Government of India
Ministry of Science & Technology
Department of Biotechnology

सत्यमेव जयते

DEPARTMENT OF BIOTECHNOLOGY

11 YEARS OF

SCIENTIFIC INNOVATIONS

Government of India

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Department of Biotechnology

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INTRODUCTION

In the last 11 years, the Department of Biotechnology (DBT), Government of India, was at the forefront of promoting biotechnological innovation missions and entrepreneurship- leveraging the strength of strategic partnerships and building capacities across the country in alignment with national missions of our Government such as AtmaNirbhar Bharat, Swasth Bharat, Swachh Bharat, Startup India and Make-in-India.

Biotechnology, recognized as a sunrise sector, is one of the key enablers for driving the bio-economy of the country. India’s bio-economy has grown from $35.5 billion in 2014 to over $165.7 billion in 2024, with projections to reach $300 billion by 2030. India is ranked 12th in the world in biotech, 3rd in Asia-pacific, 3rd largest Startups ecosystem globally, and the largest vaccine manufacturer.

The BioE3 policy was approved by the Union Cabinet chaired by Prime Minister Narendra Modi on 24th August 2024 for ‘Fostering High Performance Biomanufacturing’, aligned with National initiatives of the government of India such as ‘Net Zero’ carbon economy and Mission LiFE (Lifestyle for Environment). The GenomeIndia Project announced the release of the data of whole genome sequences of 10000 individuals from 99 different populations of India through the Indian Biological Data Centre (IBDC). Another milestone pertains to India's first In-Human Gene Therapy (Phase-1 Clinical Trial) with lentiviral vector for Severe Hemophilia A in a single-center study that resulted in an annualised zero bleeding rate in all the 5 subjects enrolled with the production of Factor VIII for a prolonged period of time thus obviating the need for repeated infusions

A new PhD programme i.e the i3C BRIC PhD Programme in biosciences designed on the four pillars of Ideation, Immersion, Innovation and Collaboration to produce highly skilled, globally competitive professionals capable of solving contemporary bioscience-related challenges was initiated. Another milestone is the formation of National Agri-Food Biotechnology Institute (NABI), Mohali as a dedicated Biomanufacturing hub that emphasises the Government's vision for a science driven Viksit Bharat. BRIC-NABI, Mohali also has a functional Speed Breeding Platform that is augmenting transformational changes in crop improvement programmes by accelerating the development of advanced crop varieties that could sustain climate change and contribute to the food and nutritional demand of the population with implementation of “Speed Breeding Cropping Methods”. The booklet gives a gist of the successes of the Department of Biotechnology over the last 11 years.

India stands on the horizon of a new biotechnology-driven industrial revolution. As we stride into an era of transformative growth, the Department of Biotechnology is leading the way, aligning science, technology, and innovation with national aspirations and societal well being- towards Viksit Bharat 2047.

VACCINES

Vaccines for Swasth Bharat

The Department of Biotechnology (DBT) is pioneering health solutions for a healthier India. Basic research was supported by DBT for next generation therapies and ‘Vaccines for Swasth Bharat’. Five COVID-19 vaccines supported under “Mission COVID Suraksha-The Indian COVID-19 Vaccine Development Mission”, received Emergency Use Authorization (EUA).

World’s 1st and India’s indigenously Developed COVID-19 DNA vaccine

India’s 1st Omicron Booster Vaccine

India’s 1st mRNA vaccine and world’s first thermostable mRNA vaccine, GEMCOVAC-19™

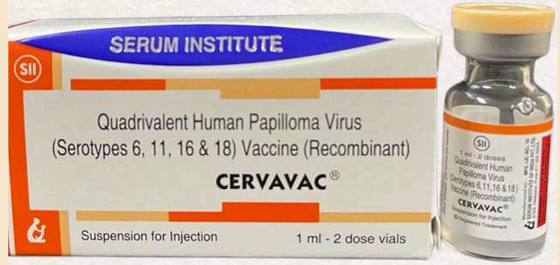
India’s 1st Intranasal Vaccine for COVID-19

Protein subunit vaccine, CORBEVAXTM

VACCINES

ROTAVAC for Rotavirus Diarrhoea Vaccine

First indigenously developed rotaviral diarrhoea vaccine, ROTAVAC®, with the support from DBT in a public-private partnership was launched by our Hon'ble Prime Minister in March, 2015. This vaccine also received World Health Organization (WHO) pre-qualification in 2018 and rolled out across India.



CERVAVAC for Cervical Cancer

India's 1st indigenously developed quadrivalent Human Papilloma Virus (qHPV) vaccine, CERVAVAC, against cervical cancer, supported by DBT and BIRAC, received market authorization in July, 2022.

Vaccines for Dengue, Influenza and Chikungunya

- Inactivated vaccine for Chikungunya is undergoing Phase II/III clinical trials.
- Live attenuated tetravalent Dengue vaccine is undergoing Phase I clinical trials.
- Recombinant tetravalent protein subunit vaccine for Influenza is in advanced preclinical development.

SCIENCE BREAKTHROUGHS

Scientific Accomplishments And Breakthroughs of DBT-BRIC Institutions

FIRST 3D STRUCTURE OF A KEY BRAIN RECEPTOR

MOLECULE THAT PLAYS A PIVOTAL ROLE IN COGNITIVE FUNCTIONS

BRIC-NCCS Pune investigators decoded the 3D structure of a glutamate receptor ion channel GluD1, an important brain receptor involved in several key brain functions. This discovery could provide novel insights into the mechanisms behind neurological disorders associated with GluD1 dysfunction, and thus help design therapeutics to treat a wide range of nervous system disorders and diseases- including loss of motor coordination and schizophrenia. (DOI: 10.1038/s41594-019-0359-y)

TAURINE DEFICIENCY

MAY BE A DRIVER OF AGING IN ANIMALS

Taurine is a semi-essential amino acid made within our body, and it declines in some tissues with age. A multi-national, collaborative study involving the BRIC- National Institute of Immunology and other institutes–found that taurine abundance decreases substantially with age in the bloodstream of mice, monkeys, and humans. Notably, taurine supplementation was shown to increase the average life span and health in different experimental models. Further, low levels of taurine in aged humans were associated with disorders like obesity, hypertension, inflammation, and diabetes and the taurine levels increased with a bout of exercise. Together, this evidence in humans suggests that taurine deficiency may be a driver of aging in humans as well. (DOI: 10.1126/science.abn9257)

FROM LUNGS TO LIVER

RESEARCH PROVIDE EVIDENCE THAT *MYCOBACTERIUM TUBERCULOSIS* (MTB) INFECTS HEPATOCYTES LEADING TO METABOLIC DYSFUNCTION

BRIC-NII researchers showed that Mtb perturbs hepatocytes, which becomes a busy hub for bacterial replication. Infection of Mtb to hepatocytes lead to a complete haywire in the liver cells, remodeling intracellular growth, localization, drug sensitivity and further increased fatty acid biogenesis and TAG biosynthesis. The researchers demonstrated active involvement of liver in a murine model which was infected with TB through aerosol infection. The data showed that infection of hepatocytes induces drug-metabolizing enzymes, resulting in either decreased bioavailability of drug or inactivation of the anti-TB drugs. In doing so, the bacteria shield itself against the common anti-TB drugs. Infection of hepatocytes by Mtb during the chronic phase can contribute to significant changes in disease progression, TB treatment, and development of infection-induced metabolic diseases. (DOI: 10.7554/eLife.103817.1.sa4)

SCIENCE BREAKTHROUGHS

Scientific Accomplishments And Breakthroughs

NOVEL BLOOD BAG TECHNOLOGY

Novel blood bag technology developed by researchers at BRIC-inStem that scavenges and removes damage-associated molecular patterns (DAMPs) from stored blood, enhancing the quality and shelf-life of stored blood. Such prophylactic technology may lead to the development of novel blood bags or medical devices, and may therefore impact healthcare by reducing transfusion-related adverse effects.

