



**DEPARTMENT OF BIOTECHNOLOGY**  
Ministry of Science & Technology  
Government of India

# **COMPENDIUM ON** **Institutes of BRIC (iBRIC)**

December 2023

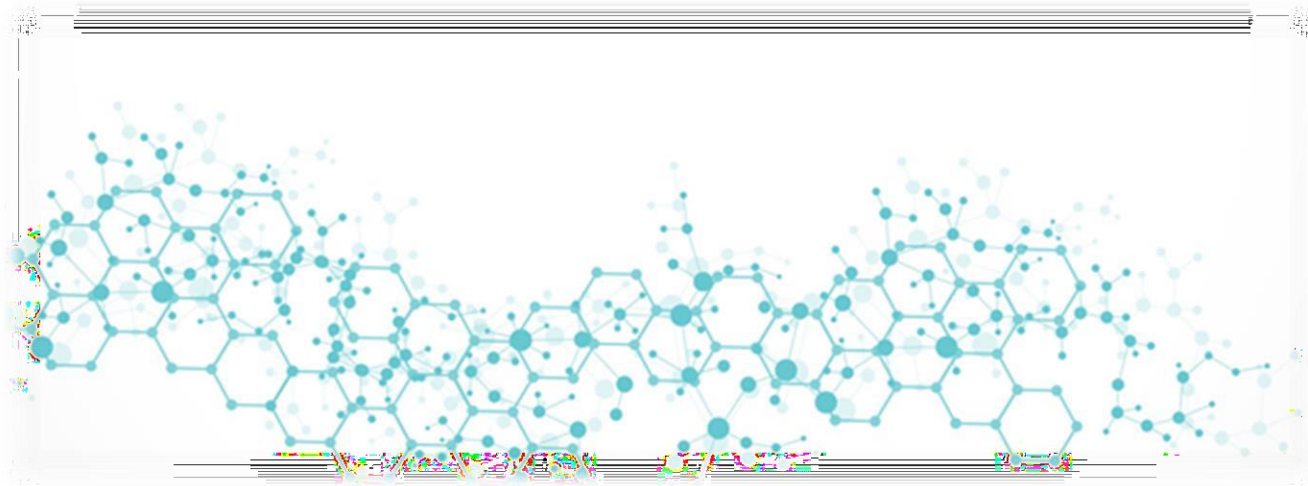


**Biotechnology Research  
and Innovation Council (BRIC)**  
A Department of Biotechnology Organization



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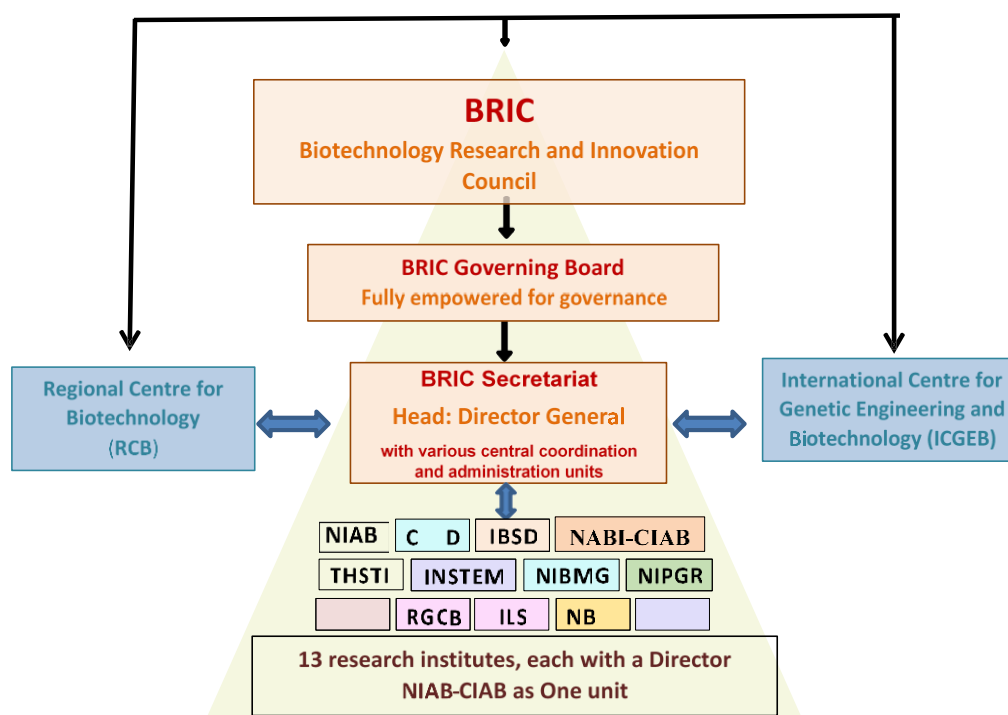
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## Executive Summary

As per the directive of DoE on “Rationalization of Autonomous Bodies” DBT has obtained cabinet approval for rationalization of its 14 Autonomous Institutions (AIs) by subsuming them under one Autonomous Society, Biotechnology Research and Innovation Council (BRIC), for centralized governance, maximization of the impact of biotech research and effective utilization of existing resources. The current effort of “Restructuring of DBT-AIs” is towards maximizing socio-economic outcomes from public funded research towards achieving the National goals of Atmanirbhar Bharat, Make-in-India and Vigyan se Vikas.

### DBT will have two Autonomous Bodies - BRIC and RCB



BRIC has been created for realization of following goals:

- *Creation of one Autonomous Body*

DBT has subsumed its 14 Autonomous Institutions (AIs) and create one Autonomous Body, Biotechnology Research and Innovation Council (BRIC), as a registered Society

- *Bring parity across cadres in the 14 DBT AIs*



DBT proposes a proportionate Human resource structure across its institutions along with their parity in their pay levels

- *Build specialized skills as per New Education Policy*

New Ph.D programs with research immersion and common course-curriculum, in order to foster creative thinking through advanced training and innovative projects.

- *Build synergies in research*

Building integrated, multi-disciplinary research programs across institutions to strengthen collective scientific effort and maximize impact.

- *Align mandates to National Missions*

Promote mission-oriented scientific research, addressing unmet societal needs and directed at public good





# **Introduction**



## 1. Introduction

### About the DBT

DBT is a relatively young organization of the GoI with a mandate of promoting and nurturing Biotechnology in the country. Despite a relatively small work force (of about 1500 personnel), DBT has created a vibrant biotech ecosystem since its inception in 1986. In the last five years alone, DBT AIs have trained more than 700 Ph.Ds, 1000 post-docs, 5000 research fellows, published more than 6000 papers, been granted 100 patents and enabled techno Start-up creation. In addition to facilitating, research and entrepreneurship, DBT has also formulated national policies/guidelines/legislations in the Biotech Sector.

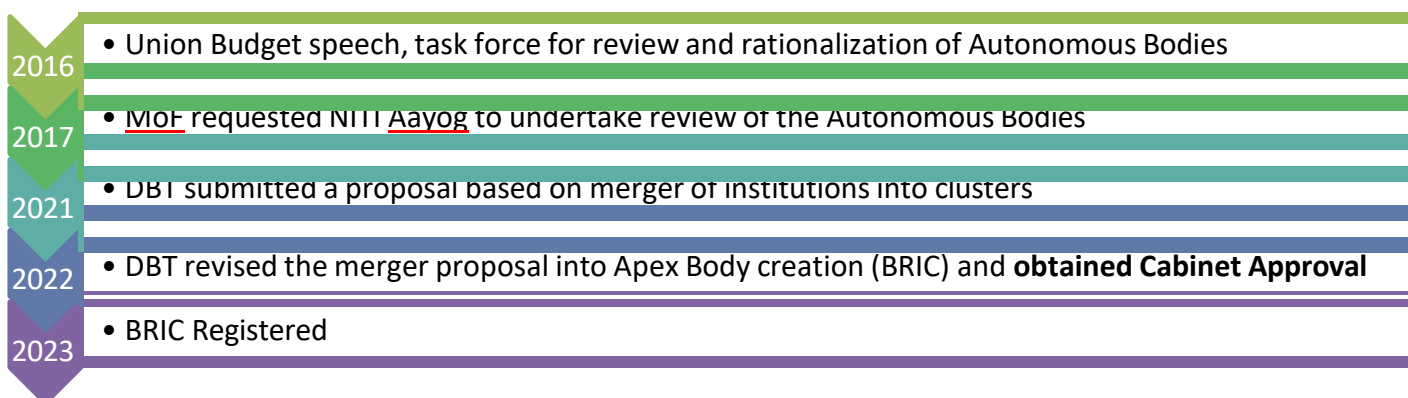
DBT has created a vibrant ecosystem for facilitating basic, early and late translational research and entrepreneurship as well as formulated policies/guidelines/legislations pertaining to various aspects of biotechnology research and its applications. The DBT implements its mandate through: core support to its 15 theme-based autonomous institutions across the country and one international organization; and competitive grants scheme support to various research, capacity-building and infrastructure efforts across the country. Two Public Sector Undertakings- Bharat Immunological and Biologicals Corporation Limited (BIBCOL) and Biotechnology Industry Research Assistance Council (BIRAC)- have also been established for manufacturing of biologicals and nurturing a start-up innovation ecosystem, respectively. DBT has shaped the research and innovation ecosystem in the country through the support to more than 6000 scientific research projects, more than 50,000 scientific personnel, 4 bio clusters, 20 Centres of Excellence, 10 biotech parks, bilateral partnerships with over 20 countries and nurtured over 1000 start-ups.

### Indian Biotechnology sector

India is among the Top 12 destinations for biotechnology worldwide and 3rd largest destination for biotechnology in Asia Pacific. In 2022, India's Biotechnology industry has crossed \$80.12 Bn, growing 14% from the previous year. The Indian Bioeconomy has witnessed a many fold increase in valuation in the past ten years, with COVID-19 giving the industry a much-needed push. India is poised as one of the leading destinations for bio innovation and biomanufacturing.



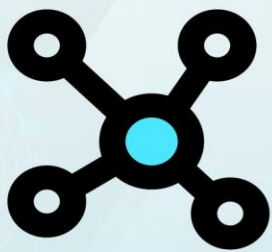
## Rationalization of Autonomous Bodies



The Government of India’s directive on “Rationalization of Autonomous Bodies”, is viewed as an opportunity to integrate multi-disciplinary research, training and innovation programmes within DBT AIs for maximum impact. Accordingly, the proposed mechanisms will bring energizing transformation by leveraging existing strengths, break silos to emphasize inter-institutional collaborations, strengthen indigenous education programs and establish mechanisms for research validation and translation to maximize biotech research impact aligning to National Missions.







**Biotechnology  
Research &  
Innovation  
Council  
(BRIC)**

## 2. DBT-Biotechnology Research & Innovation Council (BRIC)

The Department of Biotechnology (DBT), Ministry of Science and Technology with the approval of cabinet has subsumed its 14 Autonomous Institutions (AIs) and created one Autonomous Body, Biotechnology Research and Innovation Council (BRIC), as a registered Society. BRIC is intended to integrate the multi-disciplinary research, training and innovation programs operational across various DBT institutions for maximum impact and establish structures that leverage existing strengths to build systemic collaborations, identify convergent directions, and set a clear path for translation and asset monetization.

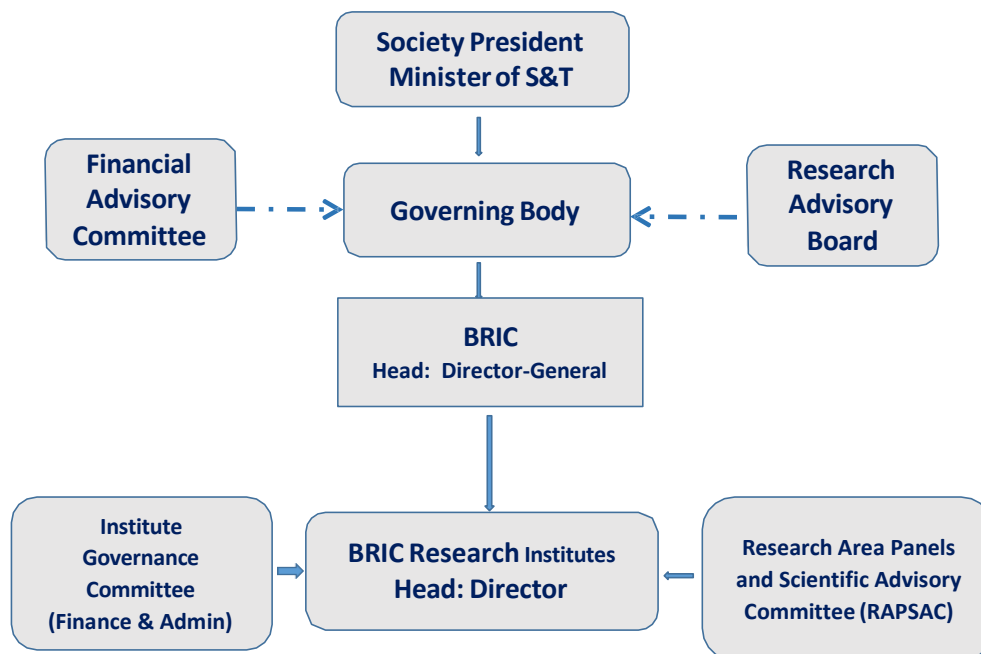
### Objectives

- Advance cutting-edge efforts in biotechnology by the establishment of multi-disciplinary research programs across institutional boundaries.
- Consolidate current achievements to move beyond mere enhancement of numerical matrices to expand the scale and scope of research endeavors, taking on complex challenging questions and finding affordable, relevant solutions, while expanding the frontiers and footprint of knowledge.
- Initiate immersion-based Ph.D programs in partnership with the Regional Centre of Biotechnology (RCB, Faridabad), to create interdisciplinary education and research programs that compete with the best in the world and accelerate innovation in biotechnology, and contemporary areas of academic, clinical, and industrial significance.
- Global networking through the International Centre for Genetic Engineering and Biotechnology (ICGEB, New Delhi) to catalyze global multi-organizational interactions.

Fostering inter-ministerial cooperation and building synergies across institutional boundaries, BRIC will leverage existing strengths, and collaborations and expand the footprint of educational and training programmes to maximize the impact of biotech research. Altogether, this will forge new paths that strengthen and amplify the vision of national goals.

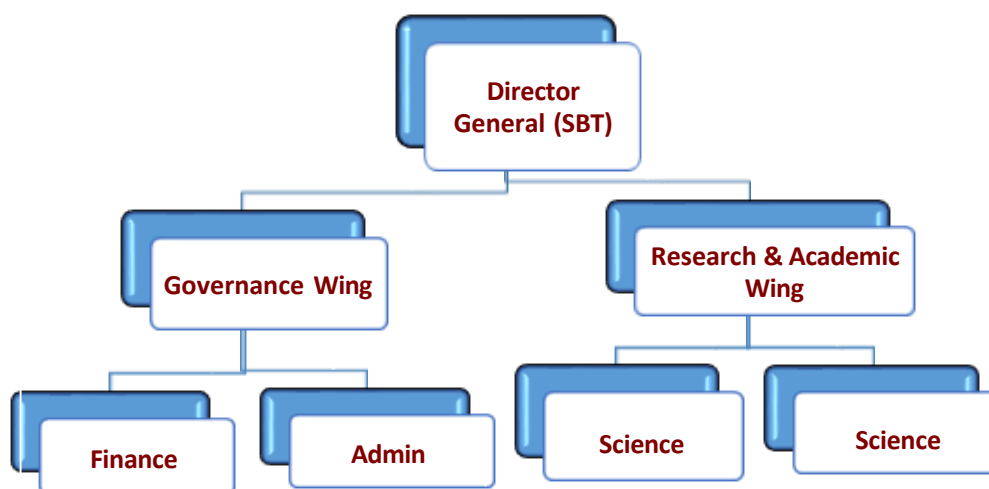


## BRIC Organizational Structure



### BRIC Secretariat

The Secretary, DBT (*ex-officio*) will be the Administrative and Financial Head BRIC as its Director General (DG). The Office of the DG will be supported by BRIC Secretariat to coordinate the activities of BRIC, including disbursement of funds received from DBT. The BRIC Secretariat will coordinate and facilitate the execution of the activities in the constituent research institutions of BRIC. The secretariat will be based in New Delhi and will be the primary contact with DBT.



