



DEPARTMENT OF BIOTECHNOLOGY  
Ministry of Science and Technology  
Government of India



# BRIC

a **DBT** Organization

BIOTECHNOLOGY RESEARCH AND INNOVATION COUNCIL



**ANNUAL REPORT 2025**

## ACKNOWLEDGEMENTS

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**Dr. Ashwani Pareek**, Executive Director BRIC-NABI

**Dr. Kalaivani Ganesan**, DBT & Nodal Officer BRIC

**Dr. Richi V Mahajan**, DBT & Additional Charge BRIC

**Dr. Sumita Kumari**, DBT & Additional Charge BRIC

**Dr. Susmita Chaudhuri**, BRIC-THSTI

**Dr. Ketan Thorat**, BRIC-INSTEM

**Dr. Dhananjay Huilgol**, BRIC-NBRC

**Dr. Divya Mishra**, BRIC-NIPGR

**Dr. D K Vashist**, BRIC-NII

**Mr. Vaibhav Anil Argade** BRIC-NCCS Dr.

**Dr. Shingar Sharma**, Consultant, BRIC

**Ms. Manisha Sharma**, Consultant, BRIC

**Mr. Debasish Debnath**, Designer



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# CONTENTS

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	Page No
<b>Foreword by DG BRIC</b>	
<b>iBRIC Highlights</b>	
1. Introduction .....	10
2. Governance & Strategic Initiatives .....	15
3. Research at iBRIC .....	24
4. Research Infrastructure at iBRIC .....	53
5. Technologies Developed at iBRIC .....	62
6. iBRIC Collaborations .....	93
7. iBRIC Events & Outreach Activities .....	103
8. Startup Catalysts: Fostering Innovation & Growth .....	120
9. iBRIC awards and Recognitions .....	124
10. RTI & Grievances .....	130
11. Annexures .....	131
i) List of Publications	
ii) List of Patents	



## RAJESH SUDHIR GOKHALE

Director General, Biotechnology Research  
and Innovation Council (BRIC)

It is with immense pride that I present the Annual Report of the Biotechnology Research and Innovation Council (BRIC) for 2025. This report encapsulates a transformative year in India's biotechnology journey—a period marked by unprecedented consolidation, institutional synergy, and tangible progress toward positioning India as a global biotechnology powerhouse.

When BRIC was established by subsuming 14 Autonomous Institutions under a unified governance framework in November 2023, we embarked on an ambitious mission: to break institutional silos, foster collaborative excellence, and accelerate the translation of groundbreaking research into innovative solutions that address India's most pressing challenges in health, agriculture, and sustainability.

### **Institutional Integration and Strategic Framework**

Establishment of BRIC in November 2023 crystallized a new paradigm for biotechnology governance in India. By bringing together premier research institutions under a coherent strategic

umbrella, we have created an integrated ecosystem where multidisciplinary collaboration transcends geographical boundaries. The integration of our 13 institutions has yielded tangible outcomes through enhanced agility, resource allocation coordination, infrastructure sharing via initiatives like SAHAJ, and synchronized pursuit of national research priorities.

The approval of the BioE3 (Biotechnology for Economy, Environment, and Employment) Policy by the Union Cabinet on August 24, 2024, provided a defining strategic framework for our work. This policy articulates an ambitious vision: to transform India into a \$300-billion bioeconomy by 2030, and toward a \$1-trillion sustainable bioeconomy by 2047.

Our bioeconomy has witnessed remarkable expansion—from \$10 billion in 2014 to \$165.7 billion in 2024, representing a growth trajectory of approximately 17.9% annually and contributing 4.25% to India's national GDP. Through BioE3, we are now prioritizing high-performance biomanufacturing, precision health, climate-resilient agriculture, and sustainable biotechnology solutions—domains where India possesses natural competitive advantages.

## Key Achievements and Innovation Frontiers

Under BRIC's stewardship, India is advancing on multiple biotechnology frontiers:

**Gene Therapy and Regenerative Medicine:** Our institutions have supported India's first gene therapy clinical trial for Hemophilia A, featuring novel hematopoietic stem cell-based lentiviral vector technology. This breakthrough exemplifies our commitment to precision biotherapeutics and personalized medicine.

**Sustainable Biomaterials:** Novel research demonstrates how biotechnology serves immediate clinical needs while contributing to sustainability goals, including electrospun nanofibrous sheets for protecting stored blood cells.

**Microbial Genomics:** The "One Day One Genome" initiative showcases India's untapped microbial potential within its incredible biodiversity, bridging research with bioeconomy creation, particularly in North-Eastern regions.

## Entrepreneurship Ecosystem and Global Standing

The biotech startup ecosystem has flourished—from 50 startups in 2014 to over 10,075 active startups in 2024-25, supported by 95+ bio-incubators established by DBT-BIRAC partnerships. In 2024 alone, India registered over 1,500 new biotech startups. Through the D.E.S.I.G.N. for BioE3 Challenge competition launched during our second foundation day, we are creating clear pathways for research discoveries to transition into viable commercial products and services.

Internationally, India's biotechnology sector has ascended the Global Innovation Index rankings—from 80<sup>th</sup> in 2014 to 39<sup>th</sup> in 2024—demonstrating the quality and relevance of our research ecosystem. BRIC remains committed to solving India's unique challenges in healthcare access, food security, and climate resilience while contributing to global solutions.

## Strategic Priorities for 2025-26

As we navigate 2025-26, BRIC's priorities are clear:

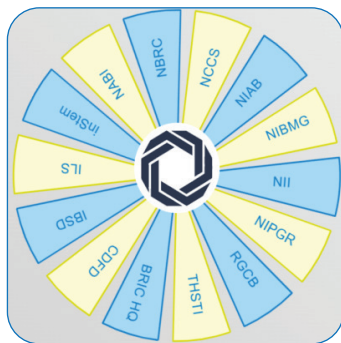
1. **Accelerate Translational Research:** Bridge the gap between laboratory discovery and clinical/commercial application.
2. **Strengthen Biomanufacturing:** Establish regional biomanufacturing hubs for biopharmaceuticals and biotech products.
3. **Deepen Institutional Integration:** Leverage the collective strengths of our 13 institutions through collaborative initiatives and shared facilities.
4. **Cultivate Talent Pipeline:** Launch specialized capacity-building programs in synthetic biology, cell and gene therapies, and AI in biology.
5. **Foster Global Collaboration:** Engage with leading biotechnology centers worldwide to elevate Indian science.
6. **Maximize Biodiversity Value:** Harness India's rich biodiversity through initiatives like "One Day One Genome" to unlock sustainable solutions.

The journey of BRIC reflects India's evolution from a technology consumer to a global biotechnology innovator and leader. Our institutions, scientists, and entrepreneurs are writing a new chapter in India's scientific narrative—one where biotechnology becomes an engine of inclusive economic growth, environmental stewardship, and public health transformation.

Together, we are charting India's course toward global leadership in sustainable innovation. As the world keenly observes India's biotech march, we carry the responsibility to translate scientific excellence into societal benefits and global leadership. Let us rise to this historic opportunity to transform biotechnology into a national growth engine.

Rajesh S Gokhale

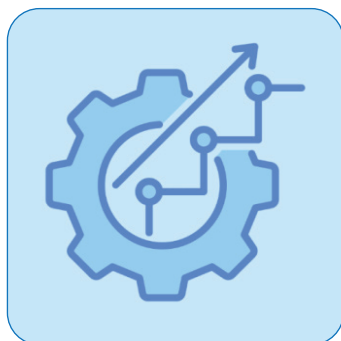
# iBRIC HIGHLIGHTS



**13 Institutes of BRIC (iBRIC)**



**Research Facilities: 400+**



**Technologies**  
 • Developed: 47  
 • Transferred: 9

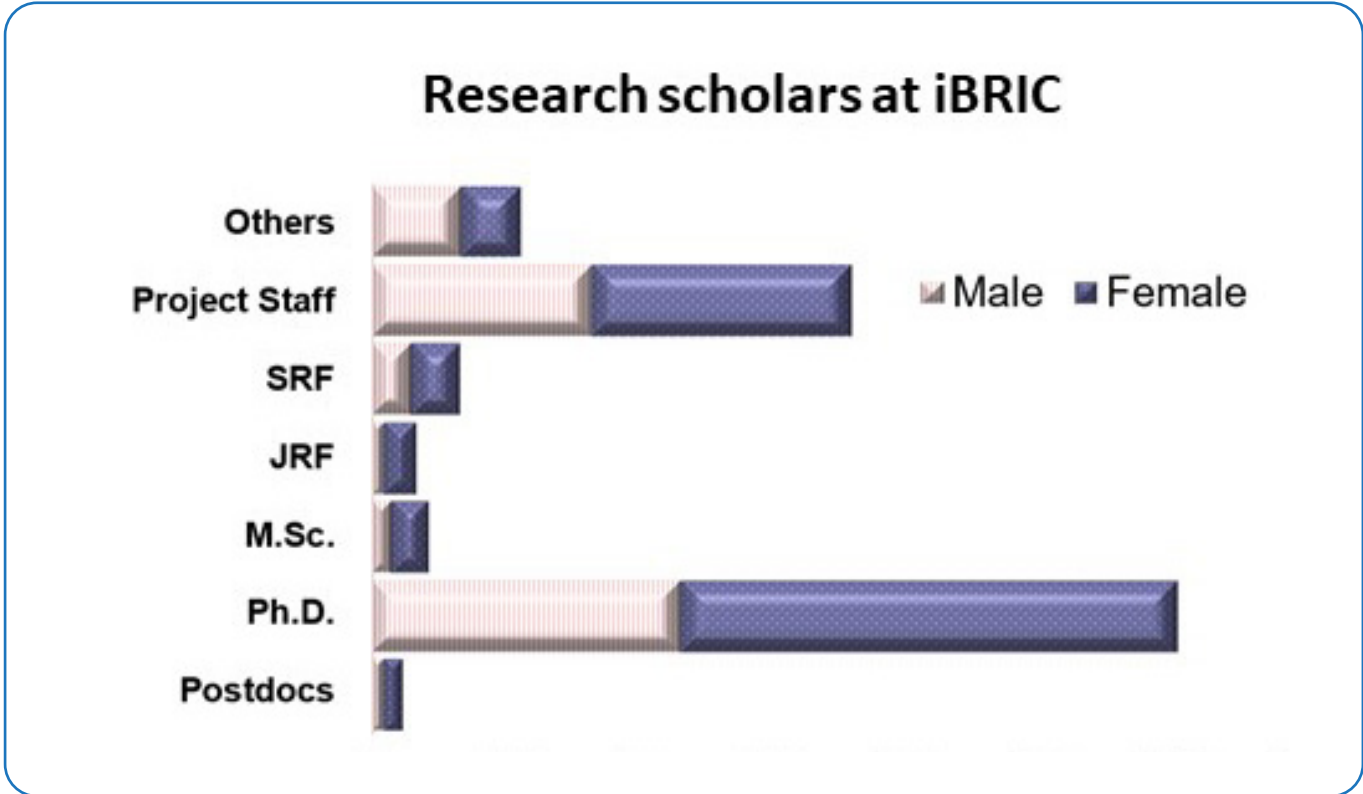
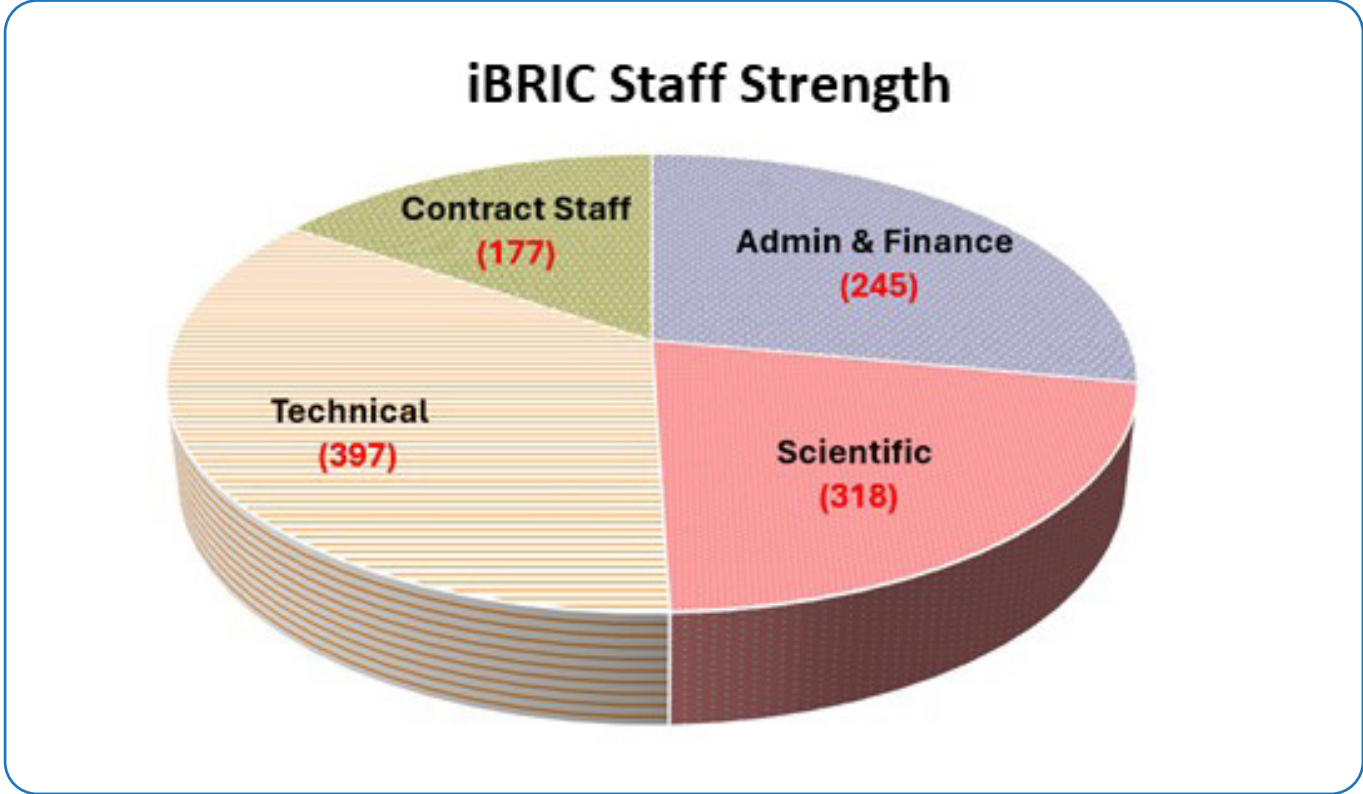