DENGUE INFECTIONS

STUDY FOUND THAT CHILDREN IN INDIA REPRESENT A LARGE PROPORTION OF PRIMARY INFECTIONS

A study published in Nature Medicine challenged the current paradigm surrounding dengue virus infections. Contrary to previous beliefs that primary dengue infections are less severe than secondary infections, the study found that children in India represent a large proportion of primary infections. Notably, primary infections accounted for more than half of severe dengue cases and fatalities. This discovery calls for a re-evaluation of dengue vaccine strategies- focusing on primary infections to prevent severe cases and deaths in regions with expanding dengue virus distribution. (Nature Medicine- DOI: 10.1038/s41591-024-02798-x)

INDIAN SCIENTISTS CRACK THE COMPLEX OF GENOME OF BREAD WHEAT

In a DBT-funded study, a group of 18 Indian scientists have cracked the complex genome of bread wheat research variety ‘Chinese Spring’- once considered by scientists and insurmountable task. Published in the journal 'Science’, the study provides full details of the DNA sequence of 21 wheat chromosomes and represents the highest quality genome sequence generated to date for the bread wheat. The reference genome has 94% genome coverage (1,45,000 lakh base pair letters) of the wheat genome and predicts 1,07,981 protein-coding genes. India was charged with the responsibility of sequencing chromosome 2A, representing about 5% of the wheat genome. The information generated is helping to identify genes controlling complex agronomic traits such as yield, grain quality, resistance to diseases and pests, tolerance to drought, heat, frost, waterlogging and salinity.
(Science - https://doi.org/10.1126/science.1251788. https://doi.org/10.1126/science.aar7191)

SCIENCE BREAKTHROUGHS

Scientific Accomplishments And Breakthroughs

7D, A SMALL MOLECULE, AGAINST DENGUE INFECTIONS

In a collaborative study, the BRIC-THSTI and RCB researchers have identified 7D, a small molecule from a library of compounds that has shown promising results in vitro and in vivo against dengue virus. 7D, with a half-life of ~2.85 hr in plasma and no significant toxicity, inhibited all serotypes of DENV in vitro. Further, 7D supplementation in mice increased synthesis of IFN-α/β and IFN-λ, and rescued disease symptoms like thrombocytopenia, leukopenia and vascular-leakage, with improved survival. A STAT3-inhibitor successfully inhibited these effects of 7D. Together, these observations identify compound 7D as a potential molecule to prevent dengue infection.
(EMBO Mol Med. 2024 Oct;16(10):2376-2401. doi: 10.1038/s44321-024-00137-8)

RESEARCH GIVES MECHANISTIC INSIGHTS ON DNA REPAIR PROTEIN

Mechanistic insights on dynamic regulation of the key DNA repair protein PARP1 were provided by the Molecular Oncology Group at BRIC-NII. Histone Deacetylase 5 (HDAC5) was found to modulate PARP1 acetylation at specific lysine residues, affecting its role in DNA damage response and the activation of genes related to cell proliferation and metabolism. Notably, inhibiting PARP1's enzymatic activity alone did not significantly impede tumor progression in mouse models, suggesting that its transcriptional functions remain active. These findings offer insights into PARP1's regulation and its implications in cancer development.
(Science Advances, 2024. DOI: 10.1126/sciadv.ado7720)

INDIA'S FIRST GENE-PROMOTER

EDITING RICE LINES

BRIC-National Institute of Plant Genome Research scientists have generated rice lines that demonstrate improved Pi uptake and grain yield, even in soils fertilized with lower phosphate levels. The team has employed an innovative approach by using CRISPR/Cas to eliminate the repressor binding site from the OsPHO1;2 gene's promoter.
(DOI: 10.1111/pbi.70165)

SCIENCE BREAKTHROUGHS

Scientific Accomplishments And Breakthroughs

HIGH LEAF LOW SEED

GLUCOSINOLATE MUSTARD BY GENE EDITING

Indian oilseed mustard, B. juncea, accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop. Further the oil cake is used as fodder for the cattle. B. juncea varieties grown in India contain high amounts of glucosinolates (>100 µmol/g of seed dry seed). To address this, BRIC-NIPGR, using the CRISPR/Cas9 system generated 'ideal oilseed mustard lines' with reduced seed and oil glucosinolate content, while maintaining high-glucosinolate in leaves and silique walls for achieving enhanced defense and uncompromised defense traits. The transgene-free lines are now being tested under ICAR trials. (Avni M et al., 2023, Plant Biotechnology Journal 21: 2182-2195)

MITOCHONDRIA AREN'T JUST THE POWERHOUSE OF THE CELL

THEY ARE SHAPE-SHIFTERS!

A recent study from BRIC-inStem shows that metabolism-driven redox changes regulate mitochondrial network morphology, independent of activity. This discovery provides fresh insight into the fundamental biology of cells and could inform future therapeutic strategies aimed at modulating mitochondrial dynamics in disease.
(PNAS DOI: 10.1073/pnas.2421953122)

EYA COMPLEX

A MOLECULAR BRIDGE TOWARD THE RIGHT DESTINATION

BRIC-CDFD researchers have identified a new molecular mechanism that ensures the accurate trafficking of one of the important proteins, Wntless (WLS), in the cells. The study shows that Eyes Absent (EYAs) proteins, (earlier implicated in eye development in Drosophila), form a complex and coat the Wntless carrier-vesicles (endosomes), and hence regulate organ development in vertebrates. The authors believe that chemicals that either stabilize the EYA complex or disrupt it could be exploited to understand the mechanism further and alleviate the disease occurrence and severity.
(DOI: 10.1016/j.devcel.2024.05.021)

SCIENCE BREAKTHROUGHS

Scientific Accomplishments And Breakthroughs

NEXT-GENERATION DENGUE DIAGNOSTICS USING NOVEL MONOCLONAL ANTIBODIES

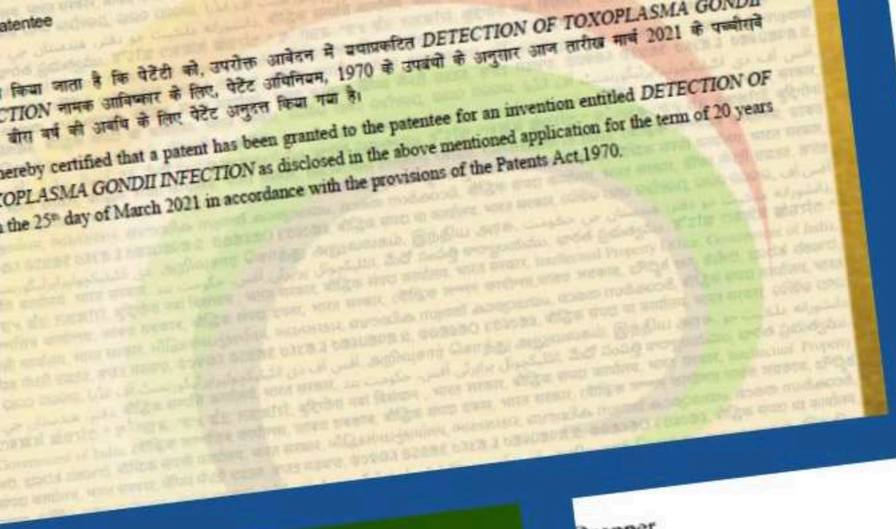
Overcoming Serotype Bias and Poor Sensitivity Commercial dengue NS1 tests often suffer from low sensitivity in secondary infections, serotype-specific bias (there are four DENV serotypes), and cross-reactivity with other flaviviruses—limiting diagnostic accuracy, especially in endemic regions like India. To address this, BRIC-THSTI generated a large repertoire of 95 monoclonal antibodies (mAbs) against dengue NS1 protein to develop a highly sensitive ELISA and a rapid lateral flow assay. THSTI has also developed a separate NS1 detection rapid test capable of differentiating dengue serotypes and is now working on a multiplex rapid test for dengue, Zika, and chikungunya (https://doi.org/10.4049/jimmunol.2200251).