## BRIC Integrated, Inter-Institutional Research Programs

The DBT research institutions will coordinate the execution of the Integrated Research Strategy for BRIC addressing national missions. Some of the components of the programs are as below:

- BRIC will tap into the faculty and talents in its Research Institutes and Centres of Excellence funded through DBT's extra-mural support to develop hubs for knowledge-based innovation and technological advances. At the core will lie, data skills, data ethics, and the ability to interrogate issues of global scope.
- Thrust areas that consolidate emerging core strengths in DBT Institutes will be identified. These reflect current contemporary areas globally and resonate with missions of national importance. The thrust areas are described in the broadest terms to remain dynamic, responsive to need, and build current, complementary linkages in globally relevant areas. The Institutes populate and will contribute to multiple thrust areas as shown below:

Thrust Area	Institutes (areas of strength)
<b>Infectious Disease &amp; Immunology</b>	NII, THSTI, RCB, RGCB, NIBMG, ICGEB, CDFD, NIAB
<b>Chronic Diseases</b>	CDFD, ILS; inStem; NCCS; NIAB, NBRC, NIBMG RCB, RGCB, NCCS, NII, THSTI
<b>Neurobiology</b>	NBRC, inStem, RGCB, ILS, CDFD
<b>Clinical Research</b>	THSTI, inStem-CSCR; CDFD, NIBMG, NII, NBRC, RGCB
<b>Plant Biotechnology</b>	NIPGR, NABI-CIAB, IBSD, RGCB, ICGEB, CDFD
<b>Animal Biotechnology</b>	NIAB; CDFD; inStem
<b>Cell Biology, Molecular Biology &amp; Genomics</b>	CDFD; ILS; inStem; NCCS; RCB, RGCB, NCCS, NII, THSTI, NIAB, NBRC, NIBMG; NABI-CIAB; NIPGR;
<b>Bio resource Management</b>	IBSD
<b>Structural Biology, Bioinformatics, and Drug Discovery</b>	NII, ICGEB, THSTI, RCB, RGCB

Genomics, Genetics, Computational and Data Science, Development of chemical and molecular tools etc. contribute to all relevant thrust areas.

Operationally, the Research Institutes will provide leadership in thrust areas by mechanisms that include but are not limited to, (i) Identifying and steering convergent directions and collaborations within and across areas; (ii) Coordinate submission of large programmatic grants and, (iii) Enable the emergence of focus groups for accelerated activities within a thrust area.





# **Immersion- based/Biotech Ph.D Programs**



### 3. Immersion-based Biotech Ph.D. programs

Overall, less than 1% of the country's approximately 40,000 higher education institutions are engaged in research, and there is a dearth of quality Ph.D. program in life sciences and biotechnology in the country. DBT, over a period of 30 years, has established 16 elite research institutions in the country with national facilities and world-class laboratories. They have built distinct research identities in biotechnology - immunology, genomics, cell science, DNA fingerprinting, translational health, animal biotech, plant biotech, food processing, stem cells & regenerative medicine, bioresource technology and brain research. These institutions are currently enrolling limited numbers of Ph.D. students in affiliation with state/central universities.

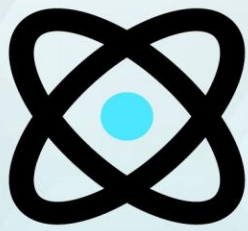
#### DBT-BRIC Research Program

The objectives of BRIC are aimed at promoting cutting edge research in biotechnology aligned with national priorities, fostering innovation and translation across institutional boundaries, and developing indigenous technologies and capabilities in line with the principles of Atmanirbhar Bharat. To this end, BRIC seeks to nurture the next generation of scientific leaders by initiating multi-disciplinary Ph.D. programmes. BRIC will work in partnership with the Regional Centre for Biotechnology (RCB) to offer globally competitive interdisciplinary education and research programs in biotechnology. The Regional Centre for Biotechnology (RCB), Faridabad, is an Institution of National Importance created by an Act of the Parliament of India, established by DBT, Government of India, under the auspices of UNESCO, with the mandate of providing world-class education, training and research at the interface of multiple disciplines in biotechnology. This is expected to create high-quality biotech PhDs in India (1000 in the next 5 years) with strong domain expertise.

#### Programme Overview

The proposed PhD programme will enroll highly talented PhD scholars in foundational coursework along with hands-on training in high-end technology platforms for the first semester at RCB. It would also include an immersion program for an additional three months to establish the need and rationale of the research hypothesis through field studies/experimentation. Scholars would be provided additional financial support for these immersion programs from Grand Challenges India (GCI). Upon completion of the foundational courses, the scholars will continue their Ph.D. research work in any of the BRIC institutions based on the domain of research.





**Global  
Networking  
Program**



## 4. BRIC- Global Networking Program

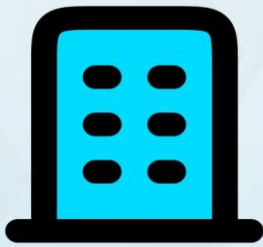
The complex challenges of current times are best addressed through strong partnerships including international collaborations that take advantage of global resources and talent. Team science, the combining of resources and expertise that cannot be found in a single institution is crucial for devising credible and sustainable solutions for the challenges we face today.

The *International Centre for Genetic Engineering & Biotechnology (ICGEB)*, at New Delhi is India's connect with a well-established global network of Member States, placing it in a unique position to anchor and helm efforts in this context.

ICGEB, New Delhi was established in 1983 and is part of a larger group of ICGEB Member States, empowered to use and apply the latest scientific developments and modern biotechnology solutions to end disease and achieve food and energy security, while fostering the development of human capital through education, training and provision of equal opportunities for all. ICGEB's role to promote South-South Cooperation aligns with the DBT's mandate to serve as a nodal point for international cooperation and play a pivotal role in enabling collaboration and cooperation between the BRIC consortium and the ICGEB Affiliated Centres and Regional Research Centres (RRCs). The ICGEB Member States now include 22 countries in Africa, 9 in the Middle East, 13 in Europe, 5 in Central America and the Caribbean, 8 in South America and 8 in Asia. Hence Biotechnology cooperation can be strengthened with these countries.

iBRIC i.e. BRIC Institutions will continue to undertake research partnerships globally. Additionally, ICGEB will serve as a nodal centre for bringing together, researchers from different parts of the world with diverse yet complementary knowledge as well as resources, to catalyze multi-organizational and inter-disciplinary research including establishing BRIC institution research stations at global locations.





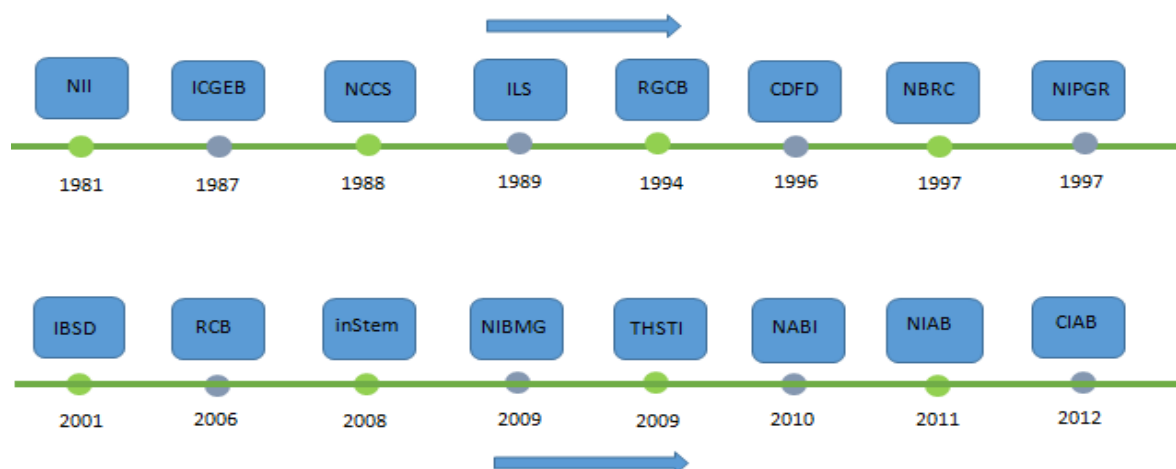
**iBRIC -  
Institutions  
of BRIC**

## 5. Brief Background of iBRIC

The Department of Biotechnology (DBT) under the Ministry of Science & Technology supports 14 Autonomous R & D Institutions (AIs), one Institution of National Importance (Regional Centre for Biotechnology- RCB, Faridabad) and hosts one international organization (International Centre for Genetic Engineering and Biotechnology- ICGEB, New Delhi).

The AIs were established as registered Societies: i) National Institute of Immunology (NII, New Delhi); ii) National Center for Cell Science (NCCS, Pune); iii) Institute of Life Sciences (ILS, Bhubaneswar); iv) Rajiv Gandhi Centre for Biotechnology (RGCB, Thiruvananthapuram); v) Centre for DNA Fingerprinting & Diagnostics (CDFD, Hyderabad); vi) National Brain Research Centre (NBRC, Manesar); vii) National Institute for Plant Genome Research (NIPGR, New Delhi); viii) Institute of Bioresources and Sustainable Development (IBSD, Imphal); ix) National Institute of Animal Biotechnology (NIAB, Hyderabad); x) Institute for Stem Cell Science and Regenerative Medicine (inStem, Bangalore); xi) National Institute of Biomedical Genomics (NIBMG, Kalyani); xii) Translational Health Science and Technology Institute (THSTI, Faridabad); xiii) National Agri-Food Biotechnology Institute (NABI, Mohali); xiv) Center of Innovative and Applied Bioprocessing (CIAB, Mohali). Details for each institute are in *Annexure I*. list of major Facilities housed in these institutes are presented in *Annexure II*

### Chronology of Inception of DBT-AIs



## Achievements of DBT AIs

The DBT AIs are among the premier scientific institutions of the country undertaking cutting-edge biomedical research and innovation. These academic hubs attract some of the brightest minds in the country.

### **Publications and Patents**

Overall, the DBT AIs have maintained high scientific productivity with publications in top-tier international peer-reviewed journals. More than 5000 papers were published and close to 100 patents were granted to the institutes since 2017. Seventeen innovative technologies were successfully commercialized.

<b>Name of AI</b>	<b>Publications (2017-22)</b>	<b>Patents granted or Technologies commercialized (2017-22)</b>
<b>NII, New Delhi</b>	569	26 patents
<b>ICGEB, New Delhi</b>	634	10 patents, 2 tech commercialized
<b>NCCS, Pune</b>	547	6 patents
<b>ILS, Bhubaneswar</b>	287	7 patents (5 out of these commercialized)
<b>RGCB, Thiruvananthapuram</b>	453	10 patents
<b>CDFD, Hyderabad</b>	294	1 patent
<b>NBRC, Manesar</b>	242	1 patent
<b>NIPGR, New Delhi</b>	681	11 patents
<b>IBSD, Imphal</b>	192	0
<b>RCB, Faridabad</b>	349	1 patent
<b>inStem, Bangalore</b>	275	2 patents, 1 tech commercialized
<b>NIBMG, Kalyani</b>	158	0
<b>THSTI, Faridabad</b>	392	11 patents, 9 tech commercialized
<b>NABI, Mohali</b>	281	0
<b>NIAB, Hyderabad</b>	93	0
<b>CIAB, Mohali</b>	147	15 patents

### **Human Resource Development**

In the last 5 years (2017-2022), the DBT AIs have awarded 777 PhDs and trained more than 7000 Post-docs/Research Fellows/Project Associates. The distribution across AIs is as below:



Name of AI	No. of Postdocs/Research Fellows/Project Associates	Total No. of PhDs trained (2017-22)
<b>NII, New Delhi</b>	818	127
<b>ICGEB, New Delhi</b>	1121	57
<b>NCCS, Pune</b>	1048	102
<b>ILS, Bhubaneswar</b>	227	52
<b>RGCB, Thiruvananthapuram</b>	458	91
<b>CDFD, Hyderabad</b>	468	63
<b>NBRC, Manesar</b>	226	27
<b>NIPGR, New Delhi</b>	1176	121
<b>IBSD, Imphal</b>	455	16
<b>RCB, Faridabad</b>	142	47
<b>inStem, Bangalore</b>	280	34
<b>NIBMG, Kalyani</b>	68	12
<b>THSTI, Faridabad</b>	198	28
<b>NABI, Mohali</b>	354	34
<b>NIAB, Hyderabad</b>	45	1
<b>CIAB, Mohali</b>	237	8

### Budget

In the last 5 years (2017-2022), the institutes have received a total core grant of Rs 3317.18 Crore from DBT. The AIs have also raised extramural funding to the tune of more than Rs 2600 Crore from both public and private sectors in the same period.





## National Institute of Immunology, New Delhi

**Date of inception:** 24<sup>th</sup> June 1981

### **Mandate**

National Institute of Immunology (NII) is committed to advanced research with a view to understand body's defense mechanisms for developing modalities of immune system manipulation that can intervene with disease processes.

### **Campus:**

The main campus of NII is located within the premises of the Jawaharlal Nehru University. The total land utilized by NII (17.39 acres) has been leased/allotted to it vide agreement dated 04-08-1983. In addition, NII has flats at Dwarka, land for construction of residences at Dwarka and land at Faridabad for Bioscience cluster.

### **Research Focus**

The institute's research thrust areas under immunology and related disciplines cluster in three main themes, i) Immunity and Infection, ii) Genetics, Cell Signaling and Cancer Biology, and iii) Chemical Biology, Biochemistry and Structural Biology.

NII is a founder partner in the supra-institutional Biotech Science Cluster in the National Capital Region.

### **Human Resource**

The institute currently has 28 scientists and around 100 Research Fellows, engaged in high quality research, supported by 101 technical staff and 71 administrative staff at the institute.

### **Key Scientific Achievements**

Major achievements in the last 5 years (2017-22) are as follows:



Publications	PhD Degrees awarded	Postdocs and research fellows	Patents awarded	Technologies developed
569	127	818	26	1

- A therapeutic vaccine trial has been initiated in patients of cervical cancer and ovarian cancer. The translational cancer research program seeks to develop new modalities for the treatment of cancer. NII has received a Trademark for its tumour antigen SPAG9-ASPAGNIITM. ASPAGNIITM is being used in dendritic cell-based immunotherapy in patients of cervical and ovarian cancer; trials will soon be initiated in patients of breast cancer as well.
- Infection and Immunology studies have provided new insights into the role of NF- $\kappa$ B pathways in shaping antiviral innate immune responses; host-cell Salmonella interactions; role of dendritic cells in the development of the immune cell compartment.
- An aerosolized formulation of BCG encapsulated alginate particles was demonstrated to be safe and efficacious when evaluated in infant rhesus macaques.
- In the area of pathogen biology, studies include drug targeting of Mycobacterium tuberculosis; investigation into the molecular basis of infection caused by Plasmodium, Toxoplasma and Leishmania amongst others,
- Several Indigenous products have been developed for therapeutic interventions in Chronic Diseases.
- A method for treatment for osteoarthritis using a collagen-based herbal formulation has been developed at NII and the technology transferred to a company.
- In aging and metabolic disease, mechanisms underpinning aging are ongoing in well-defined genetically tractable model systems, and metabolism of muscle wasting and bone development are areas of active investigation.
- NII has initiated a Flagship Programme in Immuno-Engineering. This umbrella project encompasses research on novel adjuvants and vaccines (for infectious diseases and cancer), immunotherapy strategies and artificial antigen presenting cells, scaffolds and drug delivery devices, and on new methods and protocols for regenerative medicine.
- NII is lead coordinator for Indo-EU Horizon 2020 program grant titled “Indo-European Consortium for Next Generation Influenza Vaccine Innovation” and will conduct pre-clinical





vaccine efficacy studies for Computationally Optimized Broadly-Reactive Antigen (COBRA) vaccine for which the field trials will be conducted in India as well as Europe.

- The faculty and researchers at NII have received numerous major national and international awards and recognitions for their scientific contributions. These include Padma Bhushan and Padma Shree awarded to two former directors and the prestigious Shanti Swarup Bhatnagar Prize. NII faculty have been recognised by the J.C. Bose National Fellowship, National Bioscience Award, Ranbaxy Research award, Fellowships of leading Science Academies, TWAS fellowship, BM Birla Science Prize, Wellcome Trust Fellowship, HHMI award, NASI-Reliance Golden Jubilee award, Tata Innovation Fellowship, Swarnajayanti Fellowship, Goyal Prize, Vasvik award, Bhashin award, Ramalingaswamy Fellowship, NASI-SCOPUS young scientist award, SERB STAR Award, Lifetime Achievement Award (India Society for the study of Reproduction and Fertility), OPPI Woman Scientist Award, Shakuntala Amir Chand Prize etc. Research scholars have received best poster/presentation awards at several conferences.
- The institute has organized outreach and public engagement events through its participation in India International Science festival, Global Bio India, and interactions with students from various colleges.



**Mandate**

The tripartite mandate of NCCS includes the following as its key functions, i) To serve as a National Cell Repository, ii) To perform Basic Research in Cell Biology, and iii) Human Resource Development through teaching and training.

**Campus:** NCCS is located within the academically-enriched campus of the Savitribai Phule Pune University (SPPU).

**Research Focus**

NCCS is engaged in cutting-edge research in the diverse areas of modern cell biology, broadly categorized as:

- i) Cell Biology & Cancer Biology
- ii) Structural Biology, Bioinformatics & Omics
- iii) Infectious diseases & Immunology and Microbiology
- iv) Neurobiology & Stem Cell Biology. The research is focused on answering challenging health issues like cancer, infectious diseases, metabolic disorders, and regenerative medicine through approaches that integrate modern and conventional disciplines.

**Human Resource**

The institute currently has 32 scientists and around 200 Research Fellows engaged in high-quality research, supported by 69 technical staff and 38 administrative staff at the institute.