**One Day One Genome Sequence Published: 247**



**Partnerships**  
 • International: 63  
 • National: 260  
 • Industry: 39

## PEOPLE AT BRIC





# RESEARCH HIGHLIGHTS



Government of India  
Ministry of Science & Technology  
Department of Biotechnology

## Nature index



**iBRIC+ India**  
🕒 Time frame: 1 April 2024 - 31 March 2025

**Profile**

The positions in the table below reflect the iBRIC+'s positions overall, domestically, within their sectors, and in various subject areas based on their share. Each position links to the corresponding table where iBRIC+ is listed

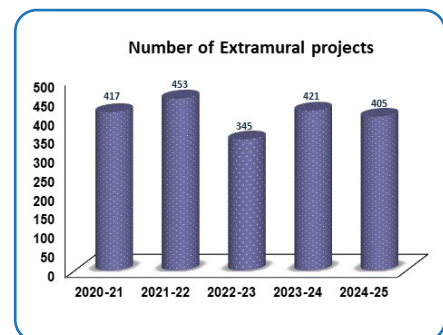
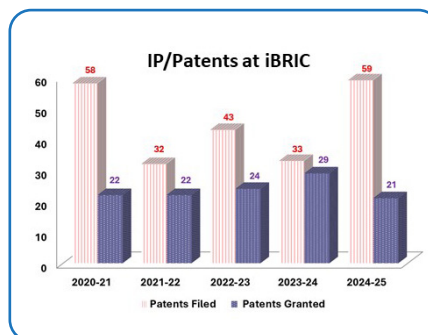
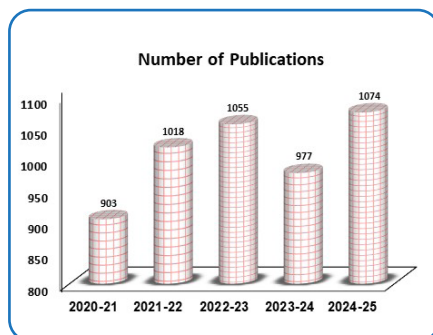
**Position by Research Output Share**

	Global	India
Overall	665	21
Government	66	4

	Global	India
Biological sciences	227	1
Chemistry	1067	49
Earth & environmental sciences	1893	54
Health sciences	648	3
Physical sciences	1649	72

**iBRIC+ (includes iBRIC + RCB +ICGEB) ranked #1 in the Biological Sciences Category and #3 in the Health Sciences Category in India, according to the Nature Index 2025**



## 01

# INTRODUCTION

The Biotechnology Research and Innovation Council (BRIC) is a pioneering scientific research institutional framework established under the auspices of the Department of Biotechnology (DBT), Government of India. As a strategic research body, BRIC serves as the cornerstone for advancing India's biotechnology ecosystem through evidence-based policymaking, collaborative research networks, and transformative innovation initiatives. The Council embodies India's commitment to positioning itself at the forefront of global biotechnology leadership, fostering an environment where scientific excellence converges with societal impact.

In an era characterized by rapid technological advancement and unprecedented biological discoveries, BRIC functions as both catalyst and facilitator, bridging the gap between fundamental research and translational applications. The Council's mandate extends beyond traditional research administration to encompass strategic foresight, capacity building, and the cultivation of public-private partnerships that accelerate the journey from laboratory bench to marketplace. Through its integrated approach, BRIC addresses the multifaceted challenges facing modern biotechnology whilst capitalising on India's unique advantages in scientific talent, biodiversity, and demographic dynamics.

BRIC's strategic mandate encompasses a comprehensive vision for biotechnology development that addresses both immediate research needs and long-term technological sovereignty. The Council operates at the intersection of science policy, research coordination, and innovation management, ensuring that India's biotechnology initiatives remain aligned with national priorities whilst maintaining global competitiveness.

The BRIC represents India's commitment to advancing biotechnology research and innovation across diverse scientific domains. Through its network of premier institutes, BRIC is driving transformative research in genomics, agriculture, neuroscience, immunology, biomanufacturing and translational medicine, positioning India as a global leader in the bio-economy. These institutes collectively embody India's vision for scientific excellence, combining cutting-edge research with practical applications that address pressing societal challenges. From DNA fingerprinting to brain research, from agricultural biotechnology to vaccine development, BRIC institutes are at the forefront of discoveries that improve human health, enhance food security, and promote sustainable development. Each institute brings unique expertise while collaborating to create a robust ecosystem of innovation, education, and technology transfer that serves both national priorities and global health needs.



## BRIC INSTITUTES



1. BRIC-Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad
2. BRIC-Institute for Stem Cell Biology and Regenerative Medicine (inStem), Bengaluru
3. BRIC-Institute of Bioresources and Sustainable Development (IBSD), Imphal
4. BRIC-Institute of Life Sciences (ILS), Bhubaneswar
5. BRIC-National Agri-Food and Biomanufacturing Institute (NABI), Mohali
6. BRIC-National Brain Research Centre (NBRC), Manesar
7. BRIC-National Centre for Cell Science (NCCS), Pune
8. BRIC-National Institute of Animal Biotechnology (NIAB), Hyderabad
9. BRIC-National Institute of Biomedical Genomics (NIBMG), Kalyani
10. BRIC-National Institute of Immunology (NII), New Delhi
11. BRIC-National Institute of Plant Genome Research (NIPGR), New Delhi
12. BRIC-Rajiv Gandhi Centre for Biotechnology (RGCB), Thiruvananthapuram
13. BRIC-Translational Health Science and Technology Institute (THSTI), Faridabad

## 1.0 Research Priorities

### Genomics, Diagnostics, and Health Biotechnology

- BRIC-Centre for DNA Fingerprinting and Diagnostics is a leading research institute for genomic research, diagnostics, and forensic science in India. BRIC-CDFD integrates medicine, science, engineering, and technology into translational knowledge for public health.
- BRIC-National Institute of Biomedical Genomics is built on the premise that genetics and genomics constitute vital foundation for exploring complexities of human health and disease through cutting-edge research.
- BRIC-Translational Health Science and Technology Institute bridges scientific discoveries and real-world healthcare solutions through specialized centers addressing maternal health, infectious diseases, drug discovery, and clinical development. THSTI is further expanding its infrastructure with the construction of a medical research center (MRC) and translational research facility (TRF).
- BRIC-Rajiv Gandhi Centre for Biotechnology specializes in health biotechnology, plant genetic engineering, and advanced disease diagnostics, driving breakthroughs in cancer treatment, cardiovascular disease, and genetic disorder management.

These institutes form the backbone of India's genomics revolution, providing essential services and conducting groundbreaking research that advances our understanding of human health at the molecular level. CDFD's mission to make biomedical innovations accessible for public health, combined with THSTI's role as a clinical research laboratory serving researchers across India, creates a comprehensive infrastructure supporting biotechnology research nationwide. NIBMG's sophisticated approach using machine learning and AI tools like RAISING demonstrates how computational biology is transforming genomic research. Our work on cancer genomics, identifying gene signatures for

patient stratification, and contributions to the GenomeIndia project exemplify the translation of fundamental genomic knowledge into clinically actionable insights that can improve patient outcomes and advance personalized medicine approaches.

### Neuroscience, Immunology, Cellular Biology, and Fundamental Research

- BRIC-National Brain Research Centre stands as India's premier institution for neuroscience research, uniquely positioned to investigate brain function from molecular mechanisms to complex cognitive processes. The institute's multidisciplinary approach encompasses cellular and molecular neuroscience, systems neuroscience, cognitive neuroscience, computational modeling, and translational research. This comprehensive scope enables researchers to study various model systems—from molecules to intact organisms to human subjects—creating a complete picture of brain function in health and disease.
- BRIC-National Institute of Immunology advances India's position at the forefront of biomedical research, focusing on immunology and allied sciences to improve human health. BRIC-NII researchers investigate the immune system's complexities, unravel disease mechanisms, and transform discoveries into diagnostics, therapeutics, and vaccines addressing urgent global health challenges. Research spans infectious diseases including tuberculosis and malaria, extends to complex conditions such as cancer, metabolic disorders, and neurodegeneration—all unified by a mission to decode biology for human health benefit. By integrating immunology with molecular, structural, chemical, and computational biology, BRIC-NII fosters an interdisciplinary environment yielding key insights into immune regulation,

host-pathogen interactions, and molecular disease foundations.

- BRIC-National Centre for Cell Science represents India's cornerstone institution for cell biology research, conducting cutting-edge multidisciplinary investigations that advance understanding of cellular and molecular mechanisms underlying diseases and disorders. Aligned with global sustainable development goals, BRIC-NCCS focuses research efforts on addressing national health priorities, working to identify potential therapeutic targets that improve diagnostic methods and treatment regimens for enhanced disease management. Beyond research excellence, BRIC-NCCS serves critical national infrastructure roles. The institute operates as India's primary national cell repository for animal cell cultures, providing authenticated cell lines to researchers throughout academia and industry. This repository underpins a significant proportion of cell biology research conducted across India, making BRIC-NCCS an indispensable resource for the scientific community.
- BRIC-Institute for Stem Cell Science and Regenerative Medicine achieved remarkable milestones in 2025: launching Kisan Kavach (India's first anti-pesticide suit), initiating India's first in-human gene therapy trial for Hemophilia A, and conducting muscle stem cell experiments in microgravity at the International Space Station. The new Centre for Research, Application and Training in Embryology (CReATE), inStem Plus stem cell biobank, and BSL-3 facility expand capabilities in developmental biology, disease research, and pathogen handling.

#### **Agricultural Innovation and Biomanufacturing**

- BRIC National Institute of Plant Genome Research conducts fundamental and applied research across plant molecular biology, spanning genome analysis, developmental biology, adaptation to biotic and abiotic stresses, computational biology, and nutritional

genomics. A defining achievement showcases NIPGR's real-world impact is the development of two drought-tolerant chickpea varieties, ADVIKA and SAATVIK, through genome-guided breeding under DBT's Chickpea Mission Program. These varieties were selected for the Prime Minister's Self-Reliance in Pulse Mission launched in October 2025, indenting over 30% of total breeder seed highlighting their significant adoption by farmers.

- BRIC-National Agri-Food and Biomanufacturing Institute in Mohali advances sustainable bioprocessing to strengthen economy, environment, and employment in agriculture. The Institute represents a landmark achievement in India's agricultural biotechnology landscape, being the first institute under the BioE3 policy to advance biomanufacturing with cutting-edge technology. BRIC-NABI is a pioneering biomanufacturing research institute providing technological solutions that translate laboratory innovations into scalable production. Institute also create platforms for agri-food-nutrition and biomanufacturing entrepreneurship, fostering startup ecosystems and commercialization.

BRIC-NIPGR and BRIC-NABI also serves as the nodal institute for agricultural biotechnology, advancing genetic improvements for enhanced yield, resilience, and nutritional value with the research focused on human health, well-being, and addressing malnutrition challenges.

#### **Specialized Excellence: Animal & Marine Biotechnology and Biodiversity**

- BRIC-Institute of Life Sciences (ILS) advances multidisciplinary life sciences research focusing on human health, agricultural sustainability, and environmental well-being. ILS has established strong research programs in precision therapeutics, climate-resilient agriculture, functional food development, and marine research—all aligned with BRIC's thematic priorities. Significant contributions include malaria parasite biology, anti-malarial

drug development, *Candida* pathogenesis vaccine research, Chikungunya and Hepatitis viral biology, immune-stimulating compounds for sepsis, biomaterial development for tissue regeneration, and phytonanomedicine-based anticancer therapies. ILS's bioprospecting initiatives explore plants, microbes, and marine resources through collaborations including the DBT-sponsored Himalayan Bio-mission, Marine Biotechnology projects, and Ministry of Ayush partnerships. The ongoing marine and deep-ocean program, supported by the Ministry of Earth Sciences, aims to discover novel bioactive agents for medicine, pharmaceuticals, nutraceuticals, and cosmetics applications using advanced biotechnological tools.

- BRIC- Institute of Bioresources and Sustainable Development serves as the sole BRIC institute in India's North Eastern Region, headquartered in Imphal, Manipur, with centers in Sikkim, Meghalaya, and Mizoram. BRIC-IBSD champions development of bio-economy from the region's rich bioresources, engaging in multidisciplinary/interdisciplinary, and multi-stakeholder research. The institute promotes scientific validation, value addition, and innovation leveraging NER's unique biodiversity to catalyze industrial growth, generate livelihoods, and build sustainable bio-economy foundations.
- BRIC-National Institute of Animal Biotechnology drives development of a globally competitive livestock industry through cutting-edge research in animal health, infectious diseases, biosensor development, reproductive biotechnology, regenerative medicine, and livestock genomics. Notable achievements include vaccines for zoonotic diseases, rapid mastitis detection devices, recombinant bovine FSH for

reproduction, 3D bioprinted tissue scaffolds, and a pangenome for Indian desi cattle supporting breed improvement and reducing greenhouse gas emissions.