OVARIAN RESERVE AND OOCYTE QUALITY ON LIVESTOCK FERTILITY

The lack of ovarian function and oocyte reserves in livestock can lead to infertility, causing significant losses for farmers and the dairy industry. The reproductive lifespan of livestock depends on the resting oocyte pool, which can be affected by apoptotic pathways that eliminate germ cells as animal's age. Research at BRIC- NIAB, Hyderabad has shown that primordial follicles in livestock start expressing TAp63α, making them more susceptible to apoptosis. Inhibiting P63α with a synthetic chemical called PRL005, could extend ovarian life in mice and goats. Further research is ongoing to test PRL005 in goat models and search for natural, plant-based inhibitors of P63α to slow down ovarian aging (DOI: 10.1007/978-3-031-21630-5_4)

TIE2 ACTIVITY IN CANCER ASSOCIATED MYOFIBROBLASTS AS NOVEL TARGET AGAINST REPROGRAMMING OF CANCER CELLS TO EMBRYONIC-LIKE CELL STATE

Based on mechanistic investigation at both bulk and single cell levels BRIC-NIBMG investigators have identified a specific tyrosine kinase, 'Tie2' in fibroblast cells, present in oral tumor stroma. These fibroblasts were found to impact the behaviour of cancerous cells by inducing the ability of cancer cells to acquire stem cell-like properties. Tie2-activity in fibroblasts was targeted using a small molecule inhibitor which reverted the properties of these fibroblasts and negatively impacted the stemness in oral cancer cells; impeding the tumor growth in pre-clinical animal models. Through specific gene signatures, head and neck cancer patients were classified into low or high-risk of developing aggressive cancer. Thus, this study has developed a prediction method of segregating patients into risk-groups and suggested the possible molecular target which may be tested in these patients. (https://doi.org/10.1186/s13046-025-03405-8)



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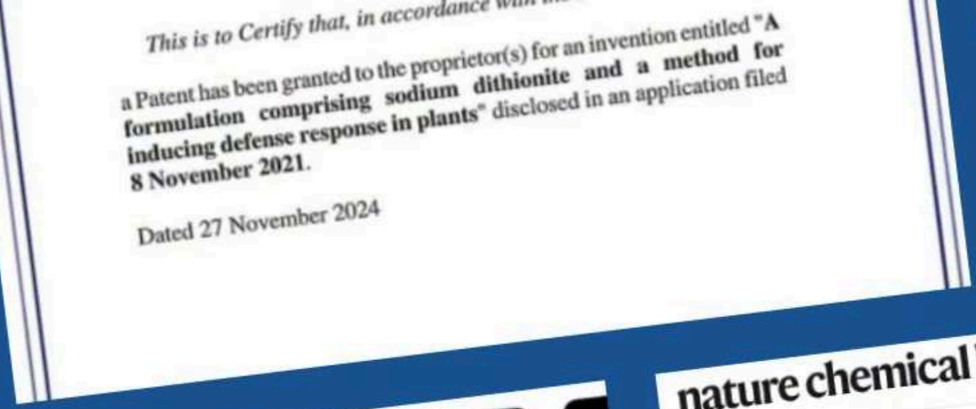
hereby certified that a patent has been granted to the patentee for an invention entitled DETECTION OF
OPLASMA GONDII INFECTION as disclosed in the above mentioned application for the term of 20 years
the 25th day of March 2021 in accordance with the provisions of the Patents Act.1970.



This is to Certify that, in accordance with

a Patent has been granted to the proprietor(s) for an invention entitled "**A formulation comprising sodium dithionite and a method for inducing defense response in plants**" disclosed in an application filed **8 November 2021**.

Dated 27 November 2024

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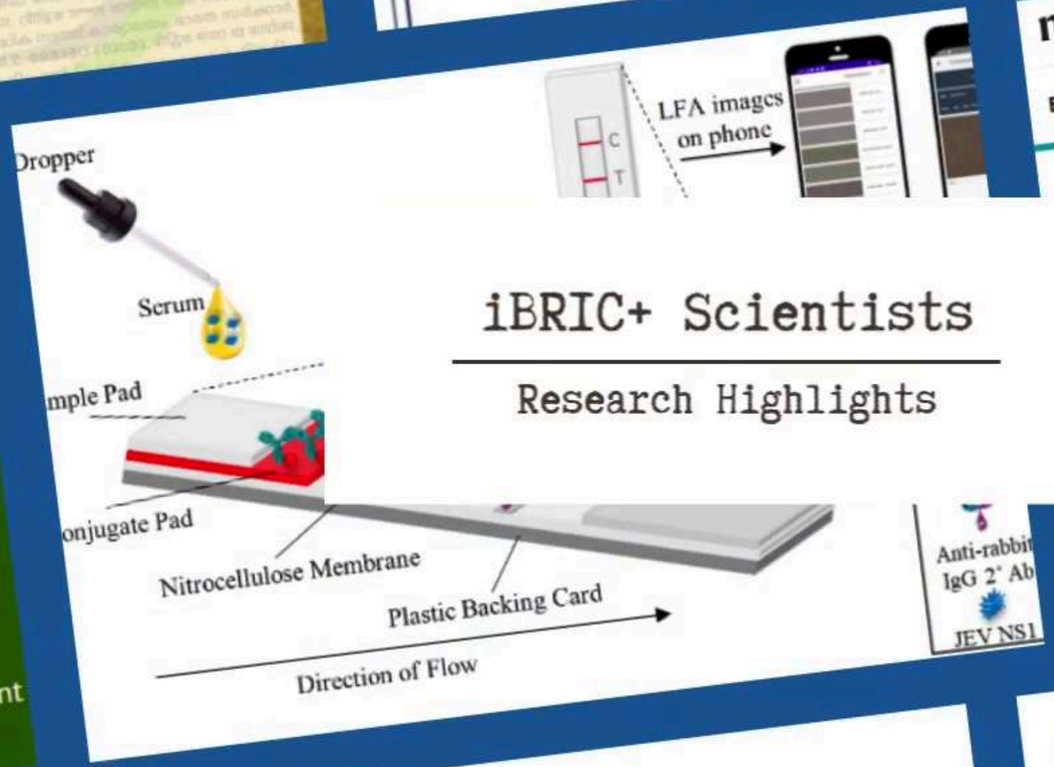
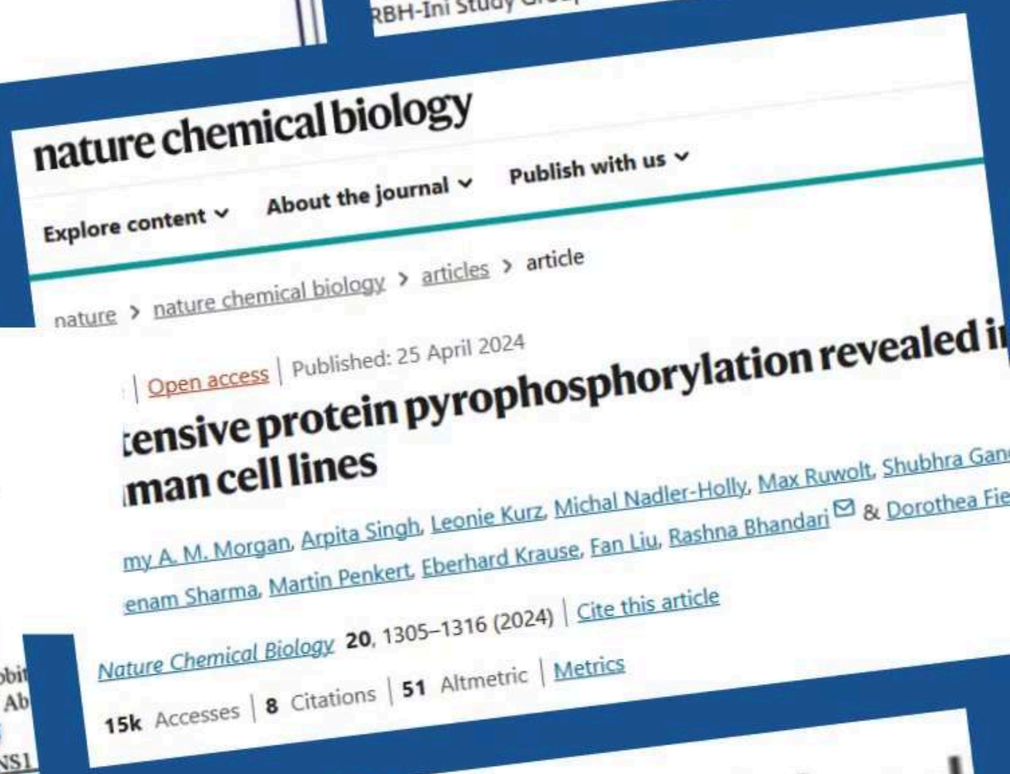


iBRIC+ Scientists

Research Highlights



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Nature Chemical Biology **20**, 1305–1316 (2024) | Cite this article