**Key Scientific Achievements**

Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees Awarded	Postdocs and research fellows	Patents awarded	Technologies transferred
547	102	1048	6	4



- The institute hosts a National Cell Repository that maintains and distributes well-characterized animal cell lines to various colleges, universities and research institutions in India at affordable costs.
- NCCS hosts the DBT funded National Centre for Microbial Research for the collection, identification, preservation and distribution of microbial cultures from various ecological niches across the country. NCCS has the third largest microbial collection in the world.
- Generating a baseline microbiome profile in Indian population for investigating the link between genotype and microbiome to understand the role of diet, geography and genetics.
- Identified the immune-modulatory role of IL-3 in the regulation of pathophysiology of rheumatoid arthritis and demonstrate that IL-3 prevents bone damage in an animal model of osteoporosis.
- Developed human iPSCs based Down syndrome impaired neurogenesis model and identification of biphasic impairment during neurogenesis.
- NCCS was the first to demonstrate that computationally-designed synthetic peptides are a potential strategy against drug-resistant infection model and Covid-19 to develop novel therapeutics.
- The faculty and students at NCCS have received numerous awards for their scientific contributions, such as Swarnajayanti Fellowship, J.C. Bose National Fellowship, Fulbright Nehru Fellowship, EMBO travel awards, Tata Innovation Fellowship etc. Several faculty members also serve on the editorial boards of prestigious international journals.
- The institute regularly organizes outreach and public engagement events such as its Open Days (Prelude to the National Science Day at NCCS-NCMR- public talks, lab visits), the Microbial Science Outreach Initiative (MSOI), Science exhibition- India International Science Festival, Science Setu webinars and such. NCCS faculty also participated in COVID-related and other outreach in Marathi & English through talks and discussions, and interviews on several radio & TV programs.





## Institute of Life Sciences, Bhubaneswar

**Date of Inception:** Established in 1989 as an Autonomous Institute under the administrative control of Govt. of Odisha. 2002, taken over by the DBT, Govt. of India.

### Mandate

The defined mandate of ILS is to foster investigations, both basic and translational, in the following areas: Infectious Disease Biology; Cancer Biology; Plant and Environmental Biotechnology; Tribal Health and Nutrition. Towards fulfilling these goals ILS works towards the upliftment of the human society and to generate skilled human resources for future India.

### Campus

The two campuses of ILS are located in Bhubaneswar. The total land utilized by the ILS is either owned by it (08 acres) or leased (0.12 acres)

### Research Focus

The following are the major thematic areas of focus: i) Cancer Biology, ii) Infectious Diseases, iii) Plant Biotechnology, iv) Environmental Biotechnology, v) Tribal Health and Nutrition, vi) Translating Research leads for Product development, vii) Technology application in rural areas, viii) Generating resources and platforms.

In all these programs partnerships and collaborations both at national and international levels are forged to strengthen the ongoing research activities of ILS.

### Human Resource

The institute currently has 25 scientists and around 180 Research Fellows engaged in high-quality research, supported by 10 technical staff and 15 administrative staff at the institute.

### Key Scientific Achievements

Major achievements in the last 5 years (2017-22) are as follows:



Publications	PhD Degrees Awarded	Postdocs and research fellows	Patents awarded	Technologies commercialized
287	52	227	7	5

- Tribal Health and Nutrition is a flagship program, which uses multi omics approach to understand the diversity and innate immunity of the tribal population for contributing to better health and nutritional outcomes. Development of probiotics associated with traditional food of the communities are used product development.
- In cancer biology research the focus has been on deciphering and understanding mechanism of gene regulation governing the onset, progression and migration of the disease. It has also focused on targeted drug delivery approaches using nano-particle based small molecules and phytochemicals as possible treatment options.
- ILS has been working on major viral diseases such as COVID, Chikungunya and Dengue, Malaria and other bacterial diseases. The approach has been to understand the epidemiology, host and pathogen diversity, identification potential small molecules and phytochemicals for management of diseases are being attempted.
- The plant and environment biotechnology group undertake studies on understanding diversity and species relationships among mangroves and underutilized species from locations inhabited by tribal population, generating genomic resources for identification and characterization of abiotic stress tolerant and nutritionally important
- Establishment of a Bioincubator to create an enabling ecosystem for the development of products arising out of research leads and their subsequent translation.
- The scientists at ILS have received key awards and recognition for their scientific contributions such as NASI-Reliance Industries Platinum Jubilee Award, Merck Young Scientist Award, DBT National Bioscience Award, SERB-STAR Award, EMBO Global Investigator Fellowship, Prof. MGK Menon Lecture Award (NASI), Biotech Product and Process Development and Commercialization Award, etc. Several faculty members are also elected Fellows and life members of prestigious national and international academies and societies.
- The institute has organized outreach and public engagement events such as its Open Day Science Exposition, National Science Day celebrations, webinar series on entrepreneurship, program on Tribal Health and Nutrition, teachers' training programs, etc.



## Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram

**Date of inception:** RGCB started as a small charitable society called the Centre for Development of Education, Science and Technology (C-DEST) in 1990. The C-DEST was made a "Grant-in-Aid" institute of the Government of Kerala in 1991 and renamed as Rajiv Gandhi Centre for Development of Education, Science and Technology (RGC-DEST). On April 1, 2007, DBT took over the institute as its Autonomous Institution.

### Mandate

The mandate of the institute is, i) Fundamental Research: Understanding the biology that defines basic mechanisms involved in disease processes and their implications for human health, ii) Translational Science: Trans-disciplinary health science to benefit individual, clinical, and public health decision making to improve health, iii) Technology Development: Turning research into technology innovation and on to business, iv) Training and Education.

### Campus:

RGCB currently operates through three campuses. The main campus is located at Jagathy in Thiruvananthapuram where the bulk of discovery research programs are implemented with the land area of 3 acres. The second campus is about 20 acres and located at the KINFRA Park in Thiruvananthapuram functions as the transit facility for the Bio-Innovation Center where RGCB's core Bio-Imaging, Genomics and Laboratory Medicine & Molecular Diagnostic core facilities are located in addition to laboratories for Chemical Biology, and Tropical Disease Biology. The third campus located in Kalamaserry, Kochi is called the Bio-Nest, a setting for translational biotechnology.

### Research Focus

The main research themes are i) Cancer research, ii) Cardiovascular disease & Diabetes biology, iii) Pathogen biology, iv) Regenerative biology, v) Neurobiology, vi) Reproduction biology, vii) Plant biotechnology, viii) Transdisciplinary biology.



## **Human Resource**

The institute currently has 40 scientists and around 100 Research Fellows engaged in high quality research, supported by 71 technical staff and 23 administrative staff at the institute.

## **Key Scientific Achievements**

Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees awarded	Postdocs and research fellows	Patents awarded	Technologies transferred
453	91	458	10	1

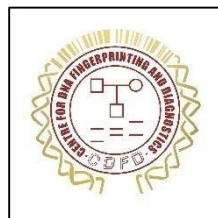
- The HPV Vaccine Study: An increase in worldwide HPV vaccination could be facilitated if fewer than three doses of vaccine are as effective as three doses. RGCB successfully implemented a multi-center clinical trial comparing two doses versus three doses of the human papillomavirus vaccine. Results from the study have led to the recommendation of 2 doses separated by 6 months or more for routine vaccination of young girls (now accepted by WHO).
- The Curcumin Chemoprevention Trial: Oral cancer continues to be one of the most common malignancies in India. RGCB successfully conducted a clinical trial that established oral curcumin as an oral cancer chemo preventive agent. Combined clinical and histologic response assessment indicated a significantly better response with curcumin. The treatment did not raise any safety concerns. Treatment of oral leukoplakia with curcumin (3.6 g for six months) thus was well tolerated and demonstrated significant and durable clinical response.
- In a joint study with Emory University RGCB investigated antimicrobial peptides from the skin of the South Indian frog, *Hylaranamalabarica* and demonstrated that a novel host defense frog peptide is virucidal for H1 hemagglutinin-bearing human influenza A viruses. It represents a novel class of anti-influenza virucide that targets hemagglutinin.
- Among the major re-emerging infections in the country, two arboviral infections assume prime importance- chikungunya and dengue. Studies at RGCB have revealed novel mutations and molecular signatures in Indian strains of chikungunya viruses and have shortlisted molecules that are differentially expressed upon infection.





- Spice Genomics - Transfer RNA Derived Small RNAs Targeting Defense Responsive Genes are shown to be induced following fungal infection in Black Pepper (*Piper nigrum* L.), which is the main component of the cash crops from Kerala, severely compromising crop yield. The evaluation of these candidate sRNAs in plant pathogen interaction will lead to advanced disease resistant strategies with wider application in the improvement of stress tolerance in plants.
- A dedicated life-time imaging facility is being established at Akkulam campus to support training in life-time imaging and development of cell line resources of molecular sensors for life time imaging.
- The Laboratory Medicine and Molecular Diagnostics (LMMD) at RGCB is a NABL, ILAC, and NABH accredited diagnostic facility of DBT.
- Molecular Forensics & DNA Technologies (MFDT) provides DNA Fingerprinting and DNA Barcoding services to the public. Established in 2007 as Regional Facility for DNA Fingerprinting (RFDF), MFDT now includes RFDF and a DNA Barcoding Lab. The major service of RFDF is to provide human DNA Fingerprinting services to judicial, crime investigating, and law enforcing agencies. Species identification in Wildlife Forensics is another service offered by RFDF, helping the law enforcing agencies to punish the offenders to prevent illegal poaching by providing evidence. RFDF has been granted accreditation by the National Accreditation Board for Testing and Calibration Laboratories (NABL) per ISO/IEC 17025: 2017 standard in the field of Forensics.
- The faculty and students at RGCB have received numerous awards for their scientific contributions such as Swarnajayanti Fellowship, Ramalingaswami Fellowship, Ramanujan Fellowship, Prof. G. P. Talwar Gold Medal Award, Merck Young Scientist Award, EMBO travel award, Prof. P. Govindarajulu Oration and Gold Medal, DBT Innovative Young Biotechnologist Award and many best poster/presentation awards in national and international conferences. Several scientists are also members of national expert committees, and elected fellows of prestigious academies and societies.
- The institute has organized outreach and public engagement events such as National Science Day celebrations, Science expos, participation in India International Science festival, Science Setu lectures, Regional Children's Science Congress, interactions with students from schools and tribal colonies and so on.





## Centre for DNA Fingerprinting and Diagnostics, Hyderabad

**Date of inception:** 26th March, 1996

### Mandate

The mandate of Centre for DNA Fingerprinting and Diagnostics (CDFD) is to provide DNA fingerprinting services to the judiciary and law enforcing agencies; to establish DNA diagnostics methods for detecting genetic disorders; to use DNA fingerprinting techniques for authentication of plant species (e.g. basmati rice); to provide training in DNA fingerprinting and diagnostics techniques and to undertake basic and translational research in frontier areas of modern biology.

### Campus:

CDFD, spread over two non-contiguous campuses (Laboratory & Residential ) spanning an area of 20 acres, is located in the fastest growing metropolitan city of Hyderabad, which is emerging as the preferred destination for information technology, large biotech and life sciences companies.

### Research Focus

The research groups are involved in a wide range of research areas in modern biology, including microbiology, disease biology, cell biology, computational biology, developmental biology & neurobiology, genetics, and genomics.

### Human Resource

The institute currently has 27 scientists and around 150 research personnel (including PhD and Post Doctoral Fellows) engaged in high quality research, supported by 41 technical staff and 46 administrative staff at the institute.

### Key Scientific Achievements

Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees Awarded	Postdocs and research fellows	Patents awarded
294	63	468	1



- Drafted the DNA Bill, which is under discussion and consideration in Parliament.
- Certification of DNA Examiners - Gazette notification that the Director and DNA examiners of CDFD are empowered as Government Scientific experts to depose evidence in court under section 293 of the Code of Criminal Procedure.
- CODIS (Combined DNA Index System) software enables laboratories to exchange and compare DNA profiles electronically. The CODIS software (in USA) contains multiple different databases depending on the type of information being searched against. Examples of these databases include, missing persons, convicted offenders, and forensic samples collected from crime scenes. It was provided by Federal Bureau of Investigation (FBI) to CDFD for DNA databases and comparison of DNA profiles. CDFD is the only institute in India having this programme. It is one of those rare instances in the world where the FBI has agreed to provide the CODIS software to a non- law enforcement agency. CODIS is FBI's (USA) programme that provides support for criminal justice DNA databases. It can be used to compare /match the DNA profiles from any part of the world. CODIS is being used to carry out DNA match statistics when reporting cases to the court of law. This software was used to match the DNA profiles to identify victims of the Uttarakhand disaster as well as to estimate the match probabilities for all the forensic DNA caseworks reports at CDFD.
- Initiated a Mission Programme on Paediatric Rare Genetic Disorders (PRaGeD) supported by DBT, to decode the genetic basis of Paediatric Rare Genetic Disorders in the country. For this program, CDFD is collaborating with paediatric departments of various medical colleges, DBT-UMMID centres, and 15 research centres across India to analyse the samples of children with rare genetic disorders, and their parents. PRaGeD aims to; create awareness, achieve genetic diagnosis, discover & characterize novel genes, provide counselling, and to develop novel therapies for paediatric rare genetic diseases in India. Furthermore, the PRaGeD aims to develop novel and cost-effective diagnostic and screening approaches for rare genetic diseases aligning with the Ministry of Health and Family Welfare's National Policy for Rare Diseases 2021, which intends to lower India's high treatment costs for rare diseases. Through this program, the investigators are aiming to minimize the burden of rare diseases in India.



- Established DBT NIDAN Kendra at Yadgir and Raichur. CDFD has established a DBT Nidan Kendra at Yadgir District hospital and Raichur Institute of Medical Sciences, Raichur Karnataka under a DBT-UMMID (Unique methods of management and treatment of inherited disorders) initiative. The activities being conducted under the programme include screening of antenatal mothers attending the district hospital for thalassemia followed by prenatal diagnosis for prevention of Thalassemia, screening newborns for 5 common and treatable genetic diseases. This is an important societal and outreach activity of CDFD.
- Established a DBT National Genomics Core (NGC-CDFD) to facilitate genomics-driven discovery and application, and to accelerate the ushering in of a vibrant bio-economy. South-Central regional core at CDFD, Hyderabad has been established to provide end-to-end genomics services. Since the establishment, NGC-CDFD has provided more than 115 services to various national institutes/universities and start-up companies accounting for ~6Tb of data and processing ~12,000 samples. The NGC-CDFD is providing specialized sequencing facilities to diverse sectors of life science disciplines including healthcare, crop production, forestry and biodiversity and basic research. Importantly, NGC-CDFD is actively engaged with various universities and institutes for the training of manpower and skill development for the utilization of high throughput NGS. In this direction, NGC-CDFD has conducted three five-days' workshops and trained ~600 participants over 16 events.
- NGC-CDFD has sequenced over ~11000 SARS-CoV-2 whole genomes under DBT's PAN-INDIA-1000 SARS-CoV-2 viral RNA Genome consortium and INSACOG.
- The faculty and students at CDFD have been endowed with numerous prestigious awards for their scientific contributions such as Shanti Swarup Bhatnagar prize, Fellowships of all three National Science Academies, JC Bose Fellowship, Tata Innovation Fellowship, DBT/Wellcome Trust India Alliance Fellowship, DBT Young Women Scientist Award, DBT National Bioscience Award, various ICMR Awards, B.M Birla Science Prize, G.P Talwar Young Scientist Award, NASI Scopus Young Scientist Award, several travel grants from EMBO, DBT, DST-SERB, ICMR, CSIR etc. for presenting research at prestigious international conferences like the Gordon Research Conference etc Several faculty members also serve on the editorial boards of reputed journals, and are members or elected fellows of academies, societies, and serve on national task forces.



- The institute has conducted outreach and public engagement events such as its Open Days, participation in India International Science festival (also organized VigyanYatra), several webinars and seminars by faculty, visits by police officers and Junior Civil Judges, hands-on training in forensic DNA workflow etc.
- CDFD is equipped with Sophisticated Equipment Facility and Experimental Animal Facility and offers these services to researchers nationwide.





## National Brain Research Centre, Manesar

**Date of Inception:** 14<sup>th</sup> November, 1997

### Mandate

NBRC is the only institute in India dedicated to neuroscience research and education. The mandate of the institute is to: i) Pursue research to understand brain function in health and disease, ii) Generate trained human resources with the capability to carry out interdisciplinary research in neuroscience, and iii) Promote neuroscience in India through networking among institutions across the country.

### Campus

NBRC has a sprawling campus located in the foothills of the Aravalli range in Manesar. The total land utilized by the NBRC (38.78 acres) has been leased to it by Indian Vaccines Corporation Limited (IVCOL), a Union Govt company of DBT

### Research Focus

Using multidisciplinary approaches, NBRC research is focused on investigating the complexities of the brain functions and cognition in health and diseases. There are five Neuroscience research divisions at NBRC, namely Cellular and Molecular, Systems, Cognitive, Computational, and Translational. The focus is on: i) development of therapeutic tools and platforms to assess and cure brain disorders, including Alzheimer's disease, Parkinson's disease, dementia, Japanese Encephalitis, Zika virus disease, Neuro, AIDS, brain tumor, spinal cord injury, and stroke, and ii) to elucidate detailed understanding of senses of touch, hearing, speech learning, memory, and spatial navigation.

### Human Resource

The institute currently has 14 scientists 110 Research Fellows involved in high caliber research, supported by 27 technical staff and 14 administrative staff at the institute.