## 2.0 Capacity Building and Human Resource Development

India's biotechnology ambitions ultimately rest upon the skills, creativity, and dedication of its scientific workforce. BRIC recognizes that building and sustaining world-class research capacity requires systematic investment in human resource development across the entire research career continuum—from undergraduate education through postdoctoral training to mid-career skill enhancement and leadership development. i3c-BRIC-RCB-Phd Programme is the epitome of BRIC's commitment towards developing future leaders in Science.

Beyond individual researcher development, BRIC invests in strengthening institutional capabilities through faculty recruitment drives, infrastructure enhancement grants, and the establishment of specialised training centres focused on advanced techniques and emerging technologies. The Council promotes best practices in research training, encouraging adoption of structured curricula, regular evaluation mechanisms, and exposure to complementary skills including scientific communication, research ethics, and project management. Recognising the global nature of contemporary science, BRIC facilitates international collaborations and researcher mobility programmes that expose Indian scientists to diverse research cultures and cutting-edge methodologies whilst attracting global talent to India's growing biotechnology ecosystem.

## 02 GOVERNANCE & STRATEGIC INITIATIVES

The Biotechnology Research and Innovation Council (BRIC) is a unique research body, founded to foster synergy in research and bio-innovation initiatives across the Autonomous Institutes of the Department of Biotechnology (iBRIC) to drive impactful scientific advancement. Besides synergizing scientific pursuits, core focus of BRIC's establishment has been the harmonisation of administrative and financial processes across iBRIC for streamlined governance, ensuring efficient operations, accountability, and transparency. This approach enables BRIC to optimise resource utilisation and institutional governance while ensuring each institute retains its unique mandate and functional autonomy.

Over the last 2 years since its inception, a host of Strategic and Governance reforms have been brought in to realize the vision of creating BRIC by leveraging collective institutional strengths, fostering synergy, nurturing future-ready human resources, enhancing collaboration and entrepreneurial momentum.

BRIC has fostered integrated multidisciplinary inter-institutional network programmes with the participation of over 100+ Scientists. i3C-BRIC-RCB Ph.D., an immersive PhD program, has been initiated for interdisciplinary research training and building future bioscience leaders. BRIC has been recognised as the No.1 organization in terms of the research output in the Biological Sciences category by Nature Index Ranking 2025. In addition, BRIC has harmonized administrative and financial processes including notification of BRIC Bye-Laws, Scientific Entrepreneurship Policy, Resource sharing token system, Director's recruitment rules (RRs), among other achievements.

### 2.1 Status and trajectories of Strategic Initiatives at BRIC

#### 2.1.1 Interdisciplinary Network Programs

Multi-institutional collaborative interdisciplinary

research programmes play a pivotal role in propelling the advancement of biological sciences and enhancing the overall impact of research. Further, addressing multifaceted contemporary scientific challenges necessitates a combination of diverse expertise, resources, and coordinated team efforts. Recognising the importance of harnessing collective intelligence, BRIC has undertaken significant measures to consolidate and synergise research efforts through the implementation of large-scale, networked, interdisciplinary research programmes. To facilitate this, a series of brainstorming sessions, 'Chintan Shivirs' were organised on 26-27 May 2023, 7-8 September 2023, 16 March 2024, and 28 September 2024. These sessions focused on the transformative potential of bio-innovations in shaping lives and economies, underscoring the necessity for robust ecosystems that can seed, nurture, and harvest research outcomes for the benefit of society. The deliberations underscored the importance of fostering collective efforts among scientists and institutions, along with facilitating the sharing of resources and skills for improving scientific outcomes and achieving technological empowerment at a national level.

To support the initiation of multi-institutional, interdisciplinary collaborative research, an online portal was developed for the submission of iBRIC+ scientist profiles as well as novel research ideas. The information collected formed a comprehensive database designed to enhance the visibility of ongoing research across the participating institutes and identify potential collaborators with shared scientific interests.

Through this portal, over 175 research ideas were submitted, and profiles of more than 320 scientists within the network of BRIC institutes (iBRIC), as well as ICGEB and RCB (collectively called as iBRIC+) were created. An independent Review Committee, consisting of distinguished domain experts from across

the country, was established to evaluate the research ideas. The shortlisted research ideas were suggested to explore synergy and complementarity with each other to develop team-based collaborative networked programs. In the first phase, 41 programme proposals were submitted, of which 24 were selected based on the committee's recommendations after thorough review for their scientific merit, interdisciplinary nature, and collaborative aspects. In the subsequent phase, 27 collaborative proposals were submitted from across iBRIC+ of which 23 were shortlisted following rigorous evaluation.

These 47 interdisciplinary programs are set to catalyse significant scientific progress and serve as foundational pillars for the i3c BRIC RCB PhD program, which aims to transform scientific research education in higher education institutions.

### 2.1.2 i3c BRIC-RCB PhD Program

The i3c BRIC-RCB PhD Program is a flagship initiative of BRIC, launched in 2024, featuring a transformative approach to doctoral training in biosciences. The program adopts a cohesive, team-

based, and inter-institutional research framework to nurture a new generation of bioscience leaders who are well-equipped to address both present and emerging scientific challenges. The curriculum is structured to promote teamwork across institutions, enabling scholars to benefit from a diversity of expertise and perspectives. A 'leadership talk' series is organised for the scholars to provide them with an opportunity to listen to thought leaders and learn from the experiences and wisdom of the distinguished luminaries of the scientific realm. This series is conceptualized to give students a glimpse of how rigorous scientific research can transform human lives and inspire them to push new frontiers of research and scientific inquiry.

Central to the programme is the immersive 'on-field' experiential learning component, placing scholars in rural or underserved environments, providing direct exposure to real-world challenges. Through active engagement with grassroots communities and firsthand encounters with societal issues, scholars bridge the gap between laboratory research and practical applications.



**Figure 2.1: Glimpses of Immersion training for i3C BRIC-RCB Ph.D students**

The program is structured to instil in scholars with a strong commitment to addressing pressing societal needs through innovative scientific solutions. This emphasis on societal relevance encourages scholars to apply their research in ways that have tangible and positive impacts on communities, thus fulfilling the core objective of creating leaders committed to meaningful scientific advancement.

The program is in its second year now, with a total of 47 ongoing networked interdisciplinary research programs and a total of 122 students currently enrolled. The first batch of 57 students, after successful completion of the 'immersion training', is currently pursuing doctoral research at their respective iBRIC+. For the immersion training, students were divided among 13 partner agencies to gain grassroots exposure to real-world challenges through direct engagement with primary health care centres, farmers, self-help groups, and rural communities. An immersion committee has been constituted, and deliberations are in progress to select new immersion partners for the 2nd batch, with student feedback being carefully considered throughout the process. Considering the positive feedback of students, funding opportunities are also being created for expanding the immersion experience to the entire PhD cohort of BRIC+. The second cohort of i3c BRIC-RCB scholars consists of 65 students, including two enrolled through Track-II, who are presently engaged in joint coursework at RCB, Faridabad. Following the completion of this phase, they will proceed for immersion training.

### **2.1.3 'iBRIC+ Biotech Spotlight' webinar series**

A webinar series was initiated in December 2024 to celebrate the groundbreaking research, impactful publications and technologies developed at iBRIC+. Another key purpose of the spotlight series is to highlight collective initiatives of BRIC towards building a stronger R&D ecosystem and disseminating the available opportunities to the relevant stakeholders. This common platform for discussion can help identify challenges and make necessary adjustments to ensure our efforts are on the right track and create the greatest possible impact.

Researchers from iBRIC+ are invited to deliver talks that are attended online by faculty and students across iBRIC+, thus facilitating interactions and providing a snapshot of the work being done at various labs. The Biotech Spotlight Series is envisaged to also encourage young early-career researchers and students to seek and benefit from mentorship beyond institutional boundaries. The Spotlight Series talks are announced regularly on the social media handles of DBT and BRIC. The seven webinars in the series so far have included presentations from at least one faculty of each iBRIC+. The talks have ranged across a wide variety of topics, including clinical trials for indigenous CAR T-cell therapy on haemophilia A, to understanding host-pathogen interactions in malaria, R&D on neurological disorders, and bio-based solutions for sustainable agriculture, antifungal vaccines, molecular and cellular basis of neuropsychiatric disorders, therapeutic strategies to impede ovarian ageing and so on. Further webinars covering various domains of scientific expertise are to be held in the same format once every month.

### **2.1.4 Entrepreneur in Residence (EIR) program**

The BRIC-BIRAC Post-Doctoral Entrepreneur-in-Residence (EIR) Program aims to bridge the gap between institutional research and entrepreneurship. Launched on BRIC's 2nd Foundation Day by the Hon'ble Minister, S&T, it mentors post-doctoral fellows in bio-entrepreneurship by connecting them with venture capitalists (VCs). Participants receive an 18-month salary, jointly funded by BIRAC and VCs, and gain hands-on experience in technology development and company formation.

The program solicited 38 technology submissions, with nine shortlisted across healthcare, agriculture, and industrial biotechnology based on readiness, market need, and quality. These were shared with over 15 VCs, leading to about 25 virtual and one in-person meetings for investment discussions. Five technologies have been selected for funding and mentoring in the first phase, with further opportunities being explored for other research outcomes/technologies. This initial phase demonstrates the program's effectiveness in

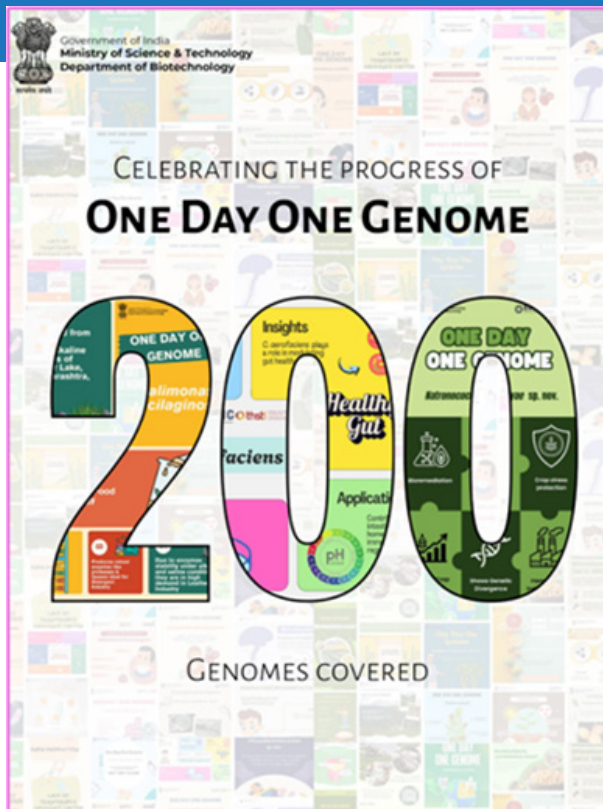
linking research with venture support for bio-entrepreneurship.

**2.1.5 Decoding Life: One Day One Genome Initiative connecting science and society**

This rich microbial wealth of the country holds significant promise for the bioeconomy due to their unique properties, including enzymatic activity, probiotic potential, antimicrobial capabilities, and applications in plant and human health.

Since its inception in November 2024, the ODOG

initiative has been strategically leveraging the capabilities of iBRIC+ for advancing microbial genomics, biotechnology popularization and public outreach. To enthuse students and create buzz around the potential of biotechnology in understanding life on earth, a logo making competition was organized at the National level. The winning design for the One Day One Genome (ODOG) Mission logo contest was created by Mr. Karthik E, from Alagappa University, Tamil Nadu. Besides capturing the spirit of ODOG mission advancing genomics, the logo contest encouraged innovation and imagination for science outreach.



ODOG marked the release of 200 genomes in September 2025, with more sequences being released everyday an annotated microbial genome each weekday and explains its features and possible uses in accessible language for the public. The BRIC-National Institute of Biomedical Genomics (NIBMG) coordinates this activity as the Nodal Institution. A web page on the BRIC-NIBMG website provides easy public access to information on all published and announced genomes.

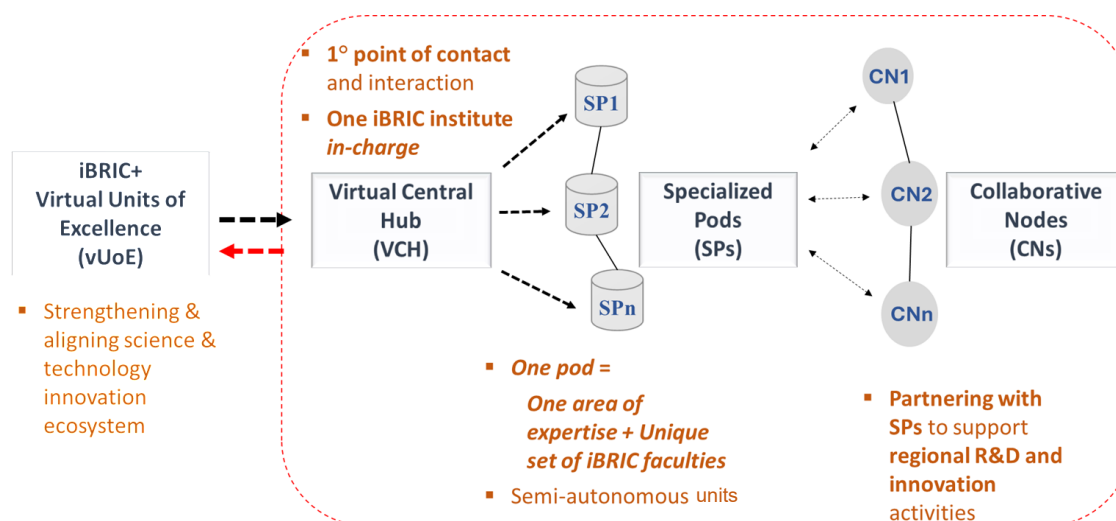
### 2.1.6 iBRIC+ Virtual Units of Excellence (vUoEs)

iBRIC+ Virtual Units of Excellence (vUoEs) aim to build a collaborative biotechnology research network in India, using shared resources to reduce duplication and speed up translating discoveries into applications. vUoEs span several

key thematic domains, including cancer biology, virology, synthetic biology, sustainable agriculture, and biomolecular intelligence, promoting interdisciplinary work and efficient use of expertise.