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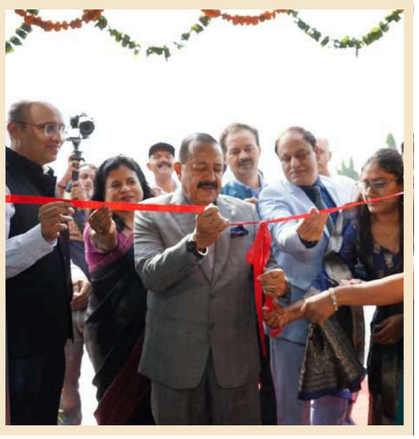
11 YEARS OF
SCIENTIFIC INNOVATIONS

INFRASTRUCTURE SUPPORT



INAUGURATION OF BRIC-NABI

IBDC

SPEED BREEDING FACILITY

INDIA'S FIRST DEDICATED BIOMANUFACTURING INSTITUTE

Hon'ble Minister (IC) S&T, Dr. Jitendra Singh, inaugurated India's first Biomanufacturing Institute BRIC-National Agri-Food Biomanufacturing Institute (BRIC-NABI), Mohali, in Punjab. BRIC-NABI will streamline the journey from research to commercialization, facilitating pilot-scale production and delivering innovative agri-tech solutions to the market. The new institute will focus on developing high-yield crops, sustainable biomanufacturing technologies, and value-added products from agricultural resources, in alignment with the Government's vision for "Doubling Farmers' Income" and the "Make in India" initiative.

IBDC

The Indian Biological Data Centre (IBDC) is India's first national repository for life science data. Established at the Regional Centre of Biotechnology (RCB), Faridabad, in collaboration with the National Informatics Centre (NIC), Dr Jitendra Singh, Hon'ble Minister S&T, dedicated the first national repository to the nation in November 2022. Due to the heterogeneity of life science data, IBDC is being developed in a modular nature, wherein different sections would typically deal with particular type/s of life science data. The IBDC has 96 TF computing capacity using 2912 CPUs, 39 TB of RAM, 865 TF computing capacity using 64 GPUs, 4 PB of parallel file system. The Department has released the Biotech-PRIDE Guidelines, 2021 followed by formulation of 'Framework for Exchange of Data (FeED) Protocols' for responsible data sharing.

SPEED BREEDING FACILITIES

Speed breeding facilities were established through DBTs support at Punjab Agricultural University (PAU), Ludhiana; BRIC-NABI, Mohali and ISARC, Varanasi to speed up varietal development of agricultural crops. Mission-Mode Phenotypic & Genotypic Characterization of Genetic Resources was completed for more than 36000 accessions of food and oils seed crops. Reference-quality genomes assembled indigenously for wheat, linseed, sesame, and safflower. 57 lines for yield and nutritional traits (low GI, high Fe/Zn) in background of varieties DRR Dhan, MTU1010 and Swarna are in various stages of varietal trials.

INFRASTRUCTURE SUPPORT

PRIMATE RESEARCH CENTRE AND SMALL ANIMAL FACILITY

BRIC-NII hosts one of the most advanced and comprehensive animal research infrastructures in the country, supporting a wide spectrum of biomedical research. At the forefront is NII's Primate Research Centre- the only facility in India with CPCSEA approval to breed macaques for research purposes. This unique capability allows the institute to generate non-human primates (NHPs) of known age and pedigree, critical for conducting approved basic, pre-clinical, and toxicological studies. Further strengthening its capabilities, NII houses an ABSL3 NHP facility- one of only two such high-containment laboratories in the country (the other being at NIV).

INDIA'S FIRST FERRET RESEARCH FACILITY AT BRIC-THSTI

India's first Ferret Research Facility at BRIC-THSTI, a state-of-the-art establishment adhering to the highest biosafety and research standards, marks a pivotal moment in India's fight against infectious and non-communicable diseases. This pioneering facility will serve as a crucial resource for vaccine development, therapeutic testing, and research into emerging infectious diseases- significantly bolstering India's pandemic preparedness strategy and positioning the nation at the forefront of global scientific endeavors.

NATIONAL GENOTYPING & GENOMICS FACILITY

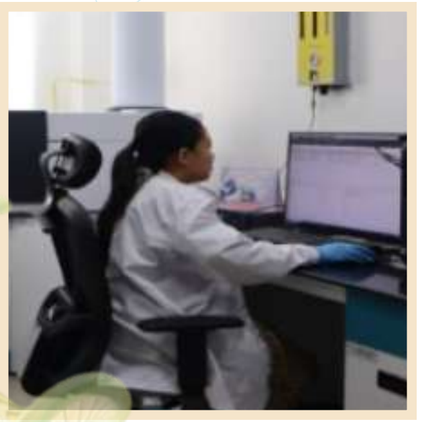
The NGGF has been established at the BRIC-NIPGR by the DBT to serve as a "Singe-Window Service System" providing advanced genomics-based solutions to the custom stakeholders of biotechnology research. It is functioning in Public Private Partnership (PPP) mode including HRD training and consultancy on appropriate technologies to be chosen, study design, and data analysis that enables and improves the quality of the research and product development.

PRIMATE RESEARCH CENTRE, BRIC-NII

NATIONAL GENOTYPING & GENOMICS FACILITY, BRIC-NIPGR

INFRASTRUCTURE SUPPORT

VACCINE TESTING FACILITY



DRUG METABOLOMICS LAB, TRIPURA

PROTEOMICS RESEARCH FACILITY, MUMBAI

VACCINE TESTING FACILITY (VTF)

Vaccine Testing Facilities (VTF) were set up at DBT-iBRIC+ institutes, funded by the PM CAREs. Both the facilities at BRIC-National Institute of Animal Biotechnology (BRIC-NIAB) and BRIC-National Centre of Cell Science (BRIC-NCCS) have been notified as Central Drug Laboratories (CDLs).

ESTABLISHMENT OF FAST LIFE TIME IMAGING FACILITY AT BRIC-RGCB, THIRUVANTHAPURAM

The DBT-SAHAJ National Facility for Lifetime Imaging at BRIC-RGCB, is dedicated to providing access to advanced imaging technologies, including lifetime and FRET imaging, for BRIC-RGCB researchers and the broader academic and life sciences community.

ESTABLISH A DRUG METABOLOMICS LAB FOR NORTH EASTERN STATES" AT TRIPURA UNIVERSITY, TRIPURA

The Drug Metabolomics Laboratory, established under this programme for the North-Eastern region, is focused on developing advanced LC/MS-based methods to detect narcotics, steroids, and other drugs of abuse in various biospecimens. Equipped with state-of-the-art UPLC-QToF HRMS/MS systems, the lab enables both targeted and on-targeted metabolomics across sample types like plasma, tissue, urine, and cell cultures. Q-TOF LC/MS System at Tripura University, Tripura

HIGH RESOLUTION MASS SPECTROMETRY BASED PROTEOMICS RESEARCH AND TRAINING FACILITY AT IIT BOMBAY, MUMBAI

The facility at IIT Bombay has successfully established and optimized standard operating procedures for a wide range of complex proteomics applications. The team has also successfully optimized advanced protocols such as Parallel Reaction Monitoring and Multiple Reaction Monitoring for complex biological samples, including plasma and tissue.

PROGRAMS & POLICY

BIOE3 POLICY AND BIOMANUFACTURING SCHEME

The Union Cabinet, chaired by the Prime Minister Shri Narendra Modi, approved DBT's 'BioE3 (Biotechnology for Economy, Environment and Employment) Policy for 'Fostering High Performance Biomanufacturing' on August 24, 2024. The policy will usher in a new bio-revolution in India driven by regenerative principles. The policy lays a framework for the convergence between biotech, engineering and digitalization for building a more equitable and sustainable future through Biomanufacturing.

This timely policy intervention is expected to enable creation of jobs, develop new technologies and products thereby accelerating the growth of manufacturing units- catapulting India's bioeconomy to new heights. BioE3 envisages green, clean, prosperous and Atmanirbhar Bharat and putting the country well ahead of its net zero carbon emission target.

Under the BioE3 policy, DBT-BIRAC joint call for proposals has been announced for various thematic sectors, and >2000 proposals have been received.