### Key Scientific Achievements

Major achievements in the last 5 years (2017-22) are as follows:



Publications	PhD Degrees awarded	Postdocs and research fellows	Patents awarded
242	27	226	1

- A national level multi-centric Dementia Science Program, that provides insights into the prevalence of dementia and discover biomarkers, risk factors, and protective factors was launched in 2017. For the diagnosis and classification of dementia, all centers use robust uniform criteria that are internationally accepted, adapted, and validated in the Indian context.
- In 2019, a flagship program entitled “Comparative mapping of common mental disorders (CMD) over the lifespan” was launched to understand the science of well-being. This involves, comparative mapping of common mental disorders (CMD) over the lifespan: This flagship program understands how information-processing networks in the brain are affected in CMD, including anxiety, depression, obsessive-compulsive disorder, and post-traumatic stress disorder. The program also studies underlying brain mechanisms that differentiate between these disorders, and whether these networks are affected in the same manner in different age groups.
- Development of computational analysis platforms processing a wide variety of data including neuroimaging as well as big data decision framework, which integrates non-invasive MRI, MRS, and neuropsychological test outcomes to identify early diagnostic biomarkers of neurodegenerative disorders.
- The researchers at NBRC have received key awards and recognition for their scientific contributions such as J.C. Bose National Fellowship, Ramalingaswami Fellowship, Tata Innovation Fellowship, K T Shetty Memorial Oration Award (Indian Academy of Neurosciences), NASI Reliance Platinum Jubilee Award, Basanti Devi Amir Chand Prize (ICMR), Global Artificial Intelligence Award, HarGobind Khorana Innovative Young Biotechnologist Award, IBRO start-up grant, several travel grants (from International Society for Neurochemistry, DST-SERB, International Cytokine & Interferon Society, International Brain Research Organization) etc. Several scientists are also elected Fellows and members of prestigious national and international academies and societies.
- The institute has organized outreach and public engagement events such as its Open Days, National Science Day celebrations, participation in India International Science festival and public talks.



### Services Offered:

- i. **Distributed Information Center (DIC):** DIC is established under the initiative of BTISNET initiative of DBT. DIC manages information and communications technology (ICT) and e-governance activities of NBRC. It provides ICT science & technology services.
- ii. **Experimental animal facility:** The facility contains animal models, including primates and transgenic mice.
- iii. **National neuroimaging facility**
- iv. **Neuroimaging and neurospectroscopy laboratory:** This laboratory functions on the metabolic analysis of different neurodegenerative disorders (e.g., AD, PD) using MRS technique
- v. **Centre for Excellence for Epilepsy/MEG facility:** This center studies epileptogenesis, better diagnosis, and localization of epileptogenic foci and new therapeutic techniques.
- vi. **Speech and Language Laboratory (SALLY):** Research in this lab focuses on unravelling cortical pathways involved in Hindi–English biscriptal adults and children. [https://en.wikipedia.org/wiki/National\\_Brain\\_Research\\_Centre\\_-\\_cite\\_note-31](https://en.wikipedia.org/wiki/National_Brain_Research_Centre_-_cite_note-31)
- vii. **Computational neuroscience and neuroimaging laboratory:** The unit works on imaging-based diagnosis of neurodegenerative diseases and planning pulsed radiotherapy and chemotherapy for treating brain tumors from translational medicine aspect.
- viii. **Translational & clinical neuroscience unit:** This unit provides neurological OPD services and assesses the occurrence of neurological cases in Gurgaon. Patients visiting the unit have access to several facilities, including MRI, computed tomography, etc.







## National Institute of Plant Genome Research, New Delhi

**Date of inception:** 30<sup>th</sup> November, 1997

### **Mandate**

The institute’s mandate is to undertake high-quality scientific research in frontier areas of fundamental and applied plant molecular biology, with the aim of having practical application in crop improvement; to serve as an important resource for material, knowledge and technologies in the areas of functional, structural, evolutionary and applied genomics of plants, including crop plants. It aims to utilize molecular biology, omics approaches, molecular breeding, genetic engineering and genome editing for generating plants with improved agronomic characters, pathogen/ pest/abiotic stress tolerance and enhanced nutritional value

### **Campus**

NIPGR is located within the campus of the Jawaharlal Nehru University, Delhi. The total land utilized by NIPGR (15 acres) has been leased to it.

### **Research Focus**

Research at NIPGR is in frontier areas of Plant Biology such as, Computational and Structural Biology, Genome Analysis, Molecular Mechanism of Abiotic Stress Responses, Nutritional Genomics, Plant Development and Architecture, Plant-microbe Interaction and Plant Immunity, Molecular Breeding, Transgenics for crop improvement and other emerging areas based on plant genomics.

### **Human Resource**

The institute currently has 29 scientists and around 675 Research Fellows engaged in high quality research, supported by 32 technical staff and 21 administrative staff at the institute.

### **Key Scientific Achievements**

Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees awarded	Postdocs and research fellows	Patents Awarded
681	121	1176	11



- NIPGR is the designated coordinator for the plant group in the Earth Bio-genome Project "Indian Initiative on Earth Biogenome Sequencing (IIEBS)". RiceCRISPR, a gene-editing platform for crop improvement and resource building been developed.
- NIPGR's First Translational Centre is being developed at Bulandshahar, UP. In addition, Institute is setting up a National Plant Computational Biology and Bioinformatics platform
- NIPGR is actively engaged in the frontier areas of Plant Biotechnology focusing both in basic science and translational work. The knowledge gained and data generated about plant processes from high calibre plant molecular biology research has aided the discovery of many genes, proteins, metabolites and markers to produce advanced crop varieties.
- Pipelines established to facilitate studies on structure and function of genes, proteins, and metabolites as also molecular interactions and crosstalk of bio-molecules using system approaches.
- "Molecular mechanisms of host-pathogen interactions and plant immunity" is a thrust area of research. Focusing on bacterial, fungal, viral and pest diseases and multi-host resistance has aided the discovery of potential target genes/proteins/metabolites and natural peptides. Studies have focused on the mechanism of action and utilization as markers for better plant health.
- Institute identified 20 novel genes for Plant architecture and development, 24 genes for Biotic stress tolerance, 34 genes for abiotic stress tolerance and 21 genes for better plant and human nutrition, 11 proteins for abiotic and biotic stress tolerance some of which have been patented and developed 50 open access databases.
- Institute unraveled the molecular mechanisms of plant defence against *Fusarium* wilt, bacterial blight, *Aschochyta* blight, sheath blight, rice blast, *Spodoptora* herbivory, grain weight, seed and flower colour, drought and heat tolerance and shelf life enhancement in economically important crops.
- Development of a Pan-Genome genotyping array for accelerated crop improvement of rice and chickpea. The first-ever pan-genome based SNP genotyping assay IndRA and IndCA has been developed to tap huge potential of Indian crop biodiversity.
- Development of a high yielding variety of Chickpea. Having successfully cleared an Advanced Varietal Trail 1 (AVT1) during Rabi season 2018-19, this line has been promoted for further evaluation for one more year under Advanced Varietal Trail 2 (AVT2) during rabi 2020-21.
- Development of extra-large seed size Kabuli chickpea variety, a chickpea variety that is amenable to high density planting and mechanical harvesting; transgenic drought-tolerant chickpea with



high mineral content and a high root biomass drought-tolerant chickpea line with high mineral content.

- Discovery of a novel anti-fungal peptide from bacteria that kills rice sheath blight pathogen is ready for being tested for nano-formulation and application in the field.
- Discovery of a novel plant metabolite for protecting plants against herbivory: This is now ready for large scale field testing.
- Development of protein rich potato and rice; antinutrient free tomato, soybean, brassica and lathyrus.
- Development of an engineered device for increasing shelf-life of fruits and vegetables using hypoxia induced Nitric oxide
- The institute has implemented mission mode programs: “Chickpea Germplasm characterization” and “Rice Protein nutrition” linking agriculture and clinical nutrition under POSHAN Abhiyan partnering with ICAR and ICMR institutes. In addition, the Institute is partnering in other three mission mode programs on “Rice Germplasm characterization”, “Wheat Germplasm characterization” and “Minor pulses Germplasm characterization.”
- The faculty and students at NIPGR have received numerous awards and recognition for their scientific contributions such as J.C. Bose National Fellowship, TATA Innovation Award, Ramalingaswami Fellowship, DBT National Bioscience Award, NASI-Reliance Industries Platinum Jubilee Award, National Young Women Bioscientist Award, Innovative Young Biotechnologist award, Dr. Abdul Kalam Gold Medal Award, NASI Scopus Young Scientist Award, NASI Young Scientist Platinum Jubilee Award, INSA Medal, Newton-Bhabha Fellowship, Alexander von Humboldt Fellowship, Technology Development Award, etc. as well as several travel grants and best poster/presentation awards at conferences. Many researchers are members and elected Fellows of esteemed academies and societies. Several faculty members also serve on the editorial boards of prestigious international journals.
- The institute regularly organizes outreach and public engagement events such as its Open Days, study tours for school and college students, participation in India International Science festival, Science Setu webinars and such. The institute also invites eminent scientists for monthly public talks and lectures.



## Services

The National Genomics and Genotyping Facility (NGGF) has been established to provide service to the scientific community. A first ever pan-genome based SNP genotyping array has been developed in crop plants, rice and chickpea, which would enormously help the rice and chickpea mission programs launched by DBT on germplasm characterization for trait discovery.

Under the Advanced Research Platform for Crop Science (ARPCS) a Gene Functional Analysis platform (GFAPC), Metabolomics facility (PAPM) and Advanced Proteomics facility (AIIPF) had been established and providing services both to internal and external users.

The newly launched NIPGR first translational centre for Speed breeding and High Throughput Phenotyping (HTP) at Bulandshahar, UP under development would soon be made successfully operational. Institute further envisaged developing the translational center at NCR bio-cluster in in Faridabad. The institute is in the process of expanding the Central Instrumentation Facility (CIF) and building the Guest House under phase-III construction.



## Institute of Bioresources and Sustainable Development, Imphal

**Date of inception:** 26<sup>th</sup> April, 2001

### **Mandate**

Institute of Bioresources and Sustainable Development (IBSD) is the only institute of the Department of Biotechnology (DBT) set up in North Eastern Region with the mandate for development of bioresources and their sustainable use through biotechnological interventions for the socio-economic growth of the North-Eastern Region (NER) which includes several key functions: i) to study and document the unique biodiversity of bio geographic junction of the Indian and oriental landmasses; ii) to develop biotechnological interventions for sustainable development and utilization of Bioresources; iii) to undertake capacity building (human resource development) in Bioresources conservation and management; iv) to generate technological packages for employment generation and economic progress of the NER .

### **Campus:**

The institute is located in Imphal, Manipur and has three centers at Gangtok in Sikkim, Shillong in Meghalaya and at Aizawl in Mizoram.

### **Research Focus**

IBSD is synergizing different research works to promote bioeconomy from bioresources with different areas including phytopharmaceutical mission, ethnopharmacology, traditional healthcare practices-drug discovery, plant resources, microbial resources, animal resources and Eco-restoration, water quality management and surveillance to boost the bioeconomy with the development of processes/ products/ technologies from the bioresources of NER. The major goal is to promote the Bioeconomy from Bioresources of Indo-Burma biodiversity hotspot in NER through several research activates and outreach programs with developing partnership with local communities and establishing effective collaboration with various institutions nationally and internationally in the area of sustainable management of Bioresources.



### **Human Resource**

The institute currently has 16 scientists and around 100 Research Fellows, supported by 8 technical staff and 7 administrative staff at the institute.

### **Key Scientific Achievements**

Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees Awarded	Postdocs and research fellows	Patents Filed
192	16	455	5

- IBSD is working on promotion of Bioeconomy from Bioresources of Indo-Burma biodiversity hotspot in NER.
- IBSD is working on Phytopharmaceutical Mission for documentation, evaluation and validation of traditional healthcare practices of NER to promote the drugs from our ancestors, drugs from nature and to explore the tradition to translation with innovation. Exploring the traditional healthcare practices and the medicinal and aromatic plants (MAPs) used in these practices of the NER and their scientific validation with translational component.
- IBSD is working on SYNERGY mission for the establishment of mechanism of action and therapeutic efficacy of traditional medicines, traditional food, medicinal plants and other bioresources for translational research from traditional knowledge.
- Established linkages between traditional healers and the scientific communities for benefit sharing and promotion of start-ups with Ethno-Entrepreneurships based on development of herbal medicine-based products, fermented foods, edible mushrooms and insects.
- Established a Microbial Repository Centre with collection of Bacteria, Actinomycetes, Yeast and Fungi from different unique ecological niches of NER viz., cave ecosystem, forest ecosystem, fermented food, endophytes, hot-spring, cold spring, lime stone deposits, high altitude ecosystems etc.
- For the promotion of Start-ups in NER, setup Bioincubators Nurturing Entrepreneurship for Scaling Technologies (BioNEST), Node Meghalaya to develop women entrepreneurship through



orchid floriculture in Meghalaya. Major focus of the program is capacity building and training of women bio-entrepreneurs and farmers.

- Initiated Household Water Quality Management through Testing, Surveillance and Technological Interventions with water testing facility for drinking water, waste water etc. in Manipur and Meghalaya. This is in association with respective State PHED Department for water quality monitoring, surveillance and development for rapid water test kit for monitoring water quality.
- The researchers at IBSD have received key recognitions such as being elected Fellows of National Academy of Agricultural Sciences, National Academy of Sciences, India (NASI), Biotech Research Society, India (BRSI), Ramalingaswami Fellowship, and awards from International Foundation for Environmental & Ecology, National Environment Science Academy etc.
- The institute is organizing many outreach activities and several conferences/seminars/webinars and workshops such as International Bioresources Conclave and Ethnopharmacology Congress 2023, International webinar on ethnopharmacology, Science Setu webinar series, Women entrepreneurship programmes, Farmers training, traditional healers' workshops etc.
- Established Science Museum at Chandel, an aspirational district of Manipur to inculcate scientific temperament among students and scientific interventions for sustainable use of local bioresources.
- IBSD is working on development of industrial linkages for promotion of bio resources taking the leads from traditional knowledge for development of technologies for its promotion and further development and benefit sharing from tradition to translation.







**Institute for Stem Cell Science and Regenerative Medicine, Bengaluru**

**Date of inception:** 28<sup>th</sup> August, 2008

**Mandate**

The primary objective of the institute is to create an organizational structure that promotes the growth of expertise in stem cell research, fosters interactions among basic scientists and clinicians in ways that support innovative research to address barriers to progress in the therapeutic use of human stem cells.

**Campus:**

inStem is located in about 20 acres of space leased out by the Gandhi Krishi Vignan Kendra, Govt of Karnataka (rent) and the translational unit CSCR is located on the campus at Christian Medical College Vellore leased from them.

**Research focus**

Research at inStem uses innovative, multidisciplinary collaborative approaches for insights into the basic biology of stem cells and their clinical translation. Research areas include basic biology of hematopoietic, cardiac, epithelial, endothelial, and neural diseases as well as lifestyle and metabolic disorders.

**Human Resource**

The institute currently has 25 scientists and around 130 Research Fellows engaged in high-calibre research, supported by 17 technical staff and 17 administrative staff at the institute.

**Key Scientific Achievements**

Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees awarded	Postdocs and research fellows	Patents filed	Technologies commercialized	Institute Spin-Off Companies
275	34	280	37	1 (6 products were launched in the market)	2 Startups formed



- inStem hosts several National laboratories, such as the DBT-funded Multiscale program in Biology, which supports the National Cryo-EM Facility, which began activities in 2018 in partnership with the National Centre for Biological Sciences, TIFR. The facility is equipped with a 300 kV Transmission Electron Microscope (TEM). This is the first of its kind in India. The facility has trained more than 40 users and supported eleven publications from laboratories nationwide. All users are provided access to a complete wet laboratory support on-site.
- inStem is a partner and coordinator of the Indo-Japan Collaborative Program on "Accelerating the application of Stem cell technology in Human Diseases (ASHD)" which is directed at capacity building in Stem Cell technology through an Indo-Japan partnership. ASHD is an initiative to apply the power of modern stem cell technology to develop solutions for human blood and brain disorders, important public health problems in India. This is a collaborative initiative between the Indian research institutes - inStem, CSCR-inStem, NCBS-TIFR, NIMHANS, CMC and the Centre for iPSC Research and Application (CiRA), Kyoto, Japan. This is also a foundational program for a Stem Cell Core (including an iPSC Repository) at inStem and a Haplobank – a collection of HLA matched homozygous individuals -of cGMP grade iPSC at CSCR-inStem.
- inStem co-hosts the DBT supported National Mouse Research Resource (NaMoR) Facility. The Facility has established and manages a state-of the-art rodent facility including transgenic and knockout mouse models of human disease. This is the only Indian academic facility, which has begun to provide services such as cryopreservation, cryo-recovery, in vitro fertilization, strain re-derivation, micro-injection and embryo transfer services to other institutes across India and has a central nationwide stock database, a mouse cryobank, and repository.
- The Program in Chemical Biology & Therapeutics. described a new approach to selectively interrupt intracellular signalling pathways initiated by protein kinases using drugs that block the molecular recognition of phosphorylated proteins.
- Development of a nucleophilic polymer, which when formulated into a topical gel can be applied on the skin before spraying of pesticides. This gel can deactivate pesticides on the skin through nucleophilic-mediated hydrolysis, thereby preventing pesticide-induced toxicity and lethality.
- Leveraging biomimicry based drug discovery approach, potential first-in-class New Chemical Entities have been developed that can heal the leaky gut, and treat barrier dysfunction associated diseases such as inflammatory bowel diseases.