A Virtual Central Hub (VCH), led by an iBRIC institute, will coordinate research via Specialized Pods (SPs), each focusing on a specific research area with dedicated scientists, and Collaborative Nodes (CNs) that involve external partners. The initiative uses quarterly, target-based funding releases and a central dashboard for monitoring progress.

As of July 2025, a total of 24 expressions of Interest (EoIs) have been received, involving approximately 150 iBRIC+ scientists and 50 collaborative partners. The review, mentoring and evaluation process for the submitted EoIs is being undertaken further.



**Figure 2.2 Schema of iBRIC+ Virtual Units of Excellence (vUoE)**

## 2.2 Administrative and process reforms

### 2.2.1 BRIC Bye Laws

A Working Group was constituted in November 2023 with the specific mandate to draft the Bye-laws for the Biotechnology Research and Innovation Council (BRIC). Following extensive consultations, the final version of the Bye-laws was prepared and formally submitted for consideration by the Hon'ble Minister

of Science and Technology on 7th April 2025. Approval for the Bye-laws was subsequently granted on 11th April 2025. Following this, the Department officially notified the Bye-laws on 24th September 2025, thereby bringing them into effect.

These Bye-laws have been structured to uphold institutional integrity and accountability, while at the same time safeguarding the autonomy of individual BRIC institutes. Rather than centralising authority, the framework empowers Directors of the institutes,

granting them the autonomy to make decisions and set their respective institutional agendas in alignment with broader strategic goals. Furthermore, the governance model emphasizes maintaining a lean secretariat, ensuring that resources are directed towards strategic initiatives and effective coordination, thus supporting BRIC's commitment to efficiency and impactful governance.

### 2.2.2 Recruitment Rules (RRs) for iBRIC Directors

The Recruitment Rules (RR) of iBRIC Directors were drafted and subsequently submitted to the Department of Personnel and Training (DoPT) on 16th May 2025 for review and approval. On 16th June 2025, BRIC received the file from DoPT which included a set of queries and comments seeking clarification on specific aspects of the submitted Recruitment Rules. The matters raised by DoPT were addressed, and the revised documents were forwarded for further consideration. Final approval for the Recruitment Rules was granted by the Hon'ble Minister on 10th July 2025, thus completing the administrative process required for their adoption and streamlining the recruitment process for iBRIC Directors.

### 2.2.3 Harmonisation of Pay Level of Directors in iBRIC

In pursuit of harmonised administration of iBRIC, the Department prepared a Cabinet Note titled "Harmonisation of Pay Level of Directors of Institutions of Biotechnology Research and Innovation Council (iBRIC) at Level - 16". The objective was to ensure parity in pay levels for Directors across all iBRIC institutions. The Cabinet Note was circulated to 20 different Scientific Ministries and Departments for their comments. Feedback received from 14 Ministries and Departments was duly incorporated into the final document. The revised Cabinet Note was submitted to the Cabinet Secretariat on 11th December 2024. The Union Cabinet, in its meeting held on 12th December 2024, approved the DBT's proposal for harmonisation of pay levels of Directors within iBRIC institutions, establishing Pay Level 16 as the standard for future appointments. All proposed changes to Pay Levels apply only to Directors who will join iBRIC henceforth. The pay levels of

incumbent Directors will remain unchanged. This measure ensures human resource parity across iBRIC and marks a significant step towards streamlining administrative processes and fostering unified governance. The harmonisation is expected to result in financial savings of approximately Rs. 23.44 lakhs per annum, contributing to efficient science governance.

### 2.2.4 Policy for Efficient Resource Utilisation in BRIC+ Institutes

BRIC has formulated a comprehensive policy aimed at promoting efficient utilisation of research resources and ensuring seamless access to instruments, high-end equipment platforms, and essential services within iBRIC+. The policy (OM issued on 2nd September 2025) specifically targets the facilitation of resource usage for scientists and faculty members, removing administrative barriers and streamlining the process of accessing these valuable assets. A token system mechanism has been introduced in place of traditional cash payments for availed services or equipment usage charges. This approach aims to enhance operational efficiency and provide a simplified, transparent means of accessing various instruments and facilities. All iBRIC+ institutes will be allotted 40,000 tokens, which could be exchanged for the use of available resources. The utilization of the facility as well as token exchanged will be reported to Finance Committee (FC) & Governing Body (GB) of BRIC. Initially, the cost of each token is Rs.500/- only. The booking of research resources and facilities may be carried out on the Sahaj portal (<https://sahaj.ibric.in/home>). Addition of new equipment/ facility to the portal will be done only in the last week of every month, with a request mail to the Director, BRIC-ILS from the head of the host institute.

### 2.2.5 Scientific Entrepreneurship Guidelines

The Biotechnology Research and Innovation Council (BRIC) has developed a set of comprehensive Operational Guidelines to support the implementation of scientific entrepreneurship and research commercialisation among scientists associated with its network of autonomous institutions (iBRIC Scientists). These guidelines (OM issued on 2nd January 2025) are directly aligned with

the Government of India's policy which encourages the translation of publicly funded research into commercially viable ventures.

A key feature of these guidelines is the provision that enables iBRIC Scientists to hold an equity stake in a scientific enterprise or establish a spin-off company while continuing their professional roles within their respective institutions. Besides specifying the time that can be spent by individual scientists on establishing or working in such enterprises while in employment at iBRIC, these guidelines also outline the approval process and revenue-sharing provisions. The guidelines enable both individual scientists and their institutions to enter commercial ventures. Institutions can contribute intellectual assets, including patents and technical data, as equity. This formalizes collaboration with industry and encourages innovation, researcher mobility, and the translation of public biotechnology investment into real economic and societal gains.

## 2.3 Key Meetings and Events

### 2.3.1 Second Annual General Meeting (AGM) of BRIC Society

The 2nd Annual General Meeting of the Biotechnology Research and Innovation Council (BRIC) Society, New

Delhi, was held on 12th December 2024. The meeting was chaired by Dr. Jitendra Singh, Hon'ble Union Minister of State (Independent Charge) for Science and Technology and President of the BRIC Society.

The Union Minister launched several pivotal publications that showcase the progress and vision of the Biotechnology Research and Innovation Council. These included the First Annual Report of BRIC for the year 2024, the i3c BRIC-RCB-PhD Programme Brochure, and BRIC News. Each publication highlighted the achievements, ongoing initiatives, and future outlook of the council, serving as a comprehensive resource for stakeholders and the wider scientific community.

The society approved the Audited Annual Accounts and the Auditor's Report for the financial year 2023-24, a testament to BRIC's unwavering commitment to transparency and accountability in its financial operations, further strengthening institutional trust and governance.

Recognising the remarkable scientific achievements made by iBRIC during its inaugural year, the Hon'ble Minister emphasised the importance of widespread dissemination of these accomplishments. He urged that these successes be publicised extensively, to enhance visibility and recognition of India's growing scientific capabilities on both national and international platforms.



Figure: 2.3 Second Annual General Meeting (AGM) of BRIC Society

### 2.3.2 Finance Committee Meeting and General Body Meeting of BRIC

The Third Finance Committee (FC) Meeting of the Biotechnology Research and Innovation Council (BRIC) was conducted on 22nd July 2025, followed by the Fourth FC Meeting on 30th October 2025. Both meetings were chaired by Mrs. Yatinder Prasad, Additional Secretary & Financial Adviser (AS & FA), Department of Biotechnology (DBT). Key agenda items included a comprehensive review of the financial requirements across all BRIC institutes, an evaluation of the pace of expenditure, and the prioritisation of immediate institutional needs to ensure efficient financial management. During these sessions, the Committee closely examined and accepted the audited financial statements for the fiscal year 2024-25 for all BRIC institutes.

The third Governing Body (GB) meeting of BRIC was convened on 30th July 2025, with the fourth meeting following on 19th November 2025. These meetings provided a platform for deliberating key ongoing and

new strategic initiatives critical to BRIC’s mission. Key administrative and process reforms were discussed to strengthen governance structures and maintain a robust ecosystem responsive to the evolving needs of the biotechnology sector.

### 2.3.3 CHINTAN SHIVIRS

The Department of Biotechnology held iBRIC+ ‘Chintan Shivir 5.0’, and ‘Chintan Shivir 6.0’ at BRIC-NII on 19th July 2025 and 10th November 2025, respectively, under the Chairmanship of Dr. Rajesh S Gokhale, Secretary, DBT and Director General, BRIC. The proceedings were focused on engaging discussions aimed at forging thematic alliances among the iBRIC+ network and working as a unified entity to maximize the potential of BRIC’s extensive infrastructure grid, ensuring seamless access to faculty and students across the iBRIC+ community. The aim was to eliminate any administrative hurdles that could impede this collaborative effort, ensuring a smooth and efficient exchange of knowledge and innovation. The new strategic initiatives of



Figure 2.4: Celebration of 2<sup>nd</sup> Foundation day of BRIC; #MyBRICMOMENT

BRIC including Virtual Units of Excellence (vUoEs), BRIC BioE3 Innovation Parks, iBRIC+ Integrated Dashboard as a centralised management platform for coordinating activities and tracking various metrics across all 15 institutes were deliberated. During the Chintan Shivir 6.0, review and monitoring of interdisciplinary research programs fostered by BRIC was also initiated, wherein the collaborative programs on HPV under the healthcare vertical and Direct Seeded Rice (DSR) program under the Climate Resilient Agriculture vertical were evaluated for their progress and any potential bottlenecks.

### 2.3.4 2nd Foundation Day of BRIC

The Second BRIC Foundation Day was successfully celebrated on November 10, 2025, at BRIC-NII, New Delhi. The event was highlighted by the esteemed presence of Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) for the Ministry of Science & Technology, making the occasion truly memorable. The celebration featured an impressive

lineup of speakers, including Guests of Honour Prof. Santishree Dhulipudi Pandit (Vice-Chancellor, Jawaharlal Nehru University) and Dr. P.M. Murali (President, Council of Presidents, ABLE, and Founder & Chairman, Jananom Pvt. Ltd.).

The event began with the inauguration of the NHP-ABSL-3 Facility at BRIC-NII and the launch of the BRIC-BIRAC Entrepreneur-In-Residence Program by the Minister. Winners of the D.E.S.I.G.N for BioE3 challenge from iBRIC+ were recognized for innovative projects in climate-resilient crops, advanced drug delivery, new therapeutics, sustainable waste upcycling, environmental solutions, and nanotechnology for targeted therapy. These proposals reflect the iBRIC+ community's commitment to developing bio-innovations and sustainable solutions for addressing societal challenges. A sports festival on November 9, 2025, encouraged camaraderie among DBT and iBRIC+ members through events like badminton, cricket, and chess.



## INTRODUCTION

The Biotechnology Research and Innovation Council (BRIC), under the Department of Biotechnology (DBT), continues to play a pivotal role in advancing India's leadership in biotechnology, biomanufacturing, and translational science. This section of the Annual Report highlights the collective achievements of BRIC's autonomous institutes, each contributing uniquely to the nation's scientific and socio-economic priorities through cutting-edge research, technology development, and human resource advancement. Over the past year, the BRIC institutes have strengthened their core scientific programs while embracing emerging opportunities across agri-food biotechnology, bioprocessing, genome engineering, infectious disease biology, environmental biotechnology, and precision biomanufacturing. With an emphasis on innovation-driven R&D, interdisciplinary collaboration, and mission-oriented research, the institutes have delivered impactful solutions spanning sustainable agriculture, nutritional security, affordable

healthcare, biomaterials, synthetic biology, and circular bioeconomy pathways. A continued focus on infrastructure expansion, talent development, and industry partnerships has enabled the institutes to accelerate translation of research into products, technologies, and policy inputs that support national goals-including Atmanirbhar Bharat, the National Biotechnology Strategy, the ANRF priorities, and the vision of Viksit Bharat 2047.

This report reflects the commitment of BRIC-DBT institutes to serve as engines of scientific excellence and societal impact, while nurturing the next generation of innovators who will shape India's biofuture. This year's highlights are presented under four transformative pillars that capture our collective scientific momentum-from advancing a circular bioeconomy and resilient agriculture to deepening biomedical insights and harnessing computational intelligence

## I. Synergizing Bioenergy and Biodiversity for a Sustainable Bio-Based Circular Economy

India is one of the most biodiverse countries with approximately 1,60,000 species of flora and fauna forming a rich biological resource base for bioenergy and bioeconomy activities. Sustainable use of natural resources supports food security, traditional medicine and economic development. Therefore, understanding biodiversity is crucial for India to figure out the climate change and environmental degradation which ultimately ensures the sustainability and bioeconomic growth for future generations. In this direction, BRIC institutions are actively

engaged in advancing these goals, with some key initiatives highlighted below:

- (a) The effect of fermented foods on healthy human gut microbiota structure and function has been largely uncharacterised. A research team of BRIC-IBSD studied the impact of long-term consumption of fermented foods on the gut microbiota composition of a genetically and culturally homogenous endogamous agrarian population of the Meitei community in Manipur, India. The indigenous

traditional knowledge of preferring different fermented foods during summer and winter in India drives them to study the impact of fermented foods on seasonal gut microbiota changes. The study selected two of the most commonly consumed fermented foods with live bacteria: a fermented milk product, Dahi (acidic fermentation by lactic acid bacteria), preferred more frequently during summer with a traditional belief in cooling effect, and a fermented soybean product, Hawaijar (alkaline fermentation by *Bacillus*) preferred more regularly during winter. They assessed the gut microbiota and faecal metabolite composition of healthy individuals who

differed in the intake of Dahi and Hawaijar by seasonal sampling during the hot and humid summer, autumn, and dry winter. The results showed that there are two main types of gut bacteria communities: Prevotella-driven and Bifidobacterium/Ruminococcus-driven. These bacterial communities shift with the seasons, especially in people who consumed fermented foods like Dahi and Hawaijar. During the summer, those who consumed dahi had a high abundance of Prevotella-driven communities. This knowledge can guide us to understand the dietary strategies to manage a healthy, balanced and resilient gut microbiota for good health.

