalitis Virus into cells; the importance of inflammatory pathways in neurodegeneration which follows infection of the brain by the Chandipura virus; role of an ubiquitin ligase, Rnf2, that regulates synapse maturation via non-degradative function of protein ubiquitination that is linked to a neurodevelopmental disorder known as Angelman Syndrome. NBRC published 24 research articles supported 1 MSc and 5 PhD students.

- Rajiv Gandhi Centre for Biotechnology (RGCB), Trivandrum published the use of a single dose of HPV vaccine to prevent cervical cancer instead of the regular three doses, showed role of metformin in regression of vascular disease in patients with type 2 diabetes and demonstrated enhancement of cardiac mitochondrial functions in hypertrophy by Amalakirasayana a traditional Indian Ayurvedic product. RGCB developed 5 technologies, transferred one technology to industry, filed 8 patents, obtained 1 patent, published 89 research articles, supported 12 PhD students and 27 Postdocs.

Dr. Harsh Vardhan, Hon'ble Minister for Science and Technology and Earth Sciences visited second time to RGCB on occasion of dedicating first phase ofRGCB Bio-Innovation Centre (BIC) at the KINFRA Film and Video Park in Kazhakootam

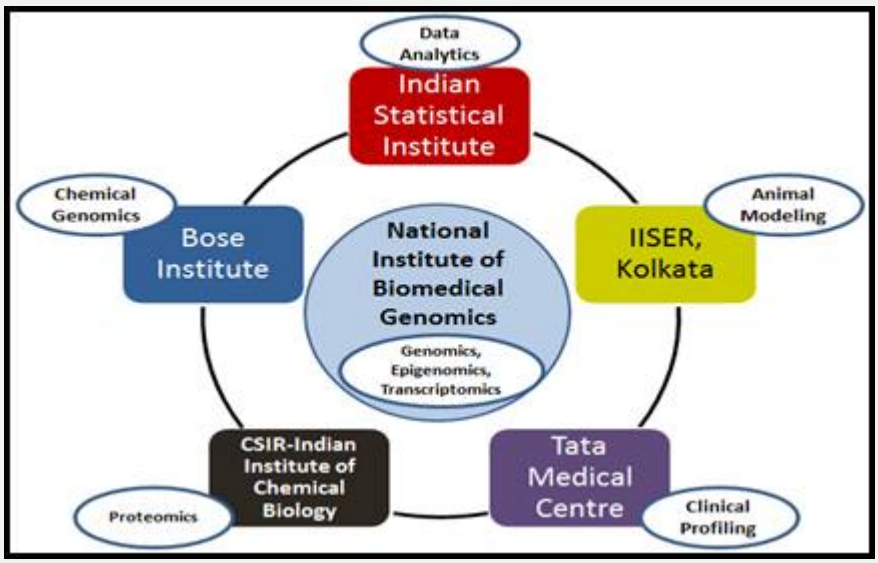
- RGCB Bio-Nest facility, managed by Rajiv Gandhi Centre for Biotechnology and Kerala Start-Up Mission, Government of Kerala, provides incubation facility for young entrepreneurs and has state-of-the-art equipment to facilitate research and development. Bio-Nest aims to provide a viable mechanism for licensing new technologies to upcoming biotech/pharma companies, start new local ventures and achieve early-state value enhancement of the technology with minimum financial inputs.

- National Institute of Biomedical Genomics (NIBMG) launched Doctoral program on Biostatistics and Bioinformatics, jointly with Regional Centre for Biotechnology (RCB) and GlaxoSmithKline Private limited (GSK).NIBMG has taken genomic laboratories and genetic testing to the doorsteps of clinicians by establishing a Unit in the largest tertiary care government hospital in Kolkata, the SSKM Hospital. About 800 patients have benefitted by getting genetic tests done for various disorders. NIBMG published 20 research articles and supported 2 PhD students.

- NIBMG through India project of the International Cancer Genome Consortium, DNA alterations in 10 genes that drive oral cancer. A new mechanism of human papilloma virus action was discovered for cervical cancer, including a gene related to this mechanism and the possible repositioning of a drug.

- NIBMG-Kalyani Systems Medicine Cluster includes six major institutions, both clinical and basic science, is an example of cross-talk between doctors, basic scientists and biotechnologists to enable deeper understanding of diseases at the level of biological systems and thereby accelerate treatment and management of diseases. This cluster is using two common diseases (gingivo-buccal oral and cervical cancers, that are most prevalent forms of cancer among men and women in India, respectively) as exemplars to

show that a combination of expertise of disparate domains can achieve the goal of understanding the pathobiology of disease and formulating a systems biology approach to clinical management. One of the major achievement include designing of a peptide to block a key gain-of-function oncogenic mutation in TP53 gene.



The year 2019 bodes well and the Department of Biotechnology is poised to further has support various research programs in modern biology and biotechnology; build capacity in cutting edge areas of research, develop right kind of infrastructure, build new partnerships and nurture the existing ones.

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