- Advanced biomaterial based technology has been developed to protect transplanted organs from rejection episodes and promote tissue regeneration.
- The faculty and early career researchers at inStem have received numerous awards and recognition for their scientific contributions such as EMBO Global Investigator Award; HarGobind Khorana Innovative Young Biotechnologist Award, DBT-Wellcome Trust India Alliance Fellowships, Ramalingaswami Fellowship, Gandhian Young Technological Innovation Award, MK Bhan-Young Researcher Fellowship, Grand Challenges Explorations (GCE) Award etc.
- The institute regularly organizes outreach and public engagement events such as its Open Science Days for visits by school and college students, participation in India International Science festival, Global Bio India, regular Science Setu Webinars, Public talks by faculty, Science Cafes, theatre performances etc.





## National Institute of Biomedical Genomics, Kalyani

**Date of inception:** 23<sup>rd</sup> February, 2009

### **Mandate**

The National Institute of Biomedical Genomics (NIBMG) is the first institution in India explicitly devoted to research, training, translation & service, and capacity-building in Biomedical Genomics. The primary aim of the institute is to understand the genetic underpinnings of all major human diseases, particularly those that are of public-health importance in India, translate the research findings to reduce the burden of disease, and build a formidable team of enablers (for disease prediction, prevention and therapy) through collaboration and training.

### **Campus**

NIBMG is located within a 30-acre campus in Kalyani, West Bengal. The land for NIBMG has been leased to President of India from Governor of West Bengal for Establishment & Running the National Institute of Biomedical Genomics

### **Research Focus**

The focus of research is the discovery of genes determining human biological processes, their functional characterization and understanding the inter-relationships of human biological systems to aid more precise management and control of human health and disease. To enable Genomic Medicine to come of age in India, the institute has adopted “Accelerating Genomics for Health” as its motto. Areas of specific interests include genomics of cancer and other chronic diseases, genomics of infectious diseases and statistical and computational genomics.

### **Human Resource**

The institute currently has 16 scientists and around 60 Research Fellows engaged in high calibre research, supported by 05 technical staff and 10 administrative staff at the institute.

### **Key Scientific Achievements**

Major achievements for the last 5 years (2017-22) are as follows:



Publications	PhD Degrees awarded	Post-docs and research fellows
158	12	68

- Genomics of Cancer: Generation of atlas of somatic genomic, epigenomic and transcriptomic alterations in gingivobuccal oral cancer (OSCC-GB) prevalent in India; characterization of intra and inter-tumor cell type and cell state diversities at a single cell level in OSCC-GB. NIBMG scientist identified most significantly altered driver genes of oral cancer that have important diagnostic potential. Further, a set of molecular features were identified which is associated with oral cancer metastasis and tumor progression from precancer states.
- The first oral cancer database, dbGENVOC, from exome/genome sequences of 100 Indian oral cancer patients has been established. Transcriptome based novel subtypes of cancer associated fibroblasts were discovered in oral cancer and oral cancer stem cells were identified and characterized. Epigenetically modulated gene expression alterations in important pathways identified in oropharyngeal cancer prevalent in Northeast India. Molecular landscape of oral precancer and frank oral cancers was obtained. Novel oral cancer cell lines are established from patients with no tobacco consumption habit as experimental models for functional validation and drug discovery research.
- Epidemiological findings of public health relevance with respect to HPV infections and cervical cancer pathogenesis. Identification of genomic, epigenomic and transcriptomic correlates of HPV16 associated cervical cancer.
- A 17-gene (METAGENE) signature to determine breast cancer recurrence/patient survival was discovered. A new tamoxifen resistant cell line and a series of cell lines with differential sensitivity to estradiol were established.
- Development of computational pipelines for analysis of multi-omics data for mission mode projects in the institute.
- Key hub coordination the nation-wide DBT sponsored INSACOG genome sequencing consortium. NIBMG spearheads this Consortium by coordinating the activities and by being one of the major sequencing hub. Until date, NIBMG has sequenced and deposited genome sequences from 40,000 samples (14%) out of the 300,000 sequences generated by the Consortium for India.
- Identification maternal common genetic variants associated with preterm birth using genome wide genotyping in the GARBH-Ini cohort. NIBMG has conducted the first GWAS on preterm



birth in South Asia, on 6,211 pregnant women, along with epigenomic and single cell transcriptomic investigations of the placenta.

- Development of fast and flexible data analytical pipeline for rapid processing of genomics multi-omics big data as a part of National Supercomputing Mission. Speed-up of some of the key modules of the state-of-the-art genomic data analytical pipeline was done. For example, specific sub components like, DNA alignment is now 1.5X faster, sorting 1.7X and base-quality-recalibration (BQSR) is 1.6X faster than the existing tools. The pipeline is now being used in NIBMG's mission mode projects. A software tool named *Mapinsights* that facilitates QC analysis of sequence files has been developed. Six different sub modules were developed that can assess the quality of the high throughput data which is capable of detecting error and biases in community standard open source data sets.
- The overarching goal of Genome India is to capture the huge genetic variations present in the Indian subcontinent. NIBMG has been in the forefront in design and execution of the project. NIBMG has been one of the four centres who have been assigned the responsibility of collection, storage and sequencing of the samples. Once the sequence and the genotype data is generated, NIBMG is also in the forefront in analyzing the data. Using genome-wide genotype data, NIBMG has developed analysis modules to identify the 'best' set of unrelated individuals who needs to be sequenced for the final dataset. NIBMG has also defined the uniform protocol for data generation and variant calling pipeline across the four centres. It has also defined the Quality control checkpoint parameters required to combine the sequence data generated at the four dataset. In Phase 1, the joint call of the variants has currently been carried out independently by NIBMG and CBR on Whole Genome Sequence data of 5750 individuals. NIBMG has sequenced 1623 samples out of 5750 samples, frozen for phase 1 joint calling. Around 400 samples, need to be sequenced to complete the target of NIBMG in the final 10K WGS dataset. Comparing the datasets generated at the two centres we can conclude that the discordance is extremely low in the datasets (<1 per billion). Preliminary analysis of 5750 individuals clearly shows that the GenomeIndia Project has been successful in capturing genomic variability in Indian population in unprecedented detail.
- The scientific contributions of the faculty and students at NIBMG have been recognized with key awards such as INSA Golden Jubilee Commemoration Medal, Lifetime Achievement Award



from SciGenom Research Foundation, Dr. Rustam D Ranji Rotary Award, DBT-Wellcome India Alliance Fellowship, travel grants from the American Society of Human Genetics, Society of Molecular Biology & Evolution, Israel Science Foundation, and number of best presentation/poster awards at international conferences. Several scientists are members or elected Fellows of prestigious academies and societies and serve on international expert committees.

- The institute regularly organizes outreach and public engagement events such as its Open Days, Educational tours, participation in India International Science festival (VigyanYatra), Science Setu webinars, Obaid Siddique Memorial Oration, several lectures and public talks by eminent international scientists and so on.





## Translational Health Science and Technology Institute, Faridabad



**Date of inception:** 15<sup>th</sup> July, 2009

### Mandate

The institute acts as a catalyst to translate fundamental discoveries by building rigorous clinical research capacity and to enable a faster transition of discoveries from bench to bedside.

### Campus

THSTI is housed within the NCR Biotech Science Cluster, in Faridabad. The institute has eight core facilities viz. Experimental Animal facility including Ferret facility, Data Management Center, Biorepository, Bioassay Laboratory, Vaccine Design and Development Centre, Immunology Core Laboratory, Multi-Omics Facility, Bio-safety Level 3 that serve not only the research programmes of THSTI, but also the NCR Biotech Science Cluster and other academic and industrial partners.

### Research focus

**The research focus is themed into the following centres:**

- **Centre for Virus Research, Vaccines and Therapeutics:** Developing effective intervention strategies against viruses of biomedical importance including Dengue, Coronaviruses, HIV, Hepatitis E, Chikungunya and Influenza.
- **Centre for Maternal and Child Health:** Focuses on the major causes of neonatal, infant and child deaths and sickness.
- **Center for Tuberculosis research:** The center focus on various aspects of Tuberculosis research including development of vaccines, drugs, diagnostics, host-pathogen interaction, shortening of treatment regimen, pathogenesis and in development of a repository of CRISPRi mutant strains of mycobacteria.
- **Centre for Microbial Research (CMR):** The center explores the interactions between microorganisms and humans and to better understand the role and effect of microorganisms in human health and disease. In addition, CMR is actively involved in Antimicrobial Resistance research for diagnostic and therapeutic development.



- **Centre for Immunobiology and Immunotherapy:** The center focus is on understanding T cell response in autoimmune, inflammatory diseases and cancer and targeting host-factors for novel anti-viral and anti-bacterial therapy.
- **Centre for Drug Discovery:** A multi-disciplinary unit that integrates basic with translational research to identify and develop new drug leads with established efficacy and safety in pre-clinical models.
- **Computational and Mathematical Biology Centre (CMBC):** The centre focuses on to develop novel computational tools and mathematical models to address biological problems, enhance the fabric of research in computing through linkages with experiments and vice-versa, inculcate the application of emerging and relevant computational technologies for in-depth and advanced biological data analysis, structural mapping and for therapeutic intervention.
- **Centre for BioDesign and Diagnostics (CBD):** The center specializes in the development of innovative in vitro diagnostic assays, with a strong emphasis on point-of-care testing.
- **Clinical Developmental Services Agency (CDSA):** CDSA functions as an academic research unit established to facilitate the development of new drugs, treatment regimes, and affordable healthcare products.

### **Human Resource**

The institute currently has 16 scientists and around 50 Research Fellows, supported by 34 technical staff and 5 administrative staff at the institute. In addition, the programs are supported by well-trained administrative and scientific staff who works on contracts. The institute engages dedicated administrative contract based support for pre-award phase of grants, human participation ethics, industrial collaborations, communication, IPR and outreach.

### **Key Scientific Achievements**

Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees awarded	Post-docs and research fellows	Patents awarded	Technologies transferred
392	28	198	11	9



- The program on Maternal and Child Health (MCH) at THSTI encompasses molecular studies in perinatal biology, maternal nutrition and other aspects relevant to maternal and child health. Gestational Weight Gain (GWG) trajectories have been evaluated in GARBH–Ini pregnancy cohort in North India involving a comparative analysis with global references. Gestational weight and fetal growth charts are generated from GARBH–Ini, for the first time in India to describe the longitudinal growth and allows comparison with the global standards. Candidate protein biomarkers predictive of preterm birth and 40 biological pathways and 8 unique metabolites modulated in preterm birth have been identified. THSTI has developed a dipstick assay for the identification of preterm birth-associated vaginal microbiota. The impact of Immediate kangaroo mother care (iKMC) has been evaluated in very low birth weight in 5 countries. This has now led to change in WHO recommendations for iKMC as treatment for very low-birth-weight infants.
- THSTI's program on non-communicable diseases has prioritized immunobiology underlying autoimmune disorders, early prediction of diabetes and identifying stage-specific molecular signatures for NAFLD/NASH.
- THSTI leads the DBT-AYUSH network project for preclinical evaluation of selected AYUSH herbal formulations against SARS-CoV2.
- The Bioassay Laboratory (BAL) at THSTI is accredited by the National Accreditation Board for Testing and Calibration Laboratories and is a part of CEPI network labs. BAL supports clinical studies by providing assay platforms for various clinical and immunological assays. During the COVID-19 pandemic, BAL carried out kit validations for vaccine developers and also provided trainings. The immunology core laboratory has BIRAC funding provides animal challenge experiments to various industries. The biorepository facility archives > 1.2 million varied biospecimen from health/disease-based longitudinal cohorts for biomarker development/validation and for seroprevalence studies and is notified as national covid-19 bio resource for well phenotyped clinical samples.
- THSTI provided animal models viz., hamsters & ACE2Tg mice, T cell based assays and neutralization assays to vaccine developers during the COVID-19 pandemic and contributed immensely in the vaccine development of CORBEVAX, ZyCoV-D and COVAXIN, SPUTNIK V and SPUTNIK Light.



- The vaccine effectiveness studies carried out in the clinical cohorts provided evidence for the GOI's policy on precautionary (booster) dose.
- An improved method for high quality metagenomic DNA extraction from human and environmental samples for microbiome study has been developed at THSTI.
- UniPEPtor , HyperQuantQuantWizIQ MODa Pipeline, ModST, ProteomeExplorer , TheoLib, konnect2protand an Artificial Intelligence Algorithm for Predicting Susceptibility to Type 2 Diabetes are some of the proteomics, computational and mathematical products/copyrights from THSTI.
- THSTI has developed an indigenous universal sample transport buffer medium for storage and transportation of microbes and nucleic acids. The product has been licensed to a company.
- The faculty and students at THSTI have received numerous awards for their scientific contributions such as DBT- National Bioscience Award, G.P. Talwar Young Scientist Award, BIRAC WInER Award for Women in Entrepreneurial Research, DBT-Wellcome Trust India Alliance Fellowship, MVP Award from IAVI, Japan Society for the Promotion of Science (JSPS) Invitational Fellowship, Merck Young Scientist Award, INSA medal, several travel awards (from- ICMR, IUIS, FOCIS, Australasian Society of Immunology, American Association of Immunologists), and many best poster/presentation awards at national and international conferences.
- The institute regularly organizes outreach and public engagement events such as its Open Days, participation in India International Science festival, Global Bio India, Science Setu webinars & seminars, visits to colleges/schools and interactions with students under programs like 'Shadow a Scientist', faculty presentation series, 'Haryana Gyanotsav' etc. THSTI also participated in COVID-related outreach in partnership with DBT-Wellcome Trust India Alliance, IAVI and Nature India through 'Ask the Experts' webinar series.





## National Agri Food Biotechnology Institute, Mohali

**Date of inception:** 18<sup>th</sup> February, 2010

### **Mandate:**

The institute has been established with the vision to provide food and nutritional security for all through agri-food biotechnology research and innovation. The mandate of NABI is to be a centre of excellence and provide leadership in agri-food biotechnology research with the goal of improving nutritional quality and availability of affordable agri-food and food products through innovations. The institute is part of agri-food cluster in the “Knowledge City” of Mohali (Punjab) along with its neighboring institutes.

### **Campus**

The campus is located in sector 81, Mohali. The institute is part of agri-food cluster in the “Knowledge City” of Mohali (Punjab) along with its neighboring institutes.

### **Research Focus**

The main research focus of NABI is to harness biotechnological tools in the area of Agriculture Biotechnology, Food Science and Technology and Nutritional Science so as to provide sustainable and novel solutions towards quality food and nutrition. Activities undertaken at NABI could be classified into five major areas that includes, a) Improving Cereals for nutrition and processing quality; b) Improving fruits for post-harvest quality and nutrition; c) Basic Biology for crop improvement; d) Functional food for better health and e) Genomics and Computational biology for marker and gene discovery.

### **Human Resource**

The institute currently has 10 scientists and around 70 Research Fellows, supported by 08 technical staff and 08 administrative staff at the institute.

### **Key Scientific Achievements**

Major achievements in the last 5 years (2017-22) are as follows:



Publications	PhD Degrees Awarded	Post-docs and research fellows	Patents filed	Technologies transferred
281	34	354	8	2

- NABI has undertaken an institutional “Flagship program” entitled “High resolution QTL mapping for Fe, Zn, grain protein and phytate content and their introgression in high yielding wheat cultivars”. The program is in collaboration with seven national institutions and is bringing researchers to common platform for sharing resources and eventually to deliver wheat grains with enriched micronutrient and proteins. Functional genomics strategies for improving micronutrient transport and its bioavailability in wheat are included in this program.
- Wheat lines have been developed containing high amylose and with low glycemic index (GI) along with the improved agronomic traits. These improved genotypes provide nutritional benefits and good processing of high amylose for consumer acceptance.
- Development of Banana enriched with Provitamin-A content using genome editing technique.
- Developed edible coating material to enhance the post-harvest shelf life of fresh fruits. This product helps in enhancing the shelf life of the fruits such as apple, banana and pears.
- Approved for use: High Value Products Viz. Nutraceuticals and Therapeutic Proteins using Sustainable Algae System; Recombinant Production of Omega-3 Polyunsaturated Fatty Acids of bacteria from High Altitude Lakes of Indian Himalayas; Fabricated nanomaterials in food for enhancement of micronutrients bioavailability and food safety.
- The faculty and students at NABI have received key fellowship awards for their scientific contributions such as Fulbright Nehru Fellowship, Newton Bhaba fellowship, Humboldt Fellowship, Rothamsted International fellowship, and INSA - NASI Fellowship.
- The institute regularly organizes outreach and public engagement events such as its Open Days, participation in India International Science festival, Global Bio India, Science Setu webinars (VigyanManthan), Nobel Prize Series etc. The institute also has organized several visits by school students to its premises.