## Fermented foods affect the seasonal stability of gut bacteria in an Indian rural population.

Jeyaram, et al. 2025. Nature Communications, 16(1), p.771

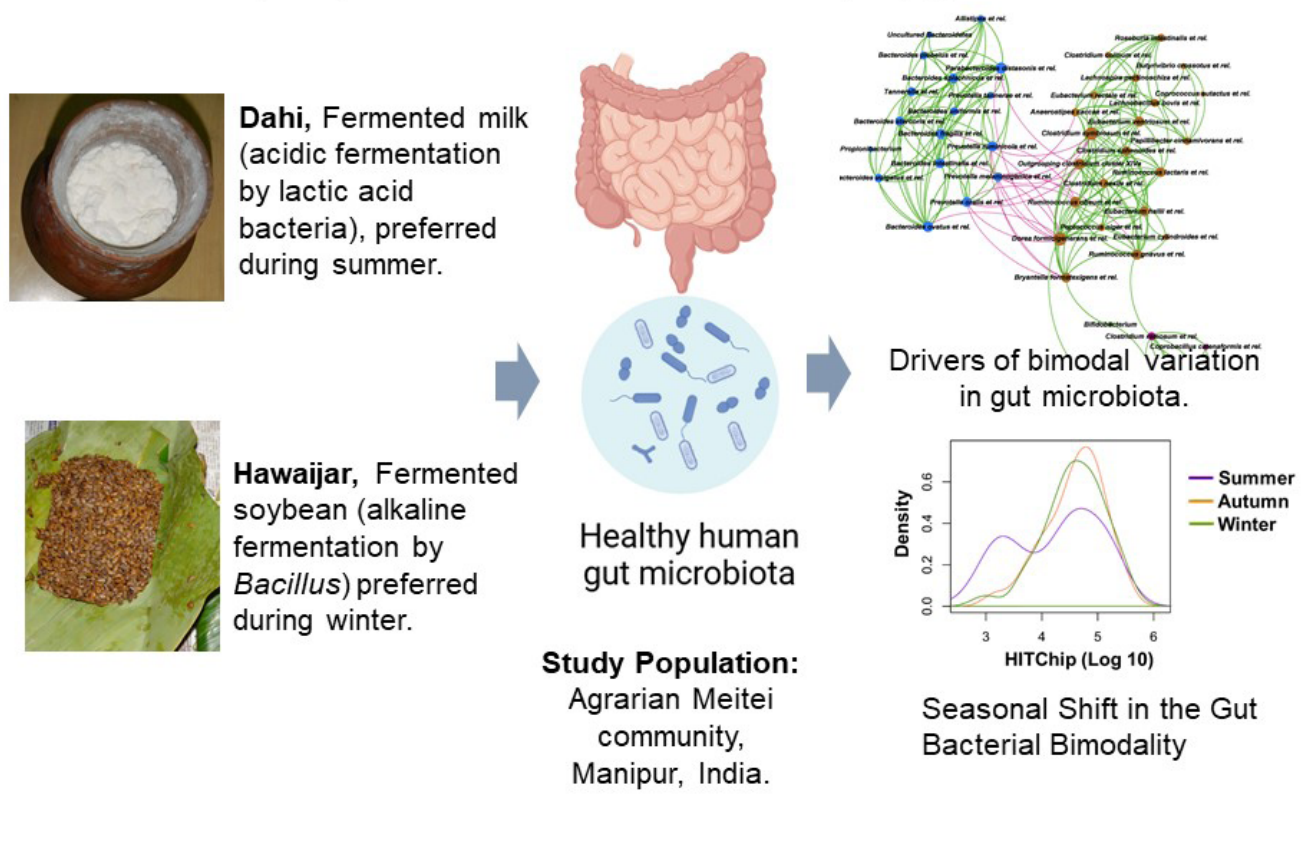
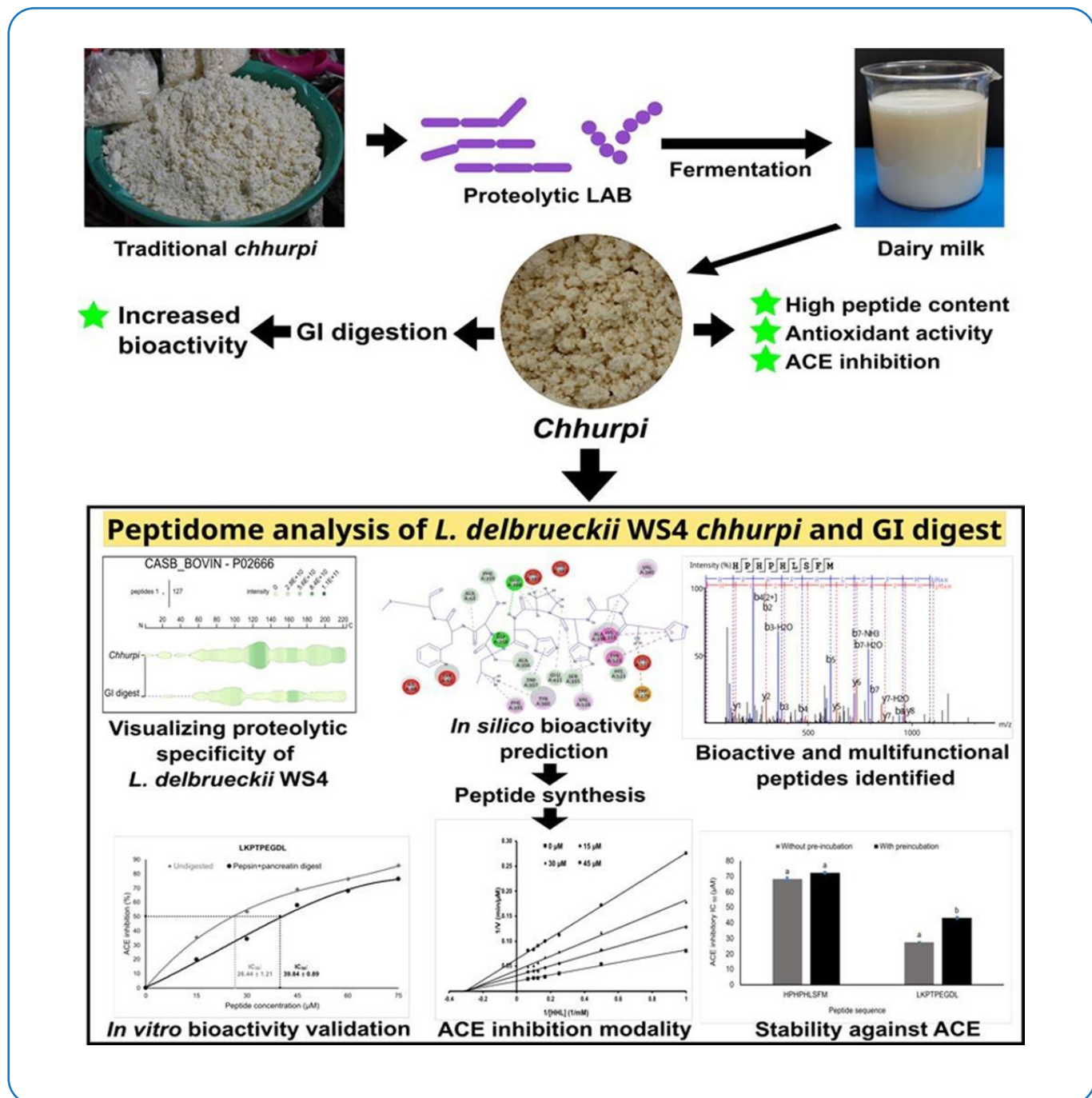


Figure 3.1: Fermented foods affect the seasonal stability of gut bacteria.

(b) Scientists at BRIC-NABI have also looked into the microbial (*Lactobacillus*) diversity in the fermented food (chhurpi cheese). The peptidome analysis of fermented chhurpi cheese identified a few novel and multifunctional peptides which have certain health benefits. The qualitative and quantitative analysis showed that these novel

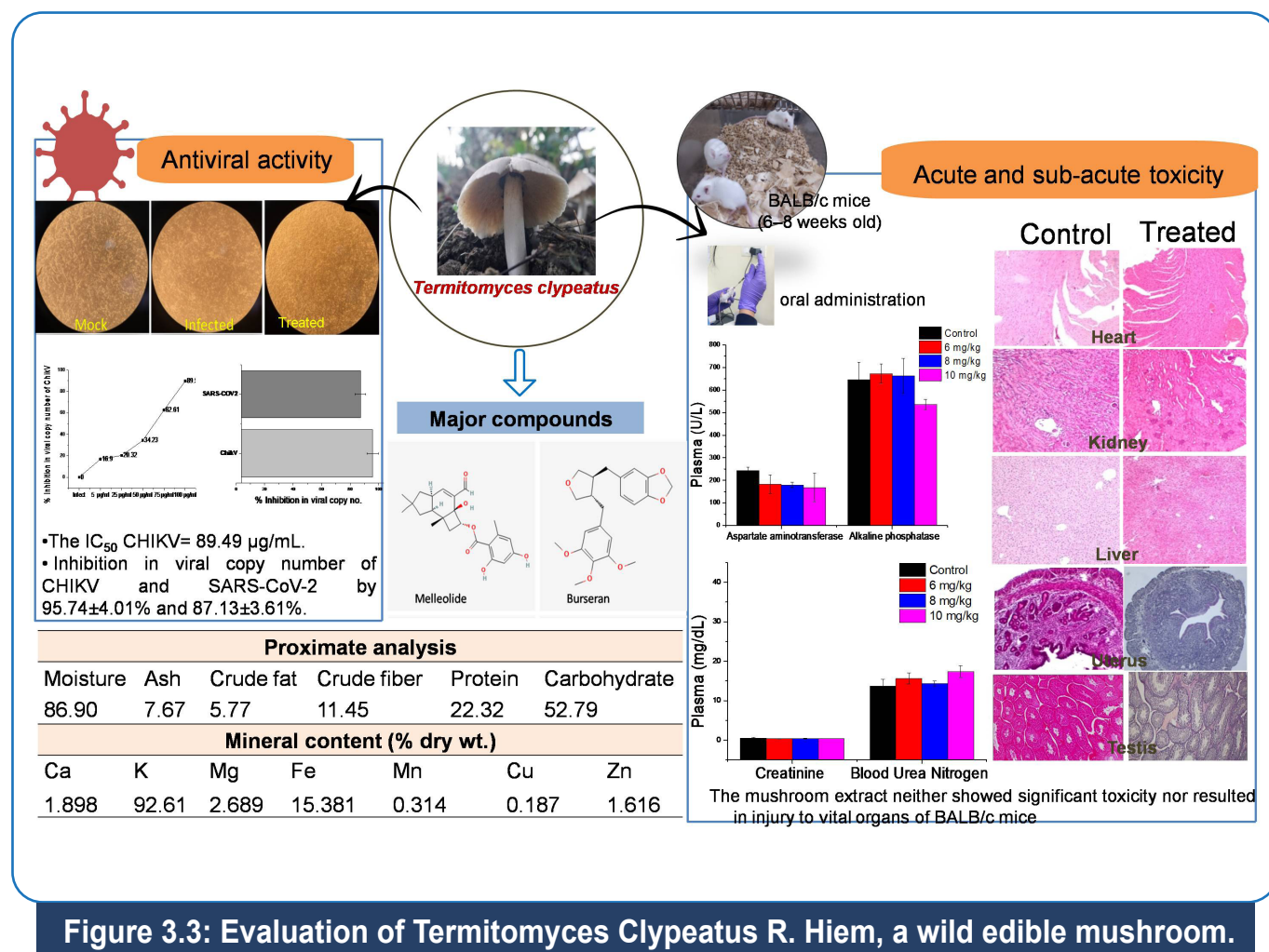
peptides help in lowering blood pressure, reducing tissue inflammation and damage and preventing hypertension as well as protecting cells from oxidative damage. These findings indicate that the traditional chhurpi food is a multifunctional fermented food with high nutritional value and rich microbial diversity.



**Figure 3.2. Chhurpi as a valuable source of naturally occurring functional peptides with potential nutraceutical and therapeutic applications.**

(C) The wild edible mushroom, *Termitomyces* has been employed in traditional medicine by various indigenous communities throughout Asia and Africa. In India, the Santal tribe used it to treat pox while the Mokochung people used it for abdominal discomfort, cough and whooping cough. However, to date, the antiviral activity of *Termitomyces* has not been evaluated. Thus, the nutritional value, chemical composition and antiviral potential of *Termitomyces* were investigated. Scientists at BRIC-IBSD investigated the nutritional content of wild mushrooms which revealed the high protein content, crude fiber, carbohydrate and minerals. The bioactive metabolites

including Sphinganine (membrane lipid stability), Burseran (anti-inflammatory and antimicrobial) and Melleolide (antifungal and antimicrobial) were also detected in the mushroom extract. These mushroom extracts also showed antiviral activity by significantly reducing the copy number of CHIKV and SARS-CoV-2 viruses. An oral administration of this mushroom extract on the mice did not show any toxicity. These findings offer the scientific rationale for the possible safe use of *Termitomyces clypeatus* as a functional food in managing RNA viruses, CHIKV and SARS-CoV-2.