DBT-ISRO MOU

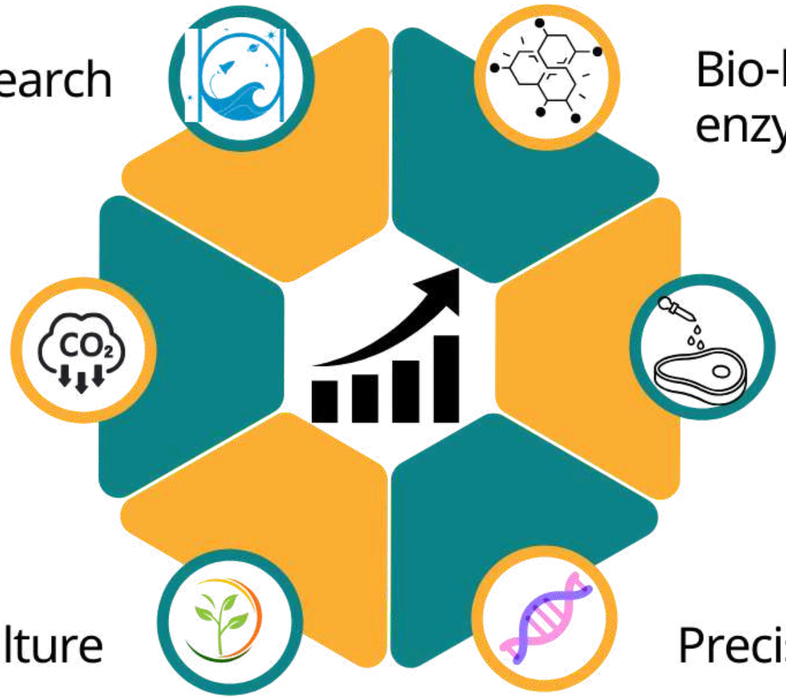
Under the BioE3 policy, DBT in collaboration with ISRO, signed an MoU with ISRO for collaboration in Space Biotechnology on 25th October 2024 of Hon'ble Minister of S&T, Dr. Jitendra Singh.

THEMATIC SECTORS OF BIOMANUFACTURING

Futuristic marine and space research

Bio-based chemicals and enzymes

Carbon capture and it's utilization

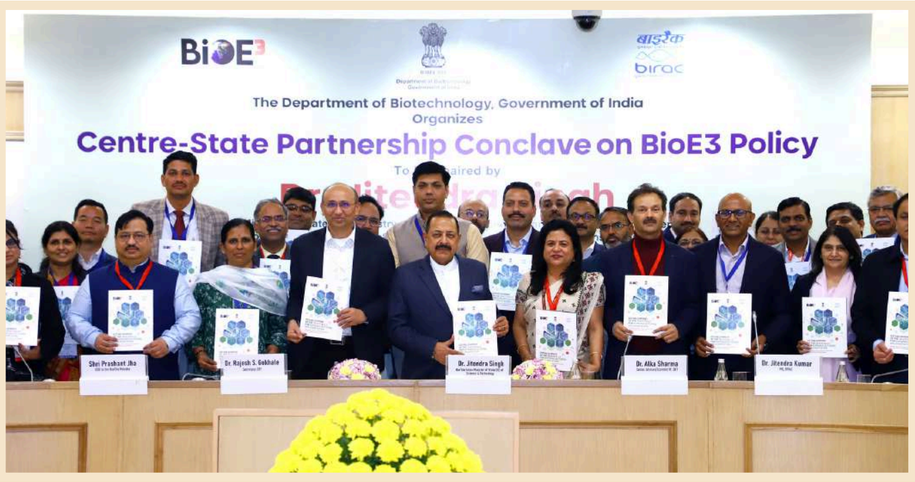


Functional Foods and Smart Proteins

Climate-resilient agriculture

Precision Biotherapeutics

PROGRAMS & POLICY



CENTRE-STATE PARTNERSHIP CONCLAVE ON BIOE3 POLICY

The Centre-State Partnership Conclave on BioE3 policy was chaired by the Hon'ble Minister (IC) S&T, Dr. Jitendra Singh, in February 2025 to sensitize the states to establish BioE3 Cells as part of India's biotechnology revolution and to advance India's bioeconomy. These BioE3 Cells will serve as interconnected knowledge hubs, linking state and national stakeholders to facilitate the effective implementation of the BioE3 Policy via knowledge exchange, policy coordination, and technology adoption in the biomanufacturing sector.

BIOE3 CELL IN ASSAM

The 1st MoU was signed between the DBT and the Government of Assam, on 12th March 2025, to formalize a strategic collaboration towards establishing a 'State BioE3 Cell' and developing an 'Assam BioE3 Action Plan'.

PROGRAMS & POLICY

ICGEB BIOFOUNDRY

The DBT-ICGEB Biofoundry at the ICGEB, New Delhi, is India's first publicly funded biofoundry, established to advance the nation's capability in the realm of synthetic biology and biomanufacturing.

The State-of-the-art platform operates on the Design-Build-Test-Learn (DBTL) cycle, integrating advanced tools such as AI, big data, synthetic biology, computational biology, and bioinformatics to streamline the design and optimization of biological systems.

This biofoundry bridges the gap between research and application- allowing innovations from the lab to be rapidly scaled up and transferred to startups, industry, and manufacturing partners across sectors like food, agriculture, chemicals, pharmaceuticals, and clean energy.

BIOE3 OUTREACH AND VARTHALAPS

Outreach activities for the BioE3 Policy carried out extensively through press meets, social media platforms, editorials, and school campaigns to highlight its significance. Several varthalap events with PIB took place across different places in India to sensitize media about the BiOE3 policy.

BIOE3 GOING GLOBAL

Inputs received from MEA/India's Mission/Posts abroad- >45 countries (52 Embassies) on the BioE3 Policy.

DBT
Delivering a **B**etter **T**omorrow

GenomeINDIA

GenomeINDIA is a pioneering scientific project funded by DBT. The project marks a landmark collaboration of 20 academic and research institutions to drive a genomics-based health revolution for India.

The project has completed whole genome sequencing (WGS) of over 10,000 individuals, representing all major population groups across the country.

Shri Narendra Modi, Hon'ble Prime Minister of India, dedicated the research data of GenomeINDIA to the researchers on 9th January 2025, during the 'Genomics Data Conclave'. The Prime Minister stated that this national database encapsulates the extraordinary genetic landscape of India, and will serve as an invaluable scientific resource to boost genetic and medical research for human health.

The analysis of the sequencing data will provide a pathway towards affordable genomics-based diagnostic tools and precision medicine tailored to the Indian population.

#OneDayGenomeInitiative

Enterobacter hormaechei

This genomic analysis of organism helps in improved prognostic outcomes and supports the fight against antibiotic resistance, promoting better health and treatment strategies.

ISOLATION
Isolated from neonatal blood sample

GENOMICS
Resistance to all antibiotics in clinical practice

Unravelling the genome of a hospital - associated Superbug

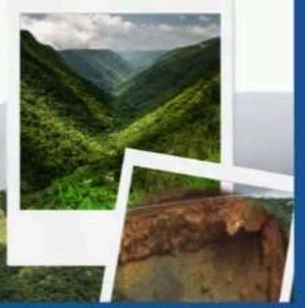
DEPARTMENT OF BIOTECHNOLOGY
Ministry of Science & Technology
Government of India

BRIC
a DBT Organization

#ONEDAYONEGENOMEINITIATIVE

BACILLUS VELENZENSIS

MRC5958



ISOLATED FROM HOT SPRING OF SHILLONG, मेघालय

Arthrobacter globiformis mrc11

Genome

Genome uncovers DNA repair, oxidative stress & organic compound degradation

Application

Used in in extreme conditions such as outer space

Isolation

Isolated from stratospheric air sample

One Day, One Genome Initiative

#ONEDAYONEGENOMEINITIATIVE

Bacillus altitudinis Lc5

Isolated from leaf of black rice of Manipur, important towards developing bioformulation for PGPR activity

AGRICULTURAL APPLICATIONS

- Stress tolerance & nitrogen fixing ability
- Production of defensive enzymes, solubize phosphate, chelates iron, presence of metabolites

#OnedayOnegenomeInitiative

Escherichia coli

Clinical Research
The organism can help in discovery of new drugs for improved clinical outcomes