## National Institute of Animal Biotechnology

**Date of inception:** NIAB was established in the year 2011.

### Mandate

The mission of the institute is to develop sustainable and globally competitive livestock-based economy through innovative science & technology development and promotion of entrepreneurship. NIAB aims to develop technology and solutions in animal biotechnology, leading to eventual commercialization.

### Research Focus

NIAB focuses on translational research and fostering bio-entrepreneurship in the animal biotechnology sector through i) Research in the cutting edge areas of biotechnology for improving health and productivity, ii) Production of animal bioreactors in order to strengthen India's role as a global player in Pharma, vaccine and enzyme production, iii) Development of high yielding livestock and poultry from indigenous and global resources, iv) Development of strategies for conservation of indigenous livestock and poultry, and v) Establishment of gene banks for genes of interest.

### Human Resource

The institute currently has 23 scientists and 115 Research Fellows engaged in research and innovation efforts, supported by 10 technical staff and 06 administrative staff at the institute.

### Key Scientific Achievements

Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees Awarded	Post-docs and research fellows	Patents filed	Technology transferred
93	01	45	16	6

- Whole genome sequencing of 43 indigenous breeds of cattle and development of a high-density single nucleotide polymorphism (SNP) chip; the chip was released to the nation on August 13, 2021.



- In a flagship project on genome-assisted pathobiology, NIAB is investigating differential transcriptomes, epi-transcriptomes and proteomes during exposure of animal and human cells to JE virus or leptospira in order to identify markers that could determine the differential pathogenicity in different hosts.
- NIAB is the coordinator of a multi-centred inter-disciplinary project to set up a consortium of human and veterinary health experts to conduct nation-wide surveillance of ten zoonotic and five transboundary animal diseases, and to develop disease forewarning systems.
- Initiation of large multi-centre collaborative programs on One Health aspects, including those on understanding the drivers of antimicrobial resistance in poultry meat production, elucidation of the pathobiology of Japanese encephalitis (JE) and leptospirosis.
- Conducting field-level interaction through Meeting of Indian Livestock farmers and Agriculturists with NIAB scientists (MILAN) to understand regional problems in livestock rearing and to devise strategies to resolve them. Working towards the upliftment of landless and marginal farmers through facilitation of goat rearing in an aspirational district.
- Initiation of programs on several fronts for enhancing livestock health and productivity.
- Development of tools and proof-of-concept and translational work on diagnostics, for disease prevention and management.
- Initiation of programs on non-germline transgenesis to produce proteins of therapeutic and commercial importance to humans and animals, such as hormones, cytokines, cell stimulating proteins and clotting factors.
- The researchers at NIAB have received awards and recognitions such as Ramalingaswami Fellowship, Ramanujan Fellowship, Bob Edward Oration award, DBT-BioCare Women Scientist Award, SERB Women Excellence Award, Prof. U. S. Srivastava memorial lecture award, and several best poster/presentation awards at national conferences. A number of scientists are members of prestigious international academies and societies, as well as expert committees at various levels.
- The institute has participated in outreach and public engagement events such as seminars and talks in India International Science festival, Science Setu lectures, public talks by faculty, Science Popularization program for school and college students, and National Science Day celebrations.





**Center of Innovative and Applied Bioprocessing, Mohali**  
**(merged with NABI Mohali)**

**Date of inception:** 27<sup>th</sup>September, 2012

**Mandate**

Center of Innovative and Applied Bioprocessing (CIAB) is the only institute in the country which works mainly on Secondary Agriculture and development of value-added products from different types of bio resources. The basic objective and purpose are to develop a pilot plant facility that services the needs of the agri-food cluster at Mohali, Punjab.

**Campus**

CIAB has campus of 14.193 acre, which is owned by the DBT. The campus is located in sector 81, Mohali.

**Research Focus**

The Institute has identified following broad areas in R&D; i) Value addition to processing residues for edible products, ii) Valorization of crop residues for specialty chemicals, iii) Nutritional and nutraceuticals products and upgradation of value or of use of primary processing products, and iv) Synthetic Biology/Biosynthetic Technology for low volume-high value products and industrial enzymes.

**Human Resource**

The institute currently has 08 scientists and around 50 Research Fellows engaged in research efforts, supported by 04 technical staff and 05 administrative staff at the institute.

**Key Scientific Achievements**

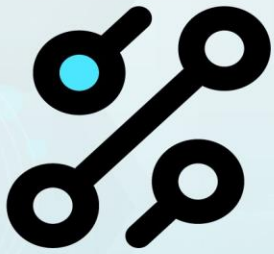
Major achievements in the last 5 years (2017-22) are as follows:

Publications	PhD Degrees awarded	Post-docs and research fellows	Patents awarded	Technologies transferred
147	08	237	15	4



- Established processes for development of tomato based Swaad-e-Seasoning, Tomaco spice-mix and Tom Zesty Fizz.
- Developed Iron fortified turmeric as a value-added product for improving iron nutrition
- Established the process for D-psicose-a nearly zero calorie sugar production from the biomass.
- Developed a liquid whey beverage product named CIAB-NAVITA.
- Developing technology for the production of alkyl pyranosides from mango seed shell and corncob
- Production of para-menthane-3,8-diols enriched Citronella (*Cymbopogon winterianus*) essential oil for making mosquito repellent fabric roll-on.
- Developing lignin-based products for surface sterilization, cosmetics and antimicrobial activities
- Scale up process for extraction of pectin, oil and citrate from galgal.
- Process development for xylitol production from agricultural residues.
- The faculty at CIAB have received several awards for their scientific contributions such as the DBT National Bioscience Award, NASI - Reliance Industries Platinum Jubilee Award, Gandhian Young Technological Innovation Award (by Society for Research and Initiatives for Sustainable Technologies and Institutions), Young Scientist Award by International Bioprocessing Association, France, Prof Hira Lal Chakravarty Award by Indian Science Congress Association etc. Some faculty members are also elected Fellows of prestigious national and international academies and societies.
- The institute has organized outreach and public engagement events such as visits by hundreds of students to the institute and public talks by faculty. It has also organized several online conferences attended by large number of students.





# **Major High-end Equipment/ Facilities at iBRIC**

## 6. Major High-end Equipment/Facilities at DBT Institutions

### I. National Cryo-EM facility at inStem, Bangalore Life Science Cluster

The Department of Biotechnology (DBT) is supporting a National Cryo-EM Facility, which is located in the inStem building, and is jointly managed by the Institute for Stem Cell Science & Regenerative Medicine (DBT-inStem) and the National Centre for Biological Sciences (NCBS-TIFR) on the Bangalore Life Science Cluster since 2018. This is the first Cryo-EM that was installed in India for the analysis of biological samples. Currently the facility contains two electron microscopes including high-resolution transmission electron microscope (TEM) Tecnai T12 G2 spirit and high-resolution field emission scanning electron microscope (SEM) Merlin Compact VP as well as a sample, purification and preparation lab.



**SEM-The MERLIN Compact VP**



**TEM (Tecnai G2 Spirit Bio-TWIN )**

### II. Advanced Technology Platform Centre (ATPC) at RCB

Advanced Technology Platform Centre (ATPC) is a DBT funded technology platform at the NCR Biotech Science Cluster. The centre is equipped with state-of-the-art research facilities and offers a wide range of services such as electron microscopy, mass spectrometry, genomics, optical microscopy, protein purification, flow cytometry. Some of the high-end facilities at ATPC are given below.





## Electron Microscopy Facility

The Electron Microscopy Facility houses Cryo-Electron Microscope: JEM2200FS; Transmission Electron Microscope: JEM1400 FLASH; and VolumeScope SEM with serial block-face imaging solution.

### 1. Transmission Electron Microscope: JEM-1400Flash

JEM1400 Flash is 120 kV TEM equipped with tungsten filament as electron source and highly-sensitive sCMOS camera. It can achieve high contrast imaging of biological specimens (including macro-molecular materials, tissue sections and viruses etc.) and material science samples (polymeric and metallic nanoparticles etc.) from low magnification (min. mag. 10X) to high magnification (max. mag. 1.2 MX) with resolution up to 0.38 nm.



### 2. Cryo Electron Microscope: JEM-2200FS

The JEM-2200FS is a field emission electron microscope which can be employed for biological and material science samples. It is equipped with a 200 kV field emission gun (FEG), piezo-controlled goniometer, holders for cryo-observation and tomography, in-column energy filter (Omega filter), and Gatan camera (K2 summit direct detection camera). This instrument is utilized for high-resolution cryo-electron microscopy, zero-loss imaging, energy-filtered imaging, spectroscopy for elemental analysis and tomography.



### 3. Scanning Electron Microscope: Apreo VolumeScope FEI

VolumeScope is a novel serial block-face imaging solution that enables excellent z-resolution from multi-energy deconvolution SEM combined with the efficiency of high-resolution cryo-electron microscopy *in situ* sectioning. The system offers highest contrast and optimal SNR with in-lens and in-column detectors for HiVac, as well as dedicated detectors for optimal resolution in LoVac. The



VolumeScope SEM unravels the complex 3D architecture of cells and tissues in their natural context which is crucial for gaining understanding of the structure–function correlation in biological systems.

## Mass Spectrometry Facility

Mass Spectrometry Facility at ATP, RCB houses ESI-MS: TripleTOF<sup>®</sup> 5600+; MALDI TOF/ TOF Mass Spectrometer: SCIEX TOF/TOF<sup>™</sup> 5800; ESI-Mass Spectrometer: SCIEX QTRAP<sup>®</sup> LCMS/MS 6500+ and Perkin Elmer Flexar<sup>™</sup> HPLC system.

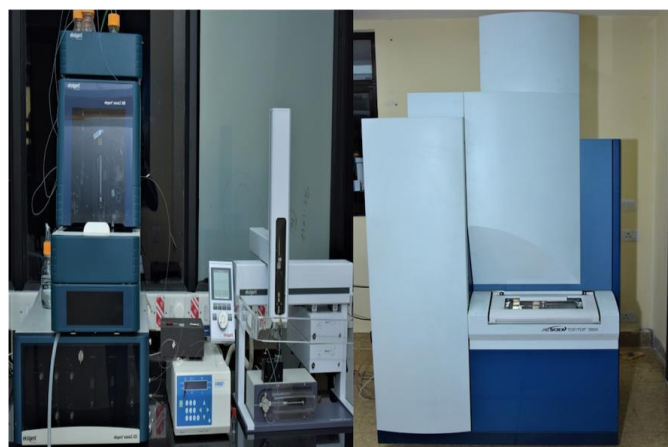
### 1. ESI-Mass Spectrometer: SCIEX TripleTOF<sup>®</sup> 5600+

Mass Spectrometry enables determination of the molecular masses of small molecules as well as of large biomolecules such as proteins and peptides. The SCIEX Triple TOF 5600+ mass spectrometer is a high-resolution LC-MS/MS mass spectrometer with high sensitivity and high mass accuracy. The Triple TOF<sup>®</sup> 5600+ has both ESI and APPI ionization sources and is hyphenated with an ExionLC for LC-MS analysis of small molecules and also with an Eksigentekspertnano LC 425 for qualitative and quantitative proteomics analysis.



### 2. MALDI TOF/ TOF Mass Spectrometer: SCIEX TOF/TOF<sup>™</sup> 5800

The facility also houses SCIEX TOF/TOF<sup>™</sup> 5800 mass spectrometer with EKSpot MALDI spotter for qualitative and quantitative proteomics analysis. The system is widely used for identification of protein/ peptide, characterization of PTM, *de novo* sequencing and relative quantification using iTRAQ, SILAC, TMT etc.





### 3. ESI-Mass Spectrometer: SCIEX QTRAP® LCMS/MS 6500+

The facility is equipped with SCIEX QTRAP® LCMS/MS 6500+ system. It is the fastest and most sensitive QTRAP. It provides the best LOD's and LOQs to enable the detection and quantification of the widest scope of chemical compounds in the most challenging matrices. Improved polarity switching and MRM3 speeds allow faster chromatography and better throughput. The built in QTRAP functionality enables quantitative MRMs and



qualitative QTRAP scans in the same injection to maximize throughput. Best being utilized for performing applications requiring ultimate sensitivity for ultra-low-level identification and quantitation of both small and large molecules and for confirmatory analysis of metabolites.

### 4. Perkin Elmer Flexar™ HPLC system

The facility provides services for cation exchange/high pH fractionation of complex proteomics samples using Perkin Elmer Flexar™ HPLC system which is coupled with automated fraction collector for wide coverage of proteome. The facility has been used for processing and analyzing more than 3000 samples from more than 360 users since its installation.



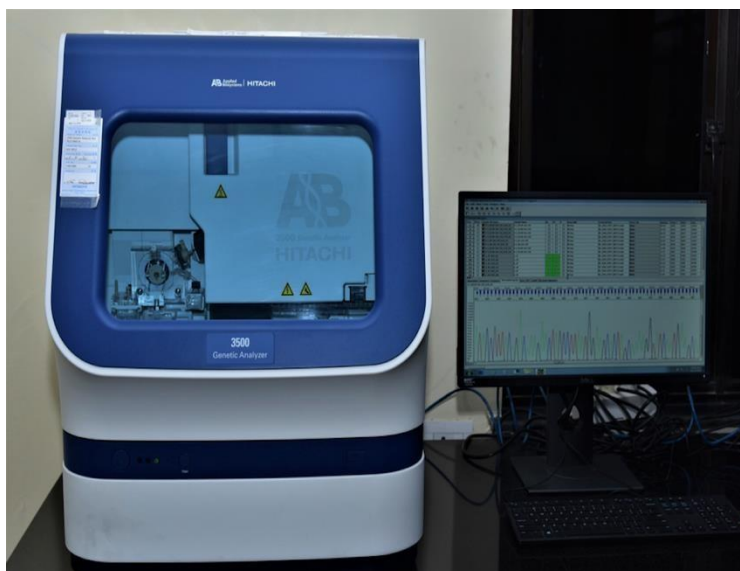
### Genomics Facility

Genomics Facility currently houses two instruments- DNA Sequencer: ABI 3500 Genetic Analyzer and Droplet Digital PCR (Bio-Rad).



## 1. DNA Sequencer: ABI 3500 Genetic Analyzer

3500 Genetic Analyzer is a fluorescence based 8-capillary sequencing instrument which is based on Sanger DNA sequencing. The system is configured with 50 cm array and an integrated software for instrument control, data collection, quality control, base-calling and size-calling of samples. The system has a varied range of applications like microbial sequencing, targeted DNA sequencing, epigenetic analysis, pathogen analysis, genetic disease research, SNP analysis and biomarker analysis.



## 2. Droplet Digital PCR: ddPCR™ (Bio-Rad)

ddPCR™ is an advanced version of PCR that provides simultaneous clonal amplification and fluorescence-based quantification of nucleic acids. A typical reaction in ddPCR™ is partitioned into several thousands of water-in-oil droplets where individual reactions are carried out providing absolute, precise and reliable quantification. ddPCR™ has demonstrated usage in the detection of rare DNA targets, determination of copy number variations and measurement of gene expression levels. The Genomics facility is heavily used, and the services have been availed by a total of more than 1300 users for processing and analyzing more than 7800 samples.



Overall, the facilities at ATPC are accessible to users in academia and industry from all over the country. Potential users can access all details of ATPC at <https://atpc.rcb.res.in> and send in requests at [services\\_atpc@rcb.res.in](mailto:services_atpc@rcb.res.in). In the past five years, ATPC has rendered services worth a cumulative revenue of Rs. 4.45 crores. Therefore, ATPC represents an ideal place to host new technologies that will be available for researchers in DBT AIs and for training students of the RCB-BRIC PhD program in cutting-edge methods in modern biological science.



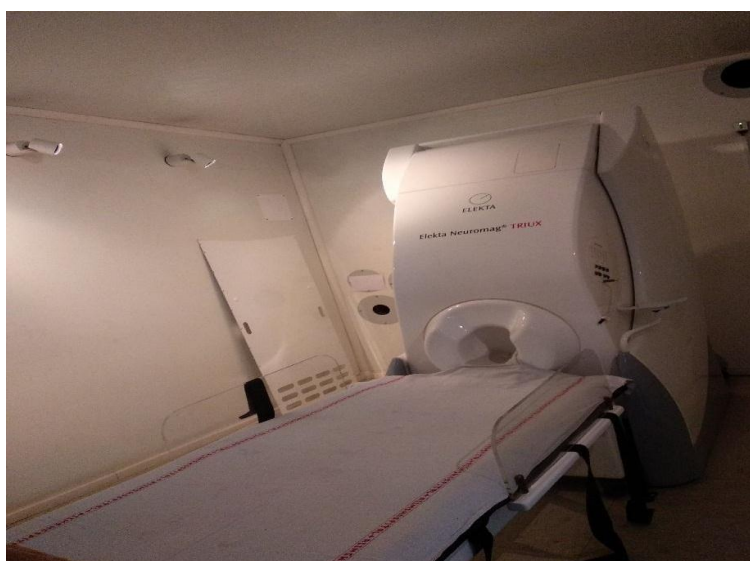
## European Synchrotron Radiation Facility (ESRF) Access Program at RCB

Regional Centre for Biotechnology (RCB) and the European Synchrotron Radiation Facility (ESRF) have entered into an agreement concerning the medium-term use of synchrotron for non-propriety research for the benefit of the Indian scientific community as a whole, and notably the structural biology research groups. The program provides access to Indian investigators to experimental stations for macromolecular crystallography, small angle X-ray scattering and Cryo-Electron Microscopy located in ESRF. The DBT-supported ESRF access program of the RCB helps Indian researchers to perform experiments at this unique facility located in Grenoble, France. The program, in its current form, was initially flagged off in June and was renewed for another three years till January, 2023.