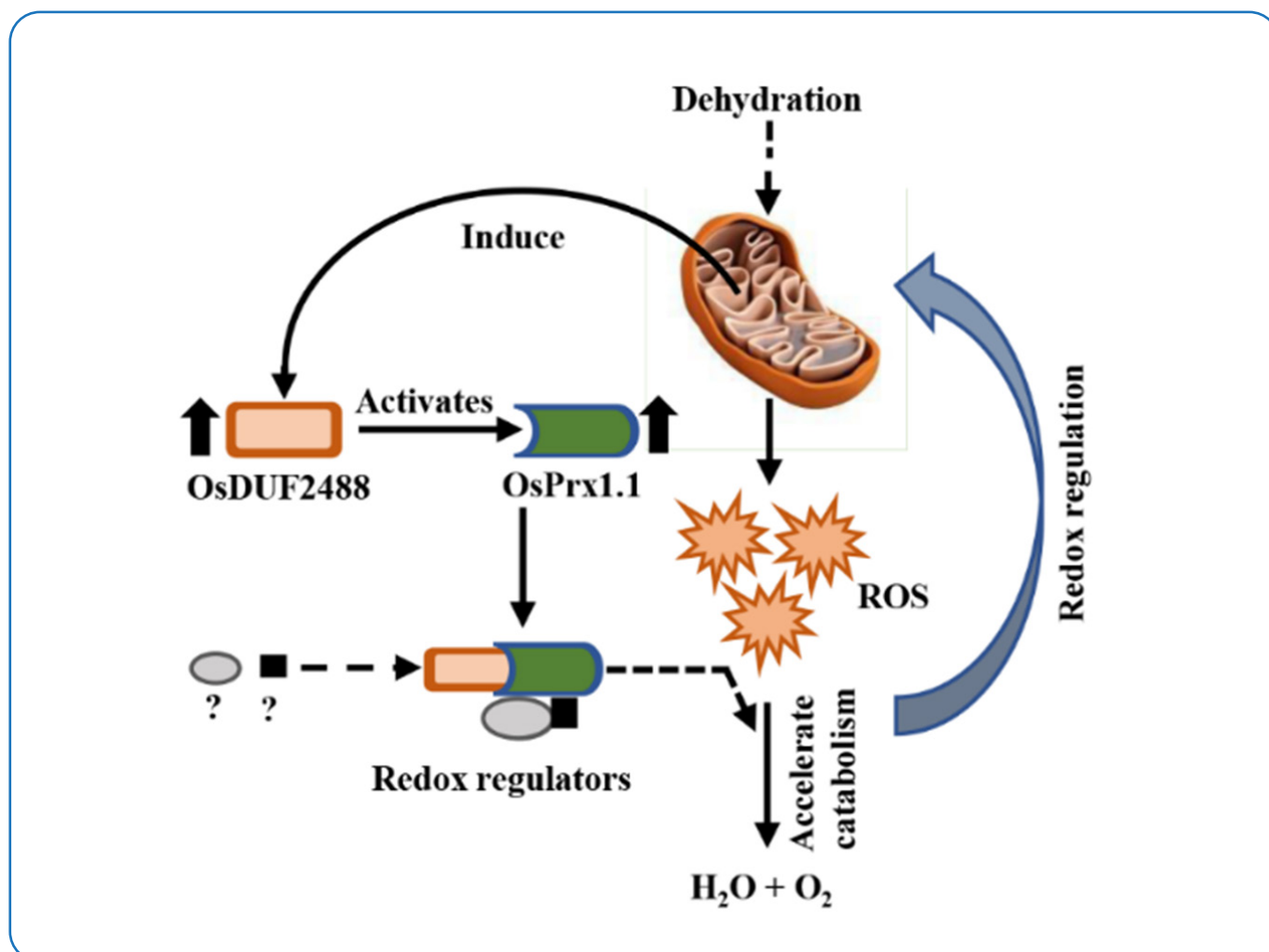


## II Smart Green Growth: Building a Resilient Agricultural Future

In today's rapidly evolving global landscape—marked by geopolitical uncertainties and shifting economic priorities—national self-reliance has emerged as an imperative. Sustainable agriculture forms a vital pillar of this vision, offering pathways to resilience, productivity, and long-term prosperity. Our institutes continue to play a pivotal role in advancing cutting-edge research across diverse areas of agricultural science, driving innovations that strengthen food systems, empower farmers, and catalyse industrial growth. The contributions showcased in this section highlight key breakthroughs that are helping steer the nation toward a more sustainable, climate-resilient, and technology-enabled agricultural future. These innovations represent meaningful

steps in our collective journey toward a robust and self-reliant agri-bioeconomy.

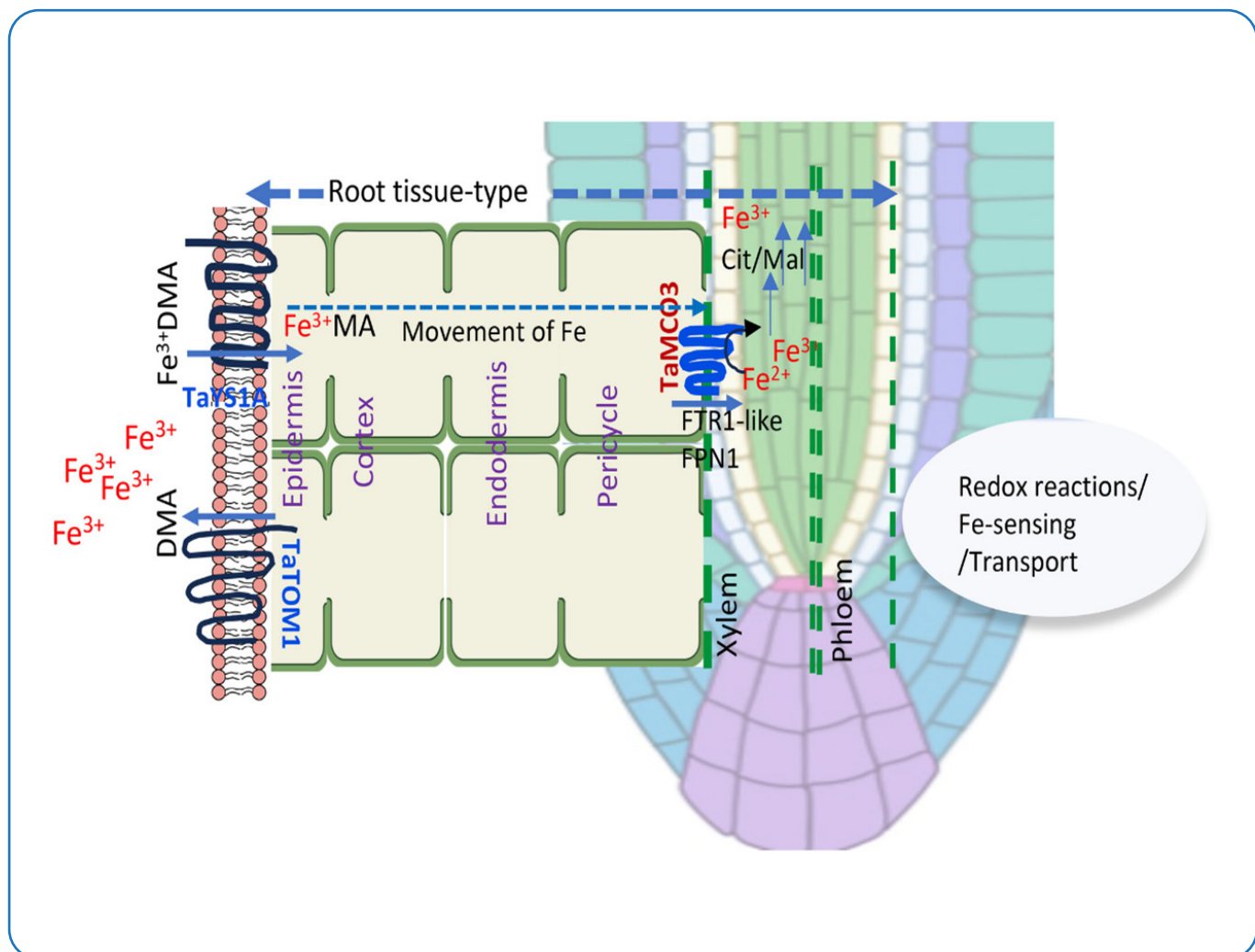
(a) In India, drought stress can reduce rice yield by up to 90% during the reproductive phase, mainly by disrupting assimilate translocation from leaves to grains. Researchers at BRIC-NIPGR identified a dehydration-responsive protein, OsDUF2488, from a drought-tolerant rice cultivar. Rice plants with higher OsDUF2488 expression showed enhanced tolerance to dehydration, while those with lower expression were more sensitive to drought stress. OsDUF2488 can be used as a positive marker for rice plants during dehydration.



**Figure 3.4: Predicted redox homeostasis involving OsDUF2488.**

(b) Research conducted by BRIC-NABI showed the molecular mechanism governing the iron uptake in roots. Several Indian states, including Gujarat, Rajasthan, Maharashtra, Karnataka and Uttar Pradesh, suffer from the iron deficiency due to the alkaline nature of soil and less moisture content which convert iron into less available ferric forms. Iron deficiency in crops results in the interveinal chlorosis and stunted growth, leading to improper growth

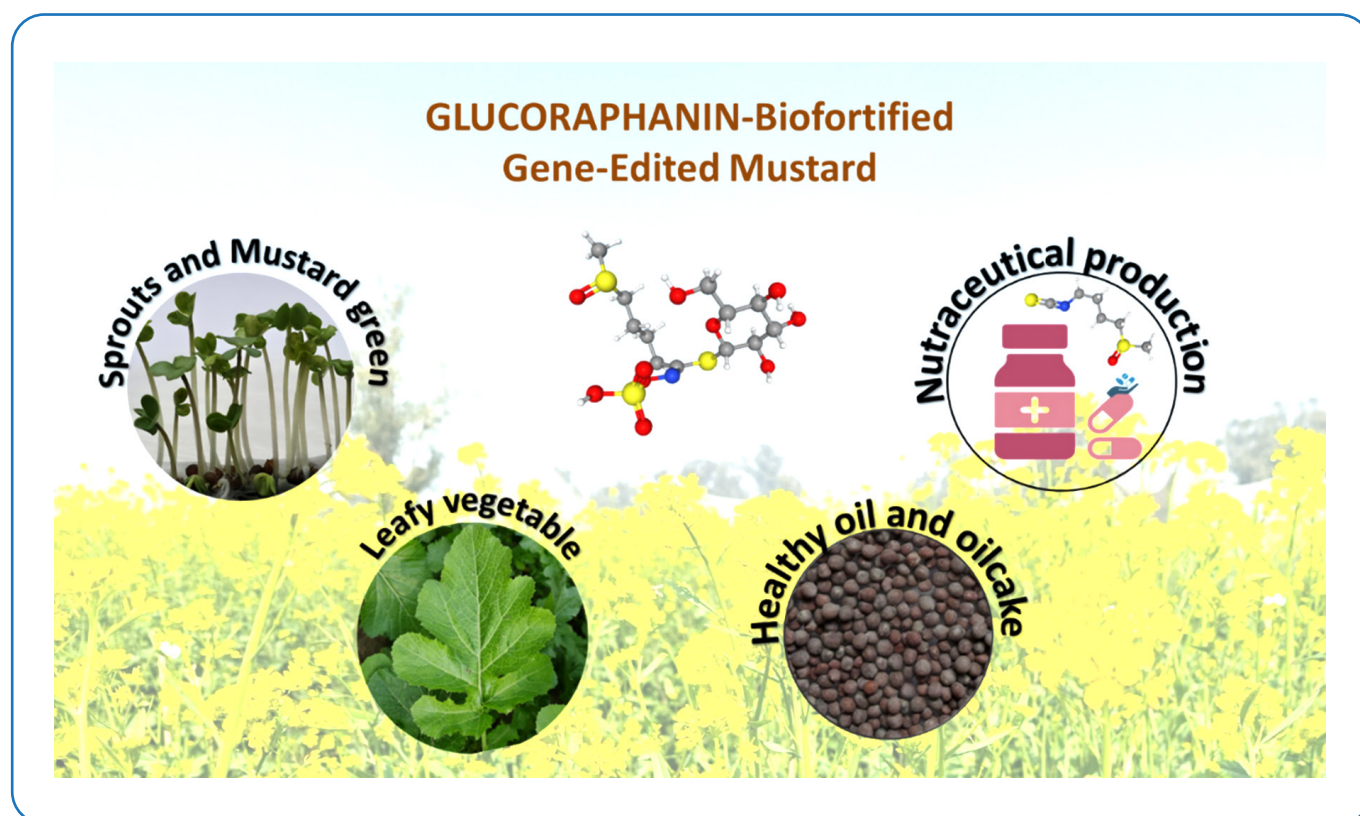
and ultimately reduced yield. Additionally, the diminished quality of seeds also makes it less beneficial for human health. To address this, the scientists have identified a multicopper oxidase MCO3 in condition. When wheat MCO3 is overproduced in crop species and model plants, they behave better in iron-deficient conditions suggesting that MCO3 plays a pivotal role in iron mobilization for survival in the nutrient-poor environment.