Isolation
Isolated from the urine of patient with a urinary tract infection

Translation
The genetic information can help in developing better diagnostics

Insights
Mobile genetic elements can be transferred to other bacteria via HGT

Genomics

#OnedayOnegenomeInitiative

Rhizobium indicum (MCC 3961)

Empowering High-Altitude Agriculture: Nitrogen Fixation for Sustainable Farming in Extreme Environments

Isolated from pea root nodules at high altitudes (4,115m) supports high-altitude agriculture

Genomic study reveals plant growth promotion & increased agricultural productivity in challenging climate

Isolated from pleural fluid of an Indian Patient

Identification of factors contributing to pathogenicity, AMR and survival under stress condition were identified

AMR
The AMR gene ultimately supports more effective clinical outcomes in healthcare

#OneDayOneGenomeInitiative

Klebsiella pneumoniae

Insights
The genome harbors multiple resistance gene against commonly used clinical antibiotics

Translation

PROGRAMS & POLICY

ONE DAY ONE GENOME

One Day One Genome initiative (ODOG) was launched on 9th November 2024 during the first BRIC Foundation Day celebrations to catalogue the rich and unique microbial diversity of our nation and share it in an interesting manner with the general public through social media.

More than 100+ Bacterial Genomes has been released by means of graphical abstract and summary on the social media handles has helped in demystifying the complex genomic data, making it more understandable and accessible for students and the general public.

These microbes demonstrates remarkable potential in various sectors such as agriculture, healthcare, and environmental sustainability.

Biotechnology Research and Innovation Council-National Institute of Biomedical Genomics (BRIC-NIBMG), is the coordinating institute for the One Day One Genome mission.

GENE EDITING & GENE THERAPY TRIAL

India's first-in-human Gene Therapy with lentiviral vector for Severe Hemophilia A, in a single center study, resulted in an annualised zero bleeding rate in all the 5 subjects, enrolled with the production of Factor VIII for a prolonged period of time thus obviating the need for repeated infusions.

INSACOG

The Indian SARS-CoV-2 Genomics Consortium (INSACOG) is a multi-agency, multi-institutional consortium to monitor the genomic variations in SARS-CoV-2 and was established in December 2020. The consortium started with 10 National laboratories (including NIBMG), and today has expanded to 67 laboratories in a “Hub and Spoke” model. INSACOG has sequenced more than 3.33 lakhs SARS-CoV-2 genomes so far.

PROGRAMS & POLICY

DATA DRIVEN RESEARCH TO ERADICATE TB: "DARE2ERAD TB" PROGRAMME

The program is aligned with 'TB Mukt Bharat' initiative of Govt. of India and setting up the Indian TB Genomic Surveillance Consortium; sequencing of 32000 whole genomes of Mtb isolates from patients and mapping drug resistance profiles through genomics and artificial intelligence to allow rapid identification of drug-resistant TB strains in patients and facilitate strategies for better control of TB.

The Union Minister of State (IC) S&T, Dr. Jitendra Singh, announced the completion of genome sequencing of 10,000 isolates of "*Mycobacterium tuberculosis*" on March 24, 2025 in New Delhi, at a summit organised on the occasion of "World TB Day".

BIOETHANOL TECHNOLOGIES

Bioethanol technologies are ushering India to a thriving low carbon economy for India. DBT through research support, aims to drive India in achieving its national target of Net Zero Carbon by 2070. Some of the major success include:

- ICGEB has developed a thermotolerant, osmotolerant and inhibitor tolerant yeast strain. This strain works as well as commercially available strains in conversion of molasses to ethanol at lower temperature and better than them at higher temperature
- 2G Ethanol Technology trial using rice straw and cotton stalk at 5 T/day scale at the Demonstration plant at Kashipur in Nov 2019.
- Indigenous, highly active, cost-effective cellulolytic enzymes were developed, and produced at 5000 L Fermenter and successfully tested for producing 2G ethanol.
- Cyanobacteria, microalgae and fungi engineered to develop heterologous pathways for production of low carbon products, to replace various petro-chemical products.
- Photo-bioreactors, demonstrated at 100,000 Liter in Mumbai coast, to grow marine algae using sea water and CO_2. Algal biomass was generated to develop fuels as well as high-value biocommodities

MAIZE
(7)

RICE
(32)

WHEAT
(3)

SOYABEAN
(1)

CHICKPEA
(5)

GROUNDNUT
(2)

IMPROVED CROP VARIETIES

PROGRAMS & POLICY

NATIONAL BIOPHARMA MISSION

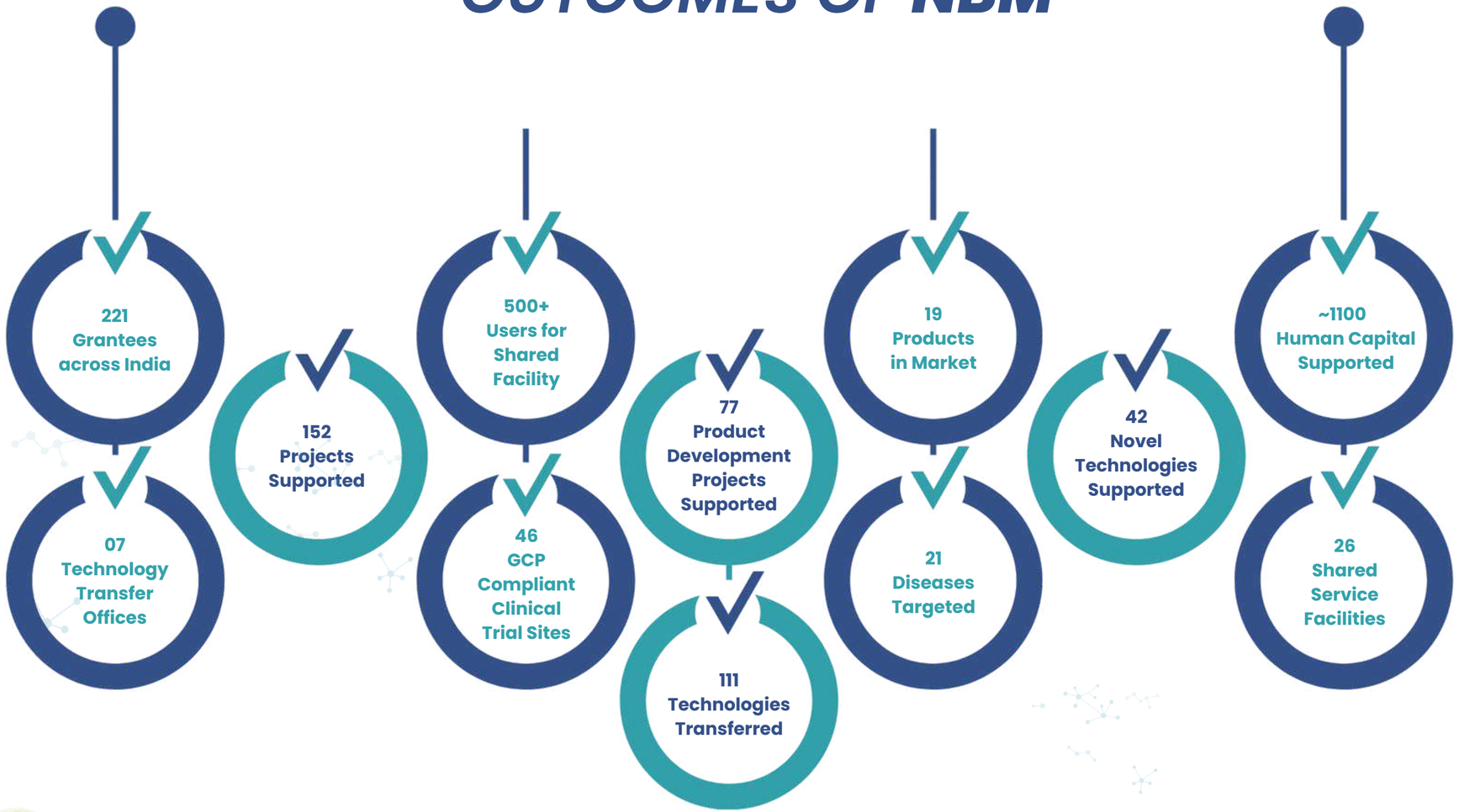
The Department is supporting the Cabinet-approved National Biopharma Mission (NBM), entitled "Industry-Academia Collaborative Mission for Accelerating Discovery Research to Early Development for Biopharmaceuticals – "Innovate in India (i3)", empowering biotech entrepreneurs & accelerating inclusive innovation. The Mission is aligned with the national missions of Make in India and Start up India.