Indian users have used the ESRF resources to shed light on molecular processes in different organisms such as Japanese Encephalitis Virus, SARS-CoV-2, *Entamoeba histolytica*, *Pseudomonas Auroginosa* and *Mycobacterium tuberculosis*. Using data collected at ESRF, Indian researchers were able to publish 181 research papers in international peer reviewed journals such as Nature Communications, Nature Structure & Molecular Biology, Journal of American Chemical Society, Nucleic Acids Research, Science Advances, PloS Pathogens etc. Due to the support provided by DBT, the researchers have started exploiting the structural information generated during the course of this project to find innovative solutions for problems that plague India in the areas of health, agriculture and environment.

## III. Magnetoencephalography (MEG) Resource Facility at NBRC

Magnetoencephalography (MEG) is a non-invasive neuro-imaging technique which maps brain activity by measuring the magnetic fields produced by the naturally occurring electrical currents in the brain. Arrays of SQUIDs (superconducting quantum interference devices) are used as magnetometers to detect magnetic signals from the brain. MEG is generally used to identify the exact location of source of epileptic seizures (epileptogenic focus). MEG facility has been installed at NBRC under RRSFP-SAHAJ scheme of DBT. The



objective of the facility is to perform MEG scans and analysis in persons with epilepsy (PWE) and issue the signed report for further procedures. At the MEG Resource facility, 2 PWEs are investigated



every day. The scanning duration is 2-3 hours. MEG scanning has been performed for a total of 1155 epilepsy patients at NBRC in the last 5 years.

### **National Neuroimaging Facility at NBRC**

The DBT funded National Neuroimaging Facility, was established to facilitate/support cutting edge brain imaging research. The facility is equipped with state-of-the-art equipment including 3T Magnetic Resonance Imaging (MRI)Scanner, sensors and computers for Electroencephalography (EEG) and setup for Evoked Response Potential Recording (ERP).

### **Magnetic Resonance Imaging**

MRI provides much greater contrast between the different soft tissues of the body compared to computed tomography (CT), making it especially useful for neurological (brain), musculoskeletal and cardiovascular imaging. Various imaging modalities also play an important role in providing crucial information which can aid in diagnosing different disease conditions. Amongst the different imaging modalities used at NBRC are:

1. MR Spectroscopy (MRS) which provides non-invasive estimations of different neurochemicals in the brain and enables clinical correlation.
2. Functional MRI (fMRI), which correlates functional (haemo dynamics) activity with images of brain activation
3. The Tesla Phillips whole-body MRI scanner at the National Neuroimaging Facility is equipped with state-of-the-art hardware, software and data processing software required for each imaging modality. The facility is being used for performing structural, metabolic (multinuclear, e.g. proton and phosphorous) and functional MRI.

In the last 5 years, National Neuroimaging facility (using 3T MRI) has been used for the following number of patients: Alzheimer's patients- 9; Early Alzheimer's Patients (MCI)- 115; Parkinson's Disease patients – 61; Elderly persons age (60-94Y range)- 361.

### **IV. National Genomics Core Facility at Centre for DNA Fingerprinting & Diagnostics (DBT-CDFD)**

The National Genomics Core facility has been established by the DBT at CDFD to provide high end genomic solutions and services for the research needs of academic institutes and industry.





The facility houses the following instruments:

### **Illumina MiSeqFGx**

MiSeqFGx solution delivers a complete DNA-to-Data workflow for the analysis of forensic DNA samples. The solution begins with the ForenSeq™ DNA Signature Prep Kit, which includes all reagents required to prepare DNA libraries for sequencing. ForenSeq Universal Analysis Software delivers a powerful suite of forensic analysis capabilities including automatic detection of mixed DNA samples, generation of population statistics. The Illumina MiSeqFGx is also a cost-effective solution for smaller sequencing applications such as Amplicon sequencing, 16s rRNA metagenomics, Small RNA sequencing, Small Genome sequencing. The platform enables up to 15 Gb of output with 25 million sequencing reads and  $2 \times 300$  bp read lengths.



### **Illumina Nextseq 2000**

NGC hosts the first NextSeq 2000 system in the country. The NextSeq 1000 and NextSeq 2000 Systems support emerging and mid-throughput sequencing applications as well as a broad range of methods such as exome sequencing, target enrichment, single-cell profiling, transcriptome sequencing, and more. The system features a novel super resolution optics system that yields highly accurate imaging data with greater resolution and higher sensitivity than traditional benchtop systems. Capable of producing upto 300Gb data generating 1billion reads with  $2 \times 150$ bp read lengths.



The facility also has Oxford NanoporeGridION X5 (a compact benchtop system designed to run and analyse up to five MinION Flow Cells), Agilent TapeStation 4200 (automated electrophoresis tool for DNA and RNA sample quality control) and Agilent 2100 Bioanalyzer system (automated electrophoresis solution for the sample quality control of biomolecules). The facility has been used for sequencing and genotyping more than 15000 samples. A total of 126 services have been provided to both internal and external users. Additionally, 11692 samples of SARS-Cov-2 have been sequenced under Indian SARS-CoV-2 Consortium on Genomics (INSACOG).



## V. National Genomics Facility at NIBMG

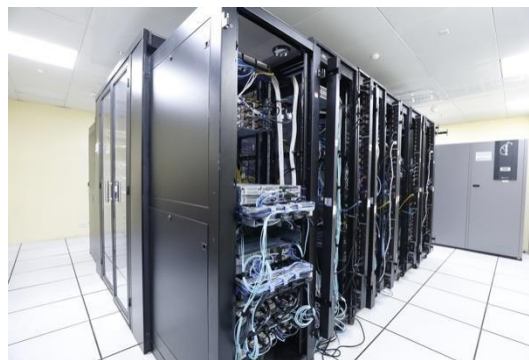
NIBMG is the first institution in India explicitly devoted to research, training, translation & service and capacity-building in Biomedical Genomics. The laboratories are equipped with state of the art instruments. The National Genomics Facility hosts a number of high-end equipment.

### DNA Sequencing & Real Time PCR

- Massively parallel sequencing platforms of GS-FLX (Roche-454), HiSeq-2000 & 2500 (Illumina), Ion Proton & Ion Torrent PGM (Life Technologies) for whole genome sequencing, exome sequencing, targeted resequencing, metagenomics, amplicon sequencing, RNA-Seq & small RNA-Seq, ChIP-Seq
- ABI3500XL Genetic Analyzer (Life Technologies) for Sanger/CE sequencing and fragment analysis
- ABI7900 HT (Life Technologies) and Lightcycler LC480 (Roche) for high throughput real time PCR
- 2100 Bioanalyzer (Agilent) for sequencing library QA/QC



The facility also has Microarray setup for processing Illumina beads, a 300 TB Grid Scalar Central Data Storage platform (DDN), High performance parallel computing Clusters (HPPC Lab), computational labs for data analysis and also has a central Digital Library for accessing high impact journals through the DBT-Electronic Library Consortium (DeLCON) network. Flow cytometry, confocal imaging and tissue and bacterial culture are other basic facilities available.



## VI. National Genomics and Genotyping Facility (NGGF) at NIPGR

The NGGF acts as a nodal centre for DNA finger printing of lines and varieties for certification purpose in coordination with Plant Variety Protection Authority. It provides consultancy as well as improved genomic tools to plant breeders and plant biotechnologists to enhance the quality of research and product development.

The facility houses three major platforms:



### 1. Fluorescent dye-labelled SNP genotyping platforms (LGC Array Tape/KASP)

This platform can genotype limited number of SNPs with large number of samples at low cost. This has major applications in foreground and background analysis in MAS, genetic fingerprinting and genetic purity testing, diversity analysis and CRISPR/Cas9 genome editing validation.



### 2. Array, Mass and Expression based SNP genotyping platforms (Affymetrix Gene Titan, Agena and Nanostring)

This platform can genotype large number of SNPs at a genome-wide scale. It is cost effective and rapid. Major applications of this platform are: Germplasm characterization to assists in core & mini-core selection, background analysis for MAS, GWAS and e-QTL mapping to identify loci for traits of interest and genomic selection.



Affymetrix Gene Titan Machine



NanostringCounter SPRINT Profiler



AgenaMassARRAYAnalyzer 4



### 3. NGS-based sequencing and genotyping platforms (NovaSeq 6000 and NextSeq 550)

This platform is used for medium to large number of SNPs at a genome-wide scale. It is cost effective and high throughput. Its major applications are: Genome sequencing, identification of novel SNPs/structural variants (SNPs, InDels, CNVs, etc) and genomic selection, for genome assembly and germplasm characterization.



**NovaSeq 6000**



**NextSeq 550**

#### IV. Indian Biological Data Centre (IBDC), NCR Biotech Cluster Faridabad

The Indian Biological Data Centre (IBDC: <https://ibdc.rcb.res.in/>) is the first national digital data repository mandated to archive all life science data generated from publicly funded research in India. It is supported by the Government of India (GOI) through the Department of Biotechnology (DBT). Housed at the **NCR Biotech Cluster Faridabad**, IBDC is being developed under active collaboration of RCB, NIC, NII and ICGEB, New Delhi. The computational infrastructure, including a High Performance Computing (HPC) cluster and archival data storage, are jointly hosted at RCB and NIC, Bhubaneswar. The site at RCB has 4.5 PB (PetaByte) of raw storage (Fig.1), while that at NIC (Bhubaneswar) has 1 PB of raw storage capacity with a total compute power of 900 TF (TeraFlops). The two sites are connected by high bandwidth internet connectivity through NKN. The biological data generated by researchers in India is being curated at IBDC-RCB for seamless access by users.







*Figure 1: The “Brahm” High Performance Computing cluster at the RCB site is displayed.*

Team IBDC comprises a blend of experts from diverse disciplines, including different domains of biological sciences, bioinformatics, information technology, etc. Owing to the magnitude and complexity of the biological data, IBDC is being developed in a modular nature. The data stored at the IBDC will enable big data analytics that will help identify emergent properties in biological systems and thus aid the development of novel solutions for problems faced by Indians in the areas of health, agriculture and the environment. Currently, IBDC operates through four specialized data portals dedicated to the management of diverse biological data types.

1. **Indian Nucleotide Data Archive** (<https://ibdc.rcb.res.in/inda>): INDA is an open-access platform for archiving, managing, and sharing diverse nucleotide sequencing data generated across India. Data are synched with INSDC (The International Nucleotide Sequence Database Collaboration) agencies like NCBI, ENA, and DDBJ. Presently, data from 47 studies from 19 research organizations containing a total of 3553 runs accounting for 34097301 million bases have been submitted to INDA.

2. **Indian Nucleotide Data Archive-Controlled Access** (<https://ibdc.rcb.res.in/indasecure>): INDA-CA is a controlled access platform for archiving and managing diverse types of nucleotide sequencing data (similar to INDA) generated across India. In contrast to INDA, data submitted to INDA-CA are shared with any international repository. Data are accessible only to the depositor, and the accession Ids are provided by IBDC only. Presently, 21 studies from 9 research organizations containing a total of 1944 runs have been submitted to INDA-CA

**IBDC has developed unique submission tracks for projects of nucleotide sequencing projects of national relevance, INSACOG (SARS-CoV-2), INSACOG Sewage Surveillance and GENOME INDIA.**



**INSACOG Dashboard** (<https://ibdc.rcb.res.in/insacog/statisticsinsacog>): The Indian SARS-CoV-2 Genomics Consortium (INSACOG), a consortium of 64 Laboratories is a Pan-India network to monitor genomic variations in the SARS-CoV-2 by a sentinel sequencing effort. It is jointly initiated by the Union Ministry of Health, Department of Biotechnology (DBT), Council for Scientific & Industrial Research (CSIR) and Indian Council of Medical Research (ICMR). Presently, 251409 SARS-CoV-2 genomes have been submitted in the INSACOG Dashboard from 64 INSACOG labs.

**INSACOG Sewage surveillance** (<https://ibdc.rcb.res.in/sewagedata/statisticsinsacog>): The main purpose of sequencing in sewage surveillance is that it will help to get the true picture of prevailing variants, emerging variants and those causing reinfection. 100 samples from 69 sewage sites (Table 4) have been deposited in the INSACOG-Sewage surveillance portal.

### Genome India:

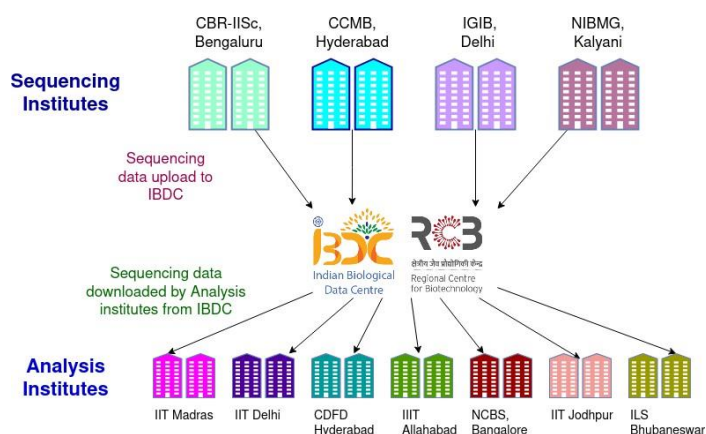


Figure 2: The network map and data path for GenomeIndia data is displayed.

Cataloguing the Genetic Variation in Indians is a Pan India initiative focused on Whole Genome Sequencing of representative populations across India. The goal is to start with and execute whole genome sequencing and subsequent data analysis of 10,000 individuals representing the country's diverse population. Currently, IBDC is providing data storage and secure access to 11 Institutes (Fig. 2) across India, which are part of the Genome India consortium, and the portal is accessible only for the consortium institutes. A total of 9219 submissions, which includes UBAM, fastq and gvcf file types accounting for ~280 terabytes have been submitted to GenomeIndia.

3. **Indian Crop Phenome Database** (<https://ibdc.rcb.res.in/icpd/>): ICPD is an open-access (Time released) platform facilitating the digitization, management, storage, analysis (implemented soon), and

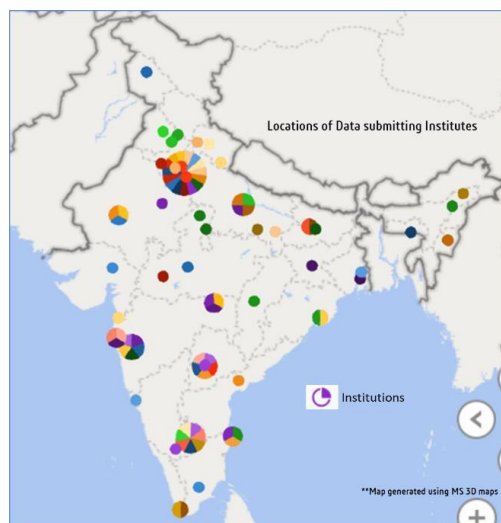


exchange of crop phenotyping data following FAIR data guidelines. Accessions will be provided by IBDC. ICPD also recently started its operation and 6 phenoprojects have been submitted (Table 1).

4. **Indian Structural Data Archive** (<https://isda.rcb.ac.in/>): ISDA (Indian Structural Data Archive) constitutes a comprehensive repository of biological 3D-macromolecular structures. The database is in sync with the www.PDB to weekly retrieve the data for major updates. All biological entries in mmCIF format are used to extract the summary, experimental and functional information along with other information such as publication, etc. to update the MongoDB database. The database is also focused on providing critical insights into the function and biology of structure, ligand and other factors. Consequently, each entry in the database is further enriched with different-level functional annotations such as Pfam, SCOP, CATH, GO, Enzyme, etc. To navigate regularly updated COVID-19 disease-related entries, a curated “Covid-19 Resource” page is designed, which provides direct access to the COVID-19 protein-wise experimental structures categorized over experiment techniques. 3D molecular visualizers have been incorporated for chemical and macromolecular visualization in the database using JSMol and Mol\*.

### Summary of Depositor Institutes

A total of 88 institutes (Fig. 3) from different funding agencies like DBT, DST, CSIR, ICMR, ICAR, Medical colleges, Universities, Private colleges and autonomous institutes across India have submitted data across all the portals.



*Figure 3: The distribution of the organizations across India that have deposited data in IBDC is displayed*



**Instrumentation facility at IBSD, Imphale established for North Eastern Region:**

**Next Generation sequencing facility:**

Next Generation Sequencing facility at IBSD, Imphal is well equipped with MiSeq, NextSeq sequencing platforms, Real-Time PCRs, TapeStation system. In this facility, DNA and RNA samples are analyzed for quality control, library preparation, quantification, enrichment and finally for high throughput sequencing. This facility is being used for sequencing transcriptomes/ genomes of microbes/ plants/ viruses.