**Figure 3.5: The role of TaMCO3, a wheat multicopper oxidase, in mediating iron uptake and mobilization.**

c) Availability of biofortified foods and superfoods are very critical to an Indian population, given economic, geographic and cultural dietary limitations that make nutrient-rich food access difficult. In this direction, BRIC-NIPGR researchers have developed Indian mustard with high content of glucoraphanin and low levels of harmful glucosinolates. Glucoraphanin acts as

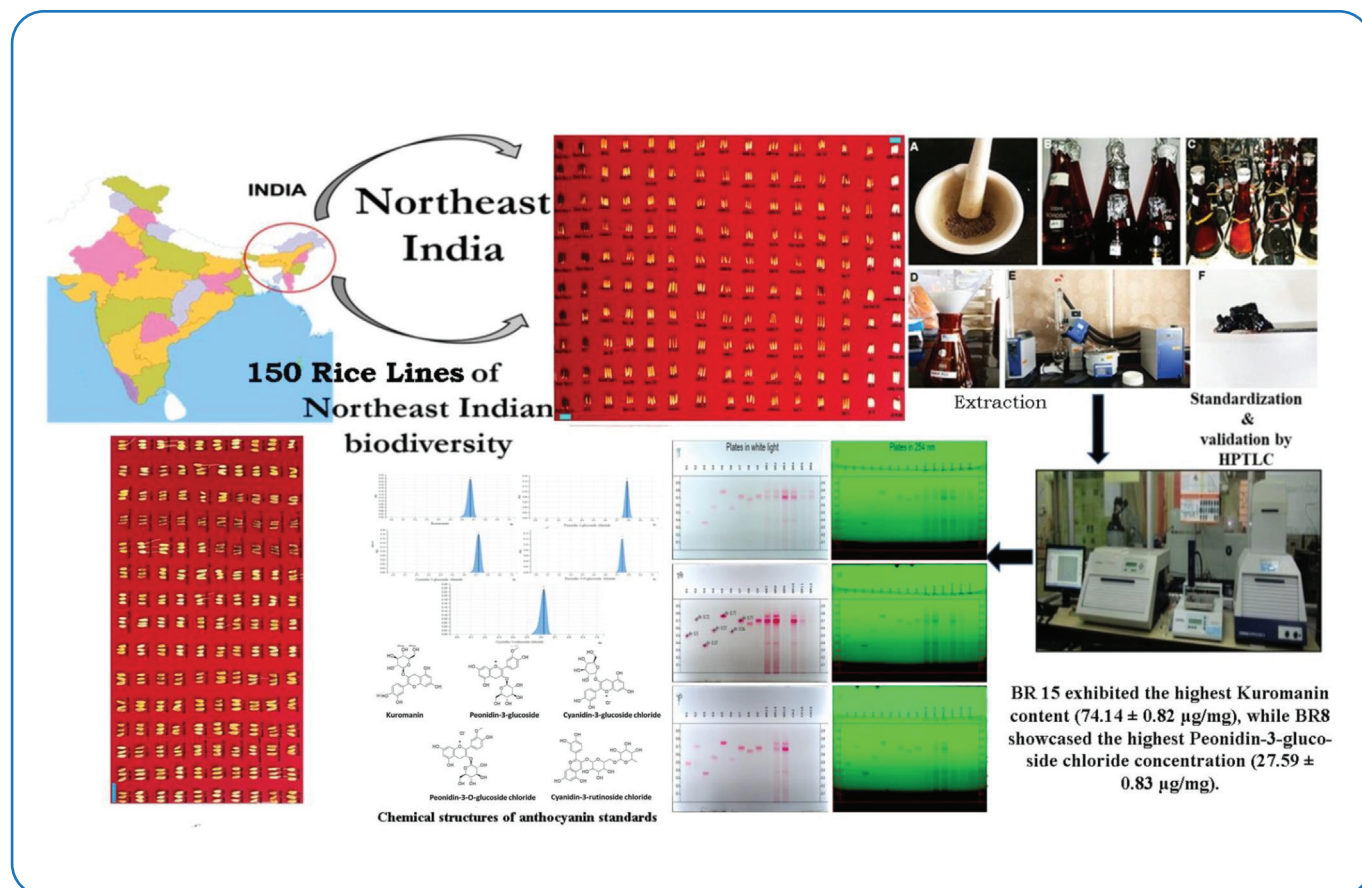
anticancer, antioxidant and anti-inflammatory and helps detoxify the human body during illness. Various parts of the mustard with high glucoraphanin such as sprouts, microgreens, leaves, oil, and oilcake can be used for human and animal diets. Glucoraphanin-supplement can be used as a medicine to enhance the nutritional aspects of the human diet (Figure 3).



**Figure 3.6: Indian mustard biofortified with cancer-preventive, GLUCORAPHANIN.**

d) The anthocyanins offer great health benefits. Black rice is a rich source of anthocyanins, cultivated and maintained by the North eastern region. Scientists at the BRIC-IBSD have used High-Performance Thin-Layer Chromatography (HPTLC) technique and developed a method for

identification and quantification of different anthocyanins on a silica plate. This method allows them to differentiate among various black rice lines and determine which ones are nutritionally superior in anthocyanin content (Figure 4).



**Figure 3.7: Quantification of anthocyanins in different black rice (*Oryza Sativa L.*) varieties using HPTLC.**

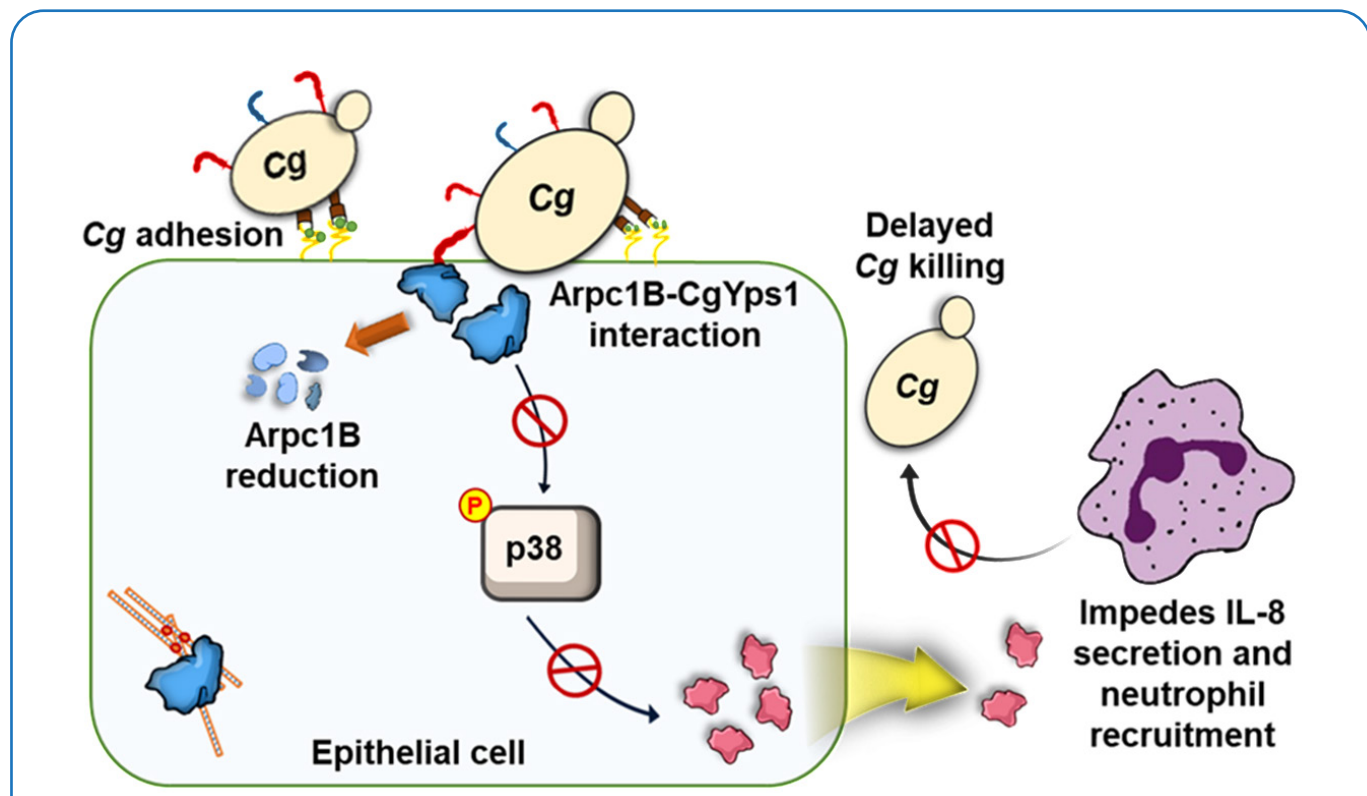
### III. Biomedical Research – Disease Fundamentals

BRIC institutes continue to advance front-line biomedical research that deepens our understanding of human health and disease. Through interdisciplinary science, state-of-the-art platforms, and collaborative innovation, the institutes are generating critical insights into disease mechanisms, host-pathogen interactions, molecular therapeutics, and diagnostic solutions. The highlights presented here reflect impactful discoveries that contribute to national health priorities and global scientific progress.

#### (a) Aspartyl proteases target host actin nucleator complex protein to limit epithelial innate immunity

This research at BRIC-CDFD, on *Candida glabrata* (Cg), a human opportunistic fungal pathogen causing candidiasis, focused on two key virulence factors - adhesins and aspartyl proteases (Yapsins), which are central to its pathogenicity. CgYapsins

play a vital role in defining the pathobiology of the pathogen, which exists solely in the yeast form. Cg can infect multiple organs such as genitourinary tracts as well as oral cavities. To combat these infections, several immune cells such as the macrophages, neutrophils, natural killer cells and epithelial cells are deployed by the host, however the Cg host cell interactions are not very well understood. Especially, how Cg crosses the epithelial barrier during an infection, is a question that is yet to be answered. This study identifies a host epithelial cell protein Arpc1B as a novel interactor of two key CgYapsins - 1 and 7. The authors unravel how CgYapsins suppress the inflammatory signalling by interacting with Arpc1B. This results in Arpc1B downregulation and the release of p38 from the Arpc1B-p38 complex, ultimately leading to cytokine secretion repression. It is also well-studied in the field that Arpc1B mutations are associated with an increased propensity to develop infections. WHO



**Figure 3.8: schematic summarizing key findings of Aspartyl proteases target host actin nucleator complex protein to limit epithelial innate immunity**

has categorized *C. glabrata* fungal pathogen in the high-priority group. This work shows the potential of developing anti-fungal strategies by using new findings about its virulence factors such as the aspartyl proteases, as well as for other infectious diseases.

**(b) MLL/WDR5 complex recruits centriolar satellite protein Cep72 to regulate microtubule nucleation and spindle formation**

A BRIC-CDFD group works on Wiedemann-Steiner Syndrome (WSS), a rare congenital neurodevelopmental disorder, that causes developmental delay, intellectual disability, unusual facial features and formation of a smaller head (microcephaly). With no specific treatment to date, approximately 1 in every 40,000 people worldwide are believed to have been documented with this condition. It is known that WSS is caused by the inadequacy of the mixed-lineage leukemia (MLL/KMT2A) protein, a protein also associated with acute leukemia in infants and adults. However, not much is known about the exact role that MLL plays in this syndrome. This genetic condition occurs when one of the two copies of the MLL gene is mutated, and the remaining functional copy is insufficient to perform the normal functions of the gene. The exact mechanism of this particular protein complex's functions during cell division, and how the lack of it leads to this genetic disorder, has been identified in this study. The study shows that the MLL complex, with its structural component protein, localizes specifically at the 'centrosome', a site primarily responsible for seeding microtubules for the cell, particularly for cell division. Centrosomes also play key roles in normal transport, repair and the overall development of the body. The BRIC-CDFD scientist discovered that this process of seeding microtubules is hampered in the case when the quantity of MLL protein is low in the cell (for instance, when inactivated by a mutation). The authors showed that the MLL protein complex helps in recruiting another protein Cep72, a protein that is responsible

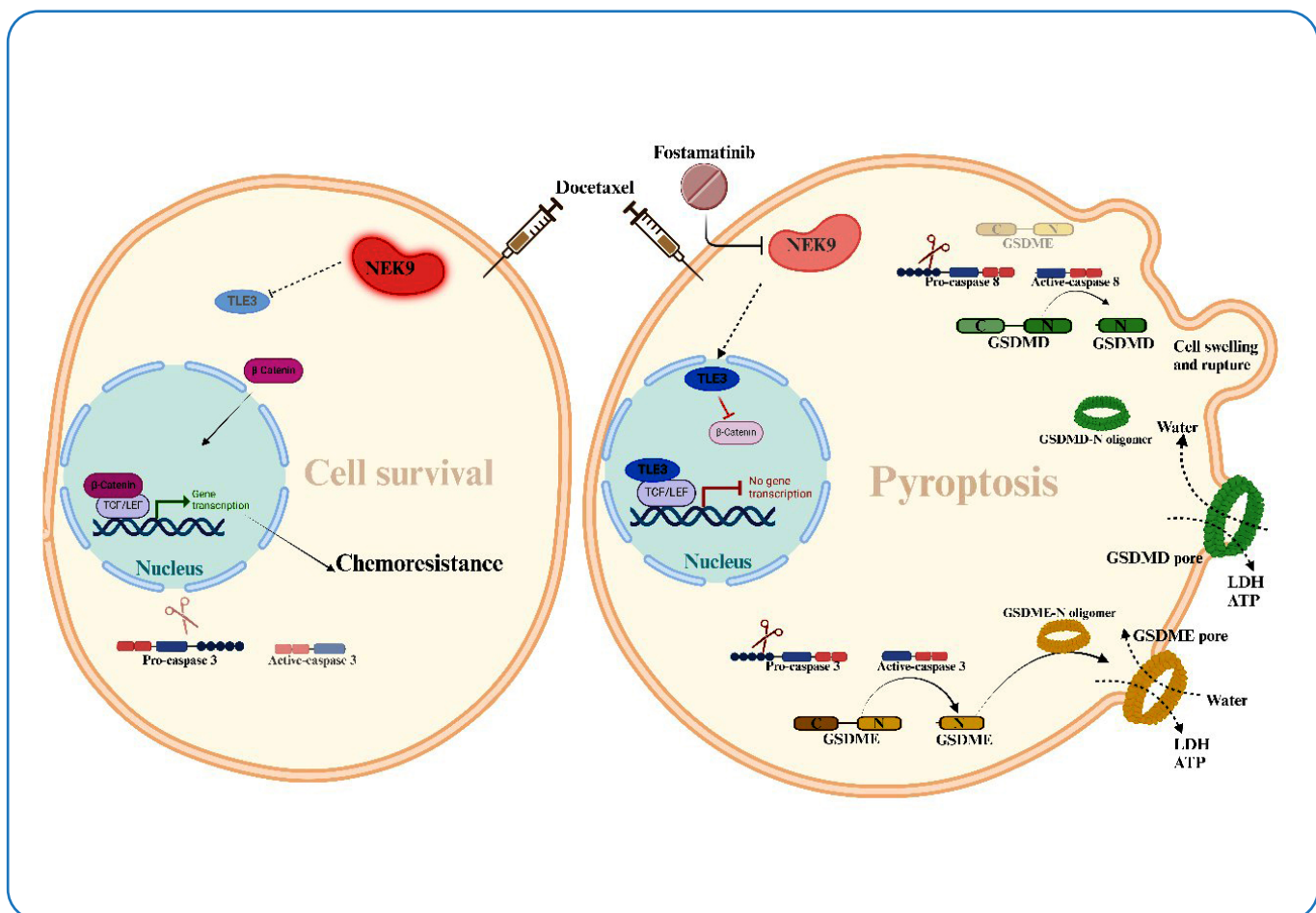
for microtubule stability, to the centrosome. This association helps the cell machinery to conduct cell division and growth in a streamlined manner. When samples from WSS patients were tested and compared to those of healthy individuals, the researchers found a 50% reduction in MLL protein complex, which inevitably led to decreased levels of Cep72 at the centrosome, thus hampering normal development. This study thus highlights the exact role that the MLL protein complex plays in cell division in our body. During development, our brain undergoes several rounds of timed cell division for its proper formation. Therefore, this study also shines light on how MLL's role in cell division can lead to a neurodevelopmental disease condition of this proportion. This new understanding of the exact mechanism of MLL's role at the centrosome can provide an impetus for further studies in mechanisms associated with genetic disorders. This can trigger the identification of possible specific treatments in such rare neurodevelopmental diseases and can save many children from a disrupted and dependent childhood.