NBM has made catalytic investments and funded capital-intensive translational development for nationally critical biopharma and medtech products, to steer the path for Atmanirbharta (self-reliance) in healthcare. The nation's first DNA vaccine and mRNA vaccines for COVID-19, and the made in India MRI are examples of path breaking innovations accelerated by NBM.

NBM's impact includes both human resource and technical capacity (technology transfer, bio-process human resources and clinical trial networks) as well as physical infrastructure (pilot production, analytical development and validation capacity etc.).

On the occasion of 5 years of implementation of Cabinet-approved Industry-Academia Mission of DBT, the "NBM Impact Book" was released by Dr Jitendra Singh, Hon'ble Minister of State (IC), Ministry of Science & Technology and Ministry of Earth Sciences.

OUTCOMES OF NBM



STARTUPS

India’s biotech startup ecosystem represents a remarkable journey of innovation, growth, and increasing global influence. Over the past decade, the startup ecosystem has emerged as a significant force, driven by key sectors such as vaccines, biotherapeutics, diagnostics, bioethanol, enzymatic applications, and bioservices. Today, India’s bioeconomy stands at around $165.7 billion, and this growth is matched by a thriving entrepreneurial landscape.

The number of Biotech Startups have increased to more than 10,000 in the last 11 years. From 10 biotech products in 2012, today this number has grown to over 800+ products. Private Fund Raised by BIRAC supported startups (INR) was approximately Rs. 7000 crores. This trend of private funding infusion in the ecosystem is expected to grow further. This innovation ecosystem nurtured by DBT-BIRAC has enabled our rapid response for the mitigation of the COVID-19 pandemic.

The DBT-BIRAC have nurtured the biotech entrepreneurship ecosystem through various schemes of BIRAC. Established 95 bio-incubators across 21 states/UTs, supporting 1800+ incubates; 4 Regional centres for mentoring and handholding, especially covering Tier 2, Tier 3 regions; 7 Technology Transfer Offices (TTOs); 12 Daughter Funds under Fund of Funds.

DBT/BIRAC’s catalytic and enabling initiatives are fostering the Made-in-India development of vaccines, biosimilars, and medical devices, that address critical healthcare challenges.

11 YEARS OF SCIENTIFIC INNOVATIONS

SKILLS: HRD PROGRAMMES

The Department of Biotechnology (DBT) has implemented several programmes for human resource development and infrastructure support for enhancing the biotechnology ecosystem in the country.

- Biotechnology Career Advancement and Re-orientation Programme (BioCARe): This programme, a special scheme of DBT, is enhancing participation of women scientists in India towards research in Biotechnology and allied area.

- Increasing human capital and quality leadership: Ramalingaswami Re-entry Fellowship is open for Indian Nationals who are working overseas in various fields of biotechnology and life sciences and are interested in taking up scientific research positions in India. Ramalingaswami Re-entry Fellows would be able to work in any of the scientific Institutions/Universities in the country.

- DBT-SAHAJ portal was launched in 2018-19, and the Unified Online Booking Portal under the DBT-SAHAJ Infrastructure Programme was officially launched

North Eastern Region (NER) Programme

- Special focus was given to the North Eastern Region (NER) for capacity building, 670+ twinning projects, 126 Biotech Hubs and setting up of 7 advanced research facilities.

- Four CoEs established, focusing on conducting R&D on local resources. These programmes have trained 3000+JRF/SRF/RAs; 500+ publications; 9 granted patents; 5 commercialised technologies.

- With the capacity now built in NER, DBT has launched programmes addressing NER specific challenges, e.g. MDR-Tuberculosis; NE Scented Rice, Banana, Citrus, Tea; NE-food fishes; Animal Disease Diagnostic & Surveillance (ADMaC) programme etc.

SKILLS: HRD PROGRAMMES

The i3c BRIC-RCB PhD Program

The year 2024 marked a revolutionary step in 'PhD' education in India. Dr. Jitendra Singh, Union Minister of State (IC) S&T, launched the i3c BRIC RCB PhD Program in Biosciences. This new PhD program will expand the scale of generating a highly-skilled workforce, and focus on 'problem-solving' approach to address societal needs. The i3c PhD program lays its foundation on the four pillars namely, Ideation, Immersion, Innovation and Collaboration. The programme will foster greater academic and research interaction, among the institutions of the DBT BRIC (iBRICs), RCB, and ICGEB, and will increase the professional networking opportunities for the Ph.D. scholars. With its first call opened in June 2024, a total of 58 students have been enrolled in its very first batch.

BIOSAFETY REGULATION

Review Committee on Genetic Manipulation (RCGM) functions from the Department of Biotechnology to monitor the safety-related aspect with respect to ongoing research projects or activities involving hazardous microorganisms, GE organisms and cells, and products thereof.

RCGM brings out Manuals of guidelines specifying procedures for regulatory processes with respect to activities involving GE organisms in research use as well as industrial & environmental applications, with a view to ensuring human health and environmental safety.

STANDARD OPERATING PROCEDURES FOR REGULATORY REVIEW OF GENOME EDITED PLANTS UNDER SDN-1 AND SDN-2 CATEGORIES, 2022

The guidelines was notified by DBT vide OM dated 04.10.2022 to facilitate regulatory review for R & D of genome edited plants falling under the categories of SDN-1 and/or SDN-2, until free from exogenous introduced DNA.

BIOLOGICAL RESEARCH REGULATORY APPROVAL PORTAL (BIORRAP) (HTTPS://BIORRAP.GOV.IN/)

BioRRAP is a gateway for dealing with and submitting applications related to research in biological sciences for regulatory approvals to various regulatory agencies. Each research requiring regulatory oversight, submitted at BioRRAP, is identified by an unique ID called “BioRRAP ID”, that is required for further submissions to requisite regulatory agencies.

BIOSAFETY REGULATION

GUIDELINES FOR SAFETY ASSESSMENT OF GENOME EDITED PLANTS, 2022

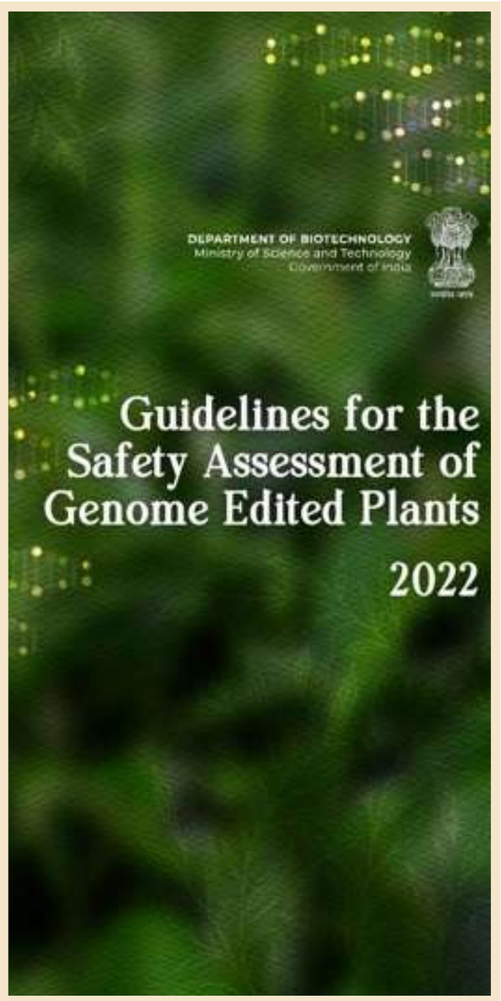
The guidelines was notified by DBT vide OM dated 17.05.2022, to harness the potential of Genome Editing technologies with proper appraisal of biosafety concerns, to ensure safety for the organisms and environment.