MiSeqNextSeq 550

**Gas Chromatography (GC-MS/MS) Facility: (Triple Quadrupole GC-MS/MS)**

GC-MS/MS facility at IBSD, Imphal is well equipped with triple quadrupole mass spectrometer. This facility provides workflow for MS/MS, full scan (FS) and selected ion monitoring (SIM) analysis. This facility is used to identify and quantify the components present in volatile/ essential oils.



Triple Quadrupole GC-MS/MS





### Confocal Microscope Facility: (Nikon A1R HD):

Confocal microscope facility at IBSD, Imphal is well equipped with Nikon A1R HD Confocal Microscope. This facility has four channel imaging, high speed resonance scanner, focus system for time lapse imaging, FRAP, FRET, photoactivation, solid state imaging with 3-D and 2-D imaging. This facility is used for confocal recording (laser scanning images) of fluorescence labelled fixed plant and animal samples.



Nikon A1R HD Confocal Microscope



## Consultations

**BRIC is a huge collective effort and established through various consultative processes**

### Snapshot of Meetings held

#### 1. For Cabinet Note Approval

<b>Nov 1<sup>st</sup>, 2021: Letter from Secy Exp to SBT for Rationalization of DBT-AIS</b>
<b>Nov 11-12<sup>th</sup>, 2021: Discussion of restructuring with AI Directors'</b>
<b>Nov 11-12<sup>th</sup>, 2021: PSA also addressed all AI Directors</b>
<b>Nov 18<sup>th</sup>, 2021: Committee constituted to draft the proposal</b>
<b>Nov 24<sup>th</sup>- Jan 13<sup>th</sup>, 2021: Eight meetings held</b>
<b>Dec 27<sup>th</sup>, 2021: SBT Discussed draft Proposal with all AI Directors'</b>
<b>Dec 28<sup>th</sup>, 2021: Draft proposal shared with AI and comments sought</b>
<b>Jan 11-13<sup>th</sup>, 2022: Comments received discussed by the committee</b>
<b>Jan 2022: Draft was submitted to Hon'ble MOST</b>
<b>Jan 21<sup>st</sup>, 2022: Presentation made to PMO officials in DBT</b>
<b>Jan 21<sup>st</sup>, 2022: Draft submitted to DoE with timelines</b>
<b>Jan 27<sup>th</sup>, 2022: Presentation to PM Adviser</b>
<b>Feb 2<sup>nd</sup>, 2022: Presentation to DBT AI Directors</b>
<b>Feb – Mar 2022: Collation of information for Cabinet Note</b>
<b>Mar 25<sup>th</sup>, 2022: SBT presented to Cabinet Secretary</b>
<b>Apr 1<sup>st</sup>, 2022: SBT presented to Expenditure Secretary &amp; AS(Exp)</b>
<b>Apr to May 2022: Cabinet Note Drafted &amp; Approved by MOST</b>
<b>May 24<sup>th</sup> 2022: Inter-ministerial circulation</b>
<b>Jul 22<sup>nd</sup>, 2022: Cabinet Approved BRIC formation</b>



## 2. For BRIC Registartion

29 <sup>th</sup> Aug, 2022	SBT took internal meeting regarding CEE Note for BRIC
5 <sup>th</sup> Sep 2022	SBT took internal meeting regarding CEE Note for BRIC
1 <sup>st</sup> , 7 <sup>th</sup> ,13 <sup>th</sup> & 23 <sup>rd</sup> Sep 2022:	JS (Admin) took internal meeting regarding CEE Note for BRIC
16 <sup>th</sup> & 22 <sup>nd</sup> September 2022	JS (Admin) meeting with AI regarding consolidation of HR Data
Oct 18 <sup>th</sup> , 27 <sup>th</sup> & 28 <sup>th</sup> , 2022	JS (A) & IFD meeting for preparation of Note
3 <sup>rd</sup> & 15 <sup>th</sup> Nov, 2022	SBT took internal meeting regarding CEE Note for BRIC
16 <sup>th</sup> Nov, 2022	1 <sup>st</sup> DBT Taskforce meeting for the creation of BRIC
21 <sup>st</sup> Nov, 2022	2 <sup>nd</sup> DBT Taskforce meeting for the creation of BRIC
1 <sup>st</sup> Dec, 2022	SBT meeting with Directors
12 <sup>th</sup> December, 2022	SBT took internal meeting regarding CEE Note for BRIC
17 <sup>th</sup> January, 2023	SBT took internal meeting regarding CEE Note for BRIC
19 <sup>th</sup> January, 2023	Meeting with NIC team regarding creation of Website for BRIC
25 <sup>th</sup> January, 2023	3 <sup>rd</sup> DBT Taskforce meeting for the creation of BRIC
14 <sup>th</sup> February, 2023	SBT took internal meeting regarding creation of BRIC Sectt
26 <sup>th</sup> February, 2023	Launch of BRIC Logo by Hon'Ble Minister of S & T
19 <sup>th</sup> July, 2023	Meeting of JS (A) with Directors
8 <sup>th</sup> Aug, 2023	SBT meeting regarding registration of BRIC society
30 <sup>th</sup> Sep, 2023	SBT Meeting with Directors
4 <sup>th</sup> Oct, 2023	SBT meeting with DBT officials
28 <sup>th</sup> Oct, 2023	SBT meeting Directors with Mr. Ananad Deshpande
16 <sup>th</sup> Nov, 2023	SBT meeting with RCB for Ph.D programs
22 <sup>nd</sup> Nov, 2023	SBT meeting with Directors



**Committee for Rationalization of DBT Autonomous Institution**

**Date: 18.11.2021**

1. **Dr. Sudhanshu Vrati**, Director RCB Faridabad – Chair
2. **Dr. Apurva Sarin**, Director, inStem, Bangalore - Member
3. **Dr. Chandrabhas Narayana**, Director, RGCB Thiruvananthapuram - Member
4. **Dr. Kalaivani Ganesan**, Scientist ‘E’, DBT - Member Secretary





### Leadership Team of DBT AI - Directors

S. No.	Autonomous Institutes	Name
1.	NII, New Delhi	<ul style="list-style-type: none"> <li>• Dr. Pushkar Sharma</li> <li>• Dr. Debasisa Mohanty</li> </ul>
2.	NCCS, Pune	<ul style="list-style-type: none"> <li>• Dr. Manoj Kumar Bhat</li> <li>• Dr. Mohan Wani</li> </ul>
3.	ILS, Bhubaneswar	<ul style="list-style-type: none"> <li>• Late Dr. Ajay Parida</li> <li>• Dr. Debasis Dash</li> </ul>
4.	RGCB, Thiruvananthapuram	<ul style="list-style-type: none"> <li>• Prof. Chandrabhas Narayana</li> </ul>
5.	CDFD, Hyderabad	<ul style="list-style-type: none"> <li>• Dr. K. Thangaraj</li> <li>• Dr. Sangita Mukhopadhyay</li> </ul>
6.	NBRC, Manesar	<ul style="list-style-type: none"> <li>• Dr. Pravat Kumar Mandal</li> <li>• Prof. Krishanu Ray</li> </ul>
7.	NIPGR, New Delhi	<ul style="list-style-type: none"> <li>• Dr. Subhra Chakraborty</li> </ul>
8.	IBSD, Imphal	<ul style="list-style-type: none"> <li>• Prof. Pulok K. Mukherjee</li> </ul>
9.	inStem, Bangalore	<ul style="list-style-type: none"> <li>• Prof. Apurva Sarin</li> <li>• Prof. Maneesha Inamdar</li> </ul>
10.	NIBMG, West Bengal	<ul style="list-style-type: none"> <li>• Prof. Saumitra Das</li> <li>• Dr. Sagar Sengupta</li> </ul>
11.	THSTI, Faridabad	<ul style="list-style-type: none"> <li>• Dr. Pramod Kumar Garg</li> <li>• Dr. Jayanta Bhattacharya</li> </ul>
12.	NABI, Mohali	<ul style="list-style-type: none"> <li>• Prof. Ashwani Pareek</li> </ul>
13.	NIAB, Hyderabad	<ul style="list-style-type: none"> <li>• Dr. G. Taru Sharma</li> </ul>



## Task Force for implementation of Biotechnology Research and Innovation Council (BRIC)

Date: 23.11.2022

S.No	Name and Address	Designation
1.	Dr. Rajesh S. Gokhale, Secretary, DBT	Chair
2.	Dr. M. Radhakrishna Pillai, Former Director, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram	Member
3.	Dr. Satyajit Rath, Emeritus Professor, Indian Institute of Science Education and Research, Pune	Member
4.	Prof. Apurva Sarin, Former Director, Institute for Stem Cell Science and Regenerative Medicine, Bangalore	Member
5.	Prof. Sudhanshu Vрати, Executive Director, Regional Centre of Biotechnology, Faridabad	Member
6.	Dr. Arvind Sahu NCCS, Pune	Member
7.	Dr. Rashna Bhandari, CDFD, Hyderabad	Member
8.	Prof. Akhilesh Kumar Tyagi, Former Director, National Institute of Plant Genome Research, New Delhi	Member
9.	Shri Vishvajit Sahay, AS&FA, DBT	Member
10.	Dr. Alka Sharma, Senior Adviser/ Scientist 'H', DBT	Member
11.	Shri Chaitanya Murti, Joint Secretary (Admin), DBT	Member
12.	Dr. Kalaivani Ganesan, Scientist 'F'	Member Secretary
13.	Dr. Richi V Mahajan, Scientist 'C'	Co-Member Secretary



## Working Groups for operationalization of Biotechnology Research and Innovation Council

Date: 03.11.2023

S.No.	Working Groups	Members
1.	Website	<ul style="list-style-type: none"> <li>• Director, NABI-CIAB, Mohali</li> <li>• Director, ILS, Bhubaneswar</li> <li>• Director, THSTI, Faridabad</li> <li>• DBT Coordinator: Dr. Richi V Mahajan, Sc. 'D'</li> </ul>
2.	Recruitment and Promotion Policy	<ul style="list-style-type: none"> <li>• Director, NII, New Delhi</li> <li>• Director, inStem, Bangalore</li> <li>• Director, NCCS, Pune</li> <li>• Administrative Officer, ICGEB, New Delhi</li> <li>• Senior Manager, NII, New Delhi</li> <li>• Head – Administration, THSTI, Faridabad</li> <li>• Senior Manager, NIAB, Hyderabad</li> <li>• Manager (Administration), NABI-CIAB, Mohali</li> <li>• DBT Coordinators: Dr. Kalaivani Ganesan, Sc 'F', Dr. Richi V Mahajan, Sc. 'D' and Shri Pankaj Upadhyay, DS (Admin)</li> </ul>
3.	Facilities and Platform Technology	<ul style="list-style-type: none"> <li>• Director, NIPGR, New Delhi</li> <li>• Director, NIBMG, West Bengal</li> <li>• Director, CDFD, Hyderabad</li> <li>• DBT Coordinator: Dr. Abhishek Kumar Mehta, Sc. 'D'</li> </ul>
4.	Collaborative Ph.D Program	<ul style="list-style-type: none"> <li>• Director, ICGEB, New Delhi</li> <li>• Director, RCB, Faridabad</li> <li>• Director, NBRC, Haryana</li> <li>• DBT Coordinator: Dr. Varshneya Singh, Sc. 'D'</li> </ul>
5.	First-Year Research Immersion Program	<ul style="list-style-type: none"> <li>• Director, NIAB, Hyderabad</li> <li>• Director, RGCB, Thiruvananthapuram</li> <li>• Director, IBSD, Imphal</li> <li>• Dr. Apurva Sarin, CEO, DBT/Wellcome Trust India Alliance (India Alliance)</li> <li>• DBT Coordinators: Dr. Kalaivani Ganesan, Sc 'F' and Dr. Varshneya Singh, Sc 'D'</li> </ul>



## Special Acknowledgements

### 1. BRIC Society Registration

- Dr. Ashwani Pareek, Director, NABI, Mohali
- Sh. S. Krishnan, Manager Administration, NABI, Mohali

### 2. BRIC Chintan Shivir

- Dr. G. Taru Sharma, Director, NIAB, Hyderabad
- Dr. Debasisa Mohanty, Director, NII, New Delhi
- Sh. Harjit Singh Johal, Senior Manager (Admin & Finance), NIAB, Hyderabad
- Dr. D.K. Vashist, Senior Manager, Head of Administration, NII, New Delhi

### 3. Support for BRIC Secretariat at DBT

- Dr. Apurva Sarin, CEO, DBT/Wellcome Trust India Alliance (India Alliance)
- Dr. Maneesha Inamdar, Director, inStem, Bangalore
- Dr. Mohan Wani, Director, NCCS, Pune
- Dr. Shringar Sharma, Project Manager (Consultant)
- Ms. Shivangi Jain, Project Assistant
- Ms. Munesh, Project Assistant

### 4. BRIC Space & Logo Registration

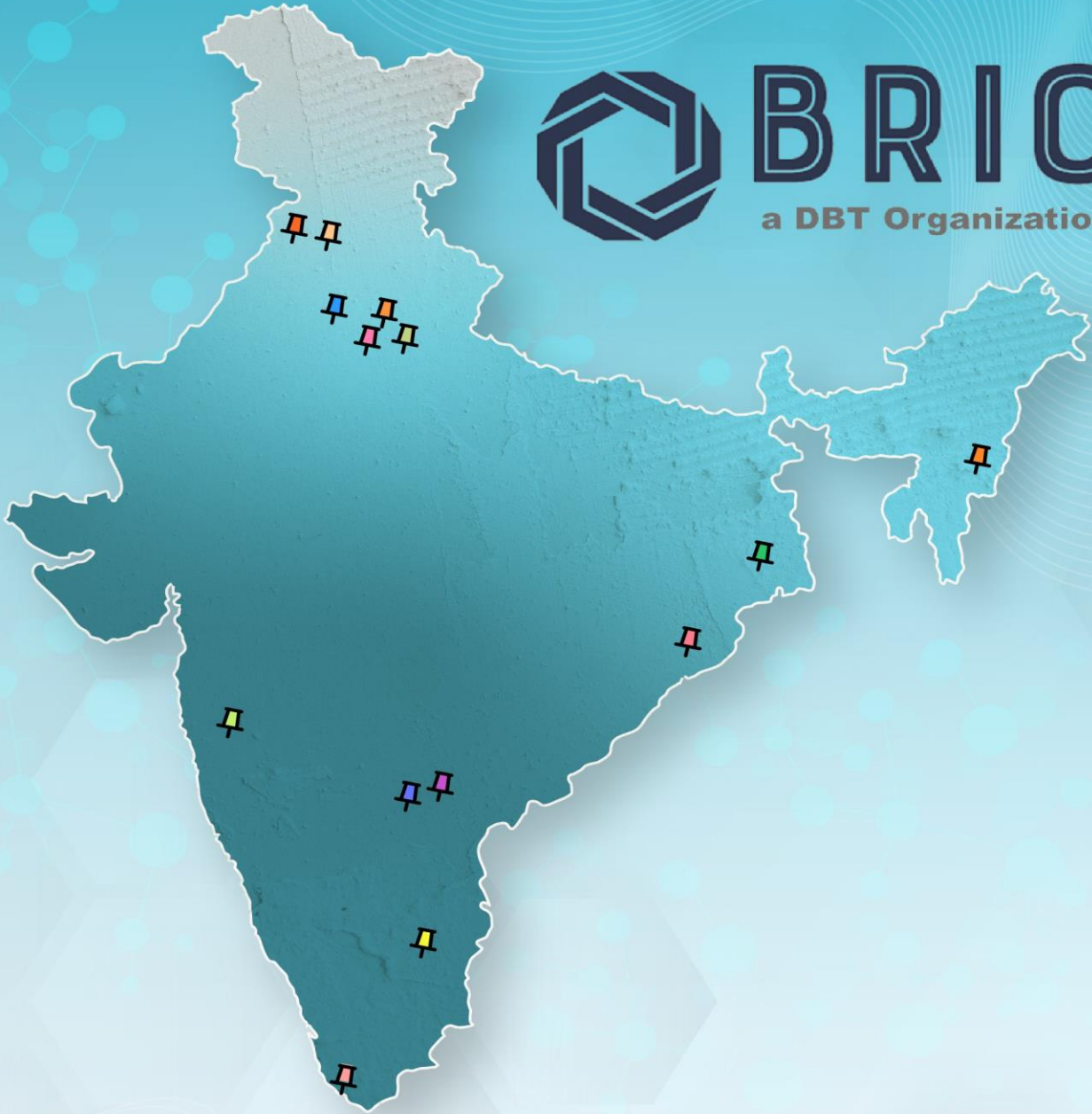
- Dr. Debasisa Mohanty, Director, NII, New Delhi
- Dr. D.K. Vashist, Senior Manager, Head of Administration, NII, New Delhi





# BRIC

a DBT Organization



**NCCS**  
National Centre  
for Cell Science



**thsti** ट्रान्सलेटोरल स्वास्थ्य विज्ञान  
एवं प्रौद्योगिकी संस्थान  
TRANSLATIONAL HEALTH SCIENCE  
AND TECHNOLOGY INSTITUTE



**NIAB**  
National Institute of Animal Biotechnology



**RGCB**  
DISCOVERIES FOR A  
BETTER TOMORROW



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