**(c) NEK9-mediated Wnt signalling repressor TLE3 rewires Docetaxel resistance in cancer cells by inducing pyroptosis**

This study from BRIC-ILS looked at Docetaxel alone or in combination with other drugs is the most common chemotherapy regimen for several neoplasms including advanced OSCC. Unfortunately, chemoresistance leads to relapse and continued tumor growth. It is therefore important to explore the causative factors for Docetaxel resistance. In this study, they performed a CRISPR-based kinome screening that identified Never In Mitosis Gene-A Related Kinase-9 (NEK9) as a major player of Docetaxel resistance in OSCC, prostate, and pancreatic cancer lines. NEK9 expression was found to be upregulated in tumor samples of chemotherapy non-responders as compared to responder OSCC patients. Our validation data suggests that selectively knocking out NEK9 sensitizes cancer cells to Docetaxel. RNA sequencing data

indicates that ablation of NEK9 upregulates Transducin-like enhancer protein 3 (TLE3) which in turn represses (TCF)- mediated canonical Wnt signalling. The in-vitro kinase activity assay identified Fostamatinib as a potent inhibitor of NEK9. The xenograft data

suggest that Fostamatinib restores Docetaxel sensitivity and facilitates a significant reduction of tumor burden. Overall, our data suggests the novel combination of Fostamatinib and Docetaxel needs further clinical investigation in advanced OSCC



**Figure 3.9: Mechanism by which NEK9 regulates Docetaxel resistance in oral squamous cell carcinomas (Ansari et al., British Journal of Cancer September 2025)**

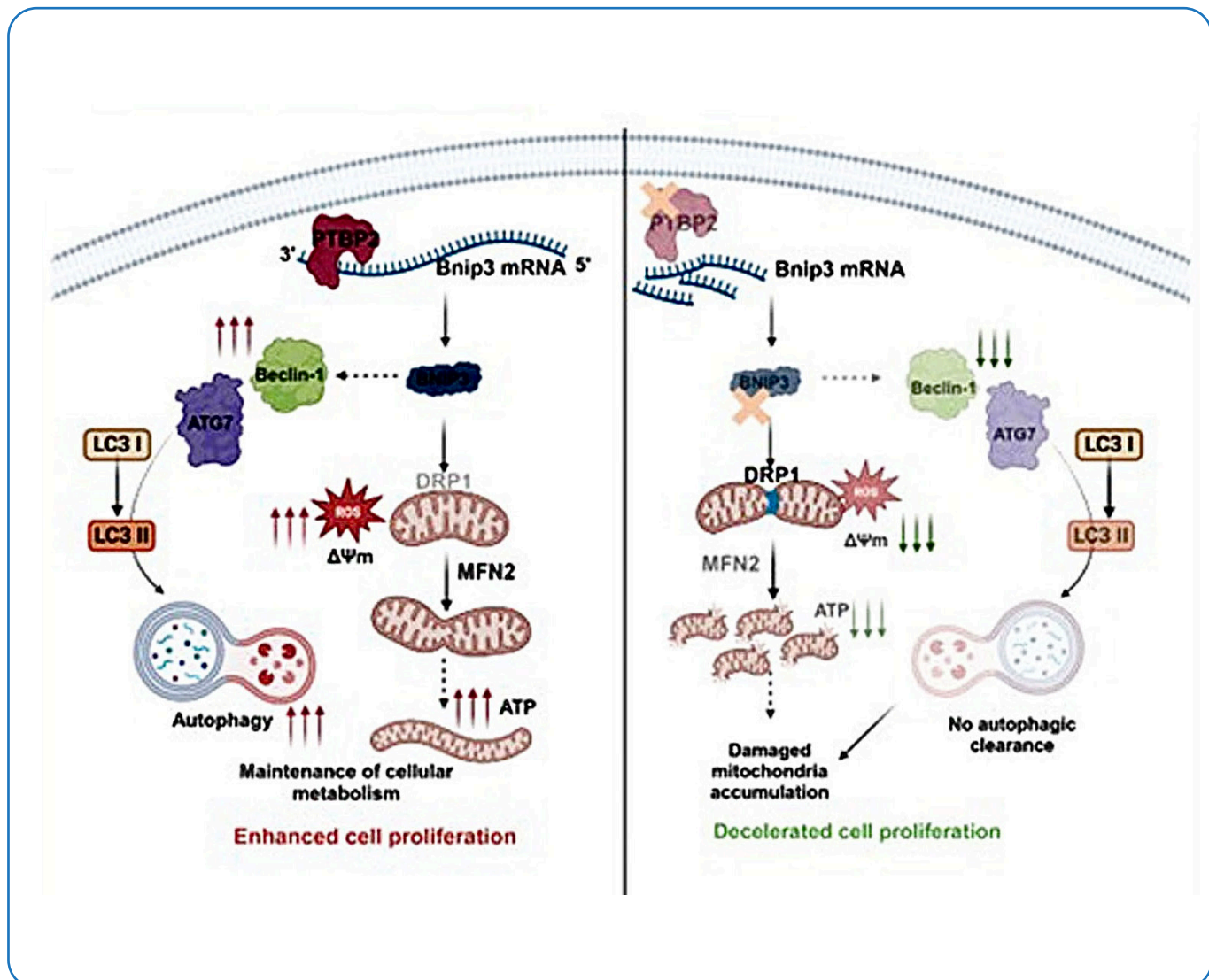
**(D) PTBP2 : A new player in CML disease progression**

Polypyrimidine tract binding protein 2 (PTBP2) regulates alternative splicing in neuronal, muscle, and Sertoli cells. PTBP2 and its paralog, PTBP1, which plays a role in B-cell development, were found to be expressed aberrantly in

myeloid leukemia. Genetic ablation of Ptpb2 in the cells resulted in decreased cellular proliferation and repopulating ability, decreased reactive oxygen species (ROS), and altered mitochondrial morphology. RNA immunoprecipitation followed by sequencing (RIP-seq) and functional assays confirmed that PTBP2 binds to Bcl-2 Interacting Protein

3 (Bnip3)-3'UTR and stabilizes its expression. This study from BRIC-ILS suggests that PTBP2 promotes autophagy, as evidenced by the low levels of LC3-II expression in Ptbp2-knockout cells treated with Bafilomycin A1. This effect was restored upon overexpression of Bnip3 in the knockout cells. Notably, when KCL22-NTC cells were subcutaneously injected into the flanks of mice, they gave rise to malignant tumors, unlike Ptbp2-KO-KCL22 cells. Also,

transplantation of KCL22 cells through the tail vein in NOD/SCID mice resulted in higher cell engraftment and increased infiltration of malignant cells in the extramedullary organs. This study underscores the role of PTBP2 in promoting cell proliferation and tumor formation while enhancing autophagy through Bnip3, thereby supporting the role of PTBP2 as an oncogene in CML.

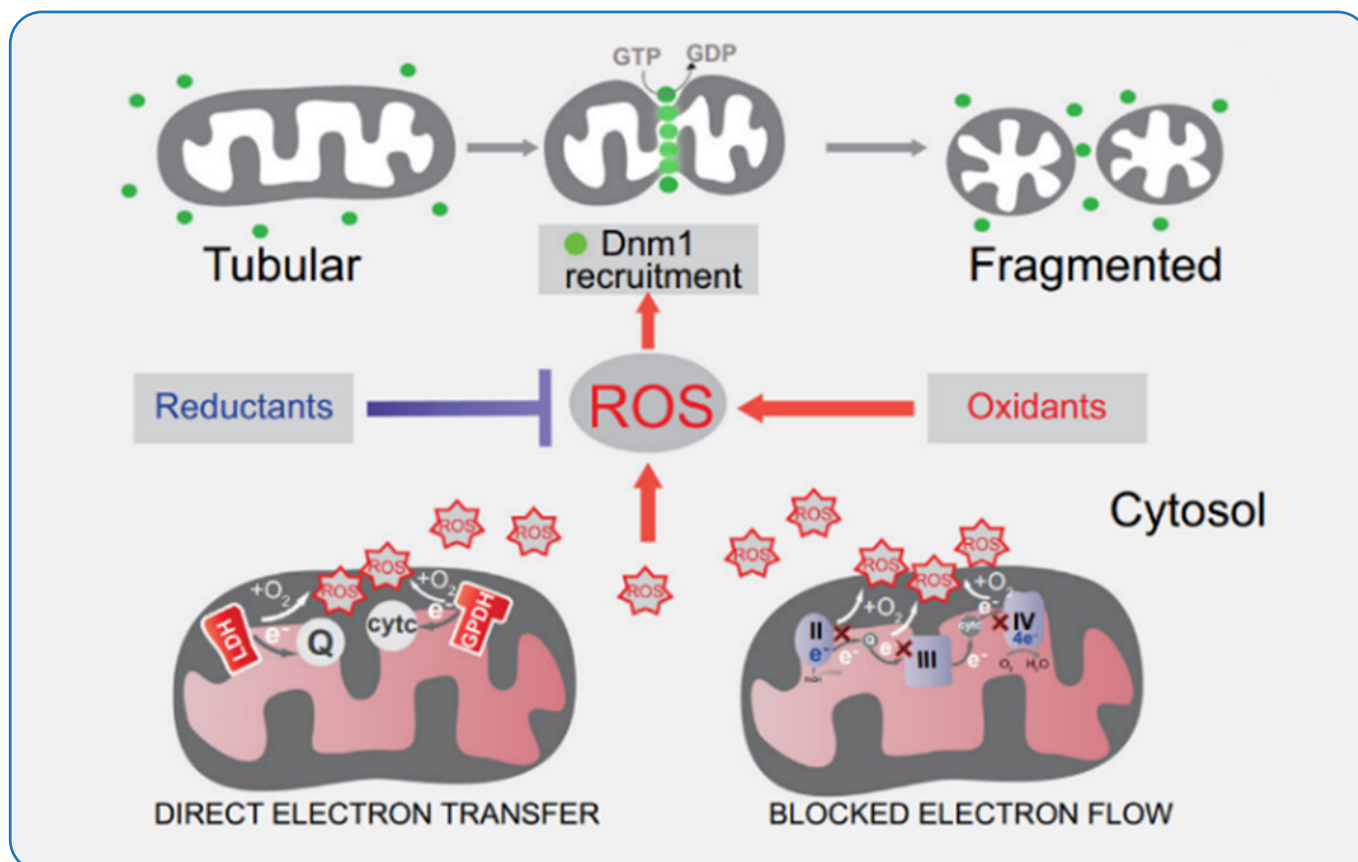


**Figure 3.10: Diagrammatic Summary of PTBP2 as a player in CML disease progression**

**(E) Mitochondria change shape in response to redox state: new study by BRIC-inStem**

A team of researchers at BRIC-inStem, has discovered an important link between the cellular “redox state” and the shape of mitochondria, the powerhouses inside our cells. Published in PNAS, the study shows that changes in cellular redox levels can actively reshape mitochondrial networks through redox signalling, helping explain how these organelles respond to stress. Mitochondria are constantly changing between fusing into large interconnected networks and fragmenting into smaller units. Until now, the mechanisms behind these shape changes were poorly understood. The new study reveals that the cellular redox state which is controlled by metabolic electron flow and reactive oxygen species (ROS) plays a key role in regulating mitochondrial shape. These changes happen

quickly and are fully reversible. Using yeast as a model, the researchers combined advanced imaging with metabolic analyses to show that when more electrons flow through the mitochondrial respiratory chain, ROS levels rise, creating a more oxidized environment. This causes rapid fragmentation of mitochondria as a normal, controlled response not as a sign of damage. This process relies on the mitochondrial fission machinery, particularly the Dnm1 GTPase enzyme. This discovery provides fresh insights into how mitochondria adapt to metabolic and oxidative stress. It also has wide-ranging implications for human health, particularly for diseases linked to mitochondrial dysfunction, such as neurodegenerative and metabolic disorders. By uncovering how redox signals shape mitochondrial dynamics, the study opens new avenues for therapies aimed at regulating mitochondrial function in disease.