GUIDELINES FOR THE ESTABLISHMENT OF CONTAINMENT FACILITIES: BIOSAFETY LEVEL 2 (BSL-2) & 3 (BSL-3) AND CERTIFICATION OF BSL 3 FACILITY

The guidelines was notified by DBT vide OM dated 18.12.2020.
It applies to the establishment of BSL-2 facilities and establishment along with certification of BSL- 3 facilities nationwide. The department started nationwide certification of BSL-3 facilities post-COVID in 2020. Thereafter, all BSL-3 facilities were designed and deployed as per the specifications detailed in these guidelines. In compliance with these guidelines, 48 facilities were certified by RCGM, DBT till 2024.

INDIAN BIOSAFETY KNOWLEDGE PORTAL (IBKP) (HTTP://IBKP.DBTINDIA.GOV.IN/)

IBKP is an online web portal to provide information and for submitting applications to Review Committee on Genetic Manipulation (RCGM) for approvals on import/export/transfer/receive materials for conducting experiments involving Hazardous Microorganisms/ Genetically Engineered Organisms or Cells.



PARTNERSHIPS

BIOTECHNOLOGY RESEARCH AND INNOVATION COUNCIL (BRIC)

The Department of Biotechnology (DBT), in line with the recommendation of the Department of Expenditure and with the approval of the Cabinet, subsumed 13 Autonomous Institutions (AIs) under one Autonomous Body- the Biotechnology Research and Innovation Council (BRIC), a registered Society. The institutions under BRIC are known as iBRIC, and together with the Regional Centre of Biotechnology (RCB), and International Centre for Genetic Engineering and Biotechnology (ICGEB), form the iBRIC+.

The Department provides core funding, that is, financial support towards salaries, infrastructure, and intramural research/ other essential activities, to the 15 iBRIC+ institutions.

The activities of BRIC are listed below:

- Interdisciplinary Network Research Programmes
- i3c BRIC-RCB Ph.D Programme in Biosciences
- Zero Waste Life on Campus Programme
- The On-Day-One Genome mission

INDIA ALLIANCE (WELLCOME TRUST)

A strategic partnership between the Department of Biotechnology, Ministry of Science & Technology, Government of India and the Wellcome Trust, a global charitable foundation based in the UK, India Alliance aims to promote and support biomedical research in India, driving innovations to tackle health challenges.

India Alliance supports collaborative, interdisciplinary research projects, and clinical research training through its Team Science Grants (TSG) and Clinical/Public Health Research Centres (CRC), respectively. These bring together scientists from multiple institutions with complementary skills, knowledge, and resources to advance knowledge and undertake need-inspired research, envisioned as virtual, research-oriented centres focusing on crosscutting research themes.

PARTNERSHIPS

Collaborative and multidisciplinary partnerships are crucial for advancing science and technology. Partnerships lead to new and innovative collaborative research programs that help address national needs. The Department of Biotechnology (DBT), through multiple national and international partnerships, is propelling India as a global leader in Biotechnology.

BIOTECHNOLOGY RESEARCH AND ASSISTANCE COUNCIL (BIRAC)

Biotechnology Research and Assistance Council (BIRAC) is a not-for-profit, Section 8, Schedule B, Public Sector Enterprise, set up by Department of Biotechnology (DBT), Government of India, as an Interface Agency to strengthen and empower the emerging Biotech enterprise to undertake strategic research and innovation, addressing nationally relevant product development needs.

It is an industry-academia interface and implements its mandate through a wide range of impact initiatives, be it providing access to risk capital through targeted funding, technology transfer, IP management, and handholding schemes that help bring innovation excellence to the biotech firms and make them globally competitive.

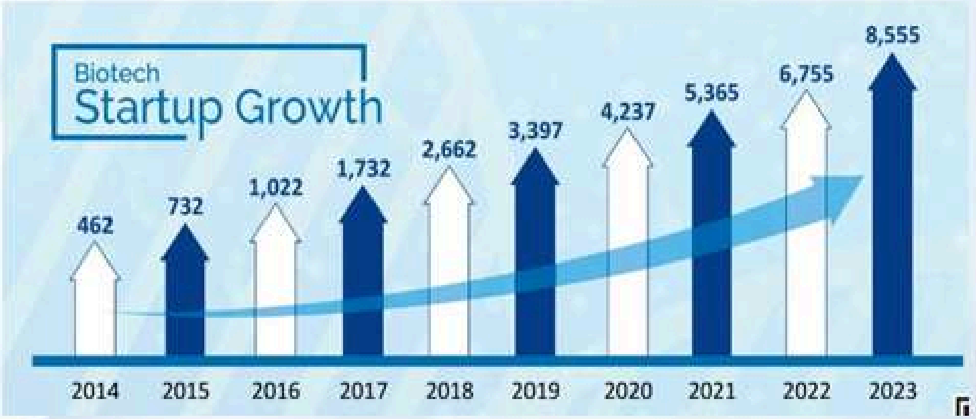
DBT-BIRAC's impact across building a thriving startup ecosystem includes:

- Promotion of Biotech Startups ecosystem through Public-Private Partnership
- BIRAC's programs, schemes and policy initiatives are supplemented through strategic collaborations, public private partnerships with National & International bodies, Government departments, States, Industry, Angels/VCs, Mentors, Experts, Philanthropic organizations, NGOs etc
- BIRAC has inculcated a culture of biotech entrepreneurship creating a pipeline of >11,000 aspiring entrepreneurs & 10000 biotech Startups
- BIRAC has established a vibrant biotech innovation network. This includes:
  - 1000 bio-incubators across 21 states/UTs supporting 1800+ incubatees
  - Regional centres for mentoring and handholding, especially covering Tier 2, Tier 3 regions; 7 TTOs
- Daughter Funds under Fund of Funds
- Funding Support to Startups: Out of 11000+ new innovative ideas, BIRAC supported:
  - 1500+ Startups were supported under 'Biotech Ignition Grant'
  - 159 Startups provided equity investment through SEED and LEAP Fund
  - 77 Companies provided investment through Fund of Funds-AcE Fund
- Biotech Startup Expo: the Global Bio-India is a mega biotechnology expo organized by DBT along with its PSU- BIRAC. It is the largest representation of entire biotechnology stakeholders in the country to the national and international biotech community.

DEPARTMENT OF BIOTECHNOLOGY
Ministry of Science & Technology

INDIAN BIOTECH INNOVATION ECOSYSTEM: GROWTH STORY

OUTCOME	2014	MULTIPLIER	2025
BIOTECH STARTUPS	<500	20X	10,000+
INCUBATORS	6	16X	100+
INCUBATION SPACE (SQ.FT)	60,000	16X	10 LAKH+
NUMBER OF PRODUCTS	10	80X	800+
FUND RAISED (INR)	10CR	650X	6500 CR+
JOBS CREATED	<500	70X	35000+
IP FILED	125+	12X	1300+
BIO-ECONOMY ($ USD)	28 Bn	6X	165.7 Bn (DEC 2024)



PARTNERSHIPS

GATES FOUNDATION

Grand Challenges India (GCI), a collaborative initiative between the Department of Biotechnology (DBT), and the Bill & Melinda Gates Foundation, has successfully supported the development of India's first indigenously-developed vaccine against cervical cancer, which is now included in the National Immunization Programme (NIP). In parallel, GCI has also launched efforts to validate indigenously developed, rapid,
point-of-care RT-PCR-based Human Papillomavirus (HPV), diagnostic test kits for cervical cancer screening. GCI-supported agriculture development innovations have been translated to similar geographies such as Nepal, Bangladesh, Latin America, Kenya, and Malawi, thereby advancing
South-South collaborations.

Mobile Diagnostic Labs were deployed for COVID-19 testing in Kerala,
Tamil Nadu, and Assam, now repurposed for other infectious diseases in these regions.

CEPI

Ind-CEPI Mission is a strategic partnership with CEPI to accelerate vaccine development for emerging infectious diseases, in alignment with the global initiative of CEPI. This programme has facilitated support for vaccine development for COVID-19, chikungunya, monkey pox, and beta coronavirus.

The bioassay lab at THSTI has been recognized by global CEPI as a centralized lab . This is a rare distinction as only 16 labs globally have received this recognition.

The India-PACT-Programme (Partnerships for Accelerating Clinical Trials), an online training programme for strengthening clinical trial capacities, was conducted for >2400 participants from 14 friendly and neighboring countries.

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DBT
EMPOWERING
Women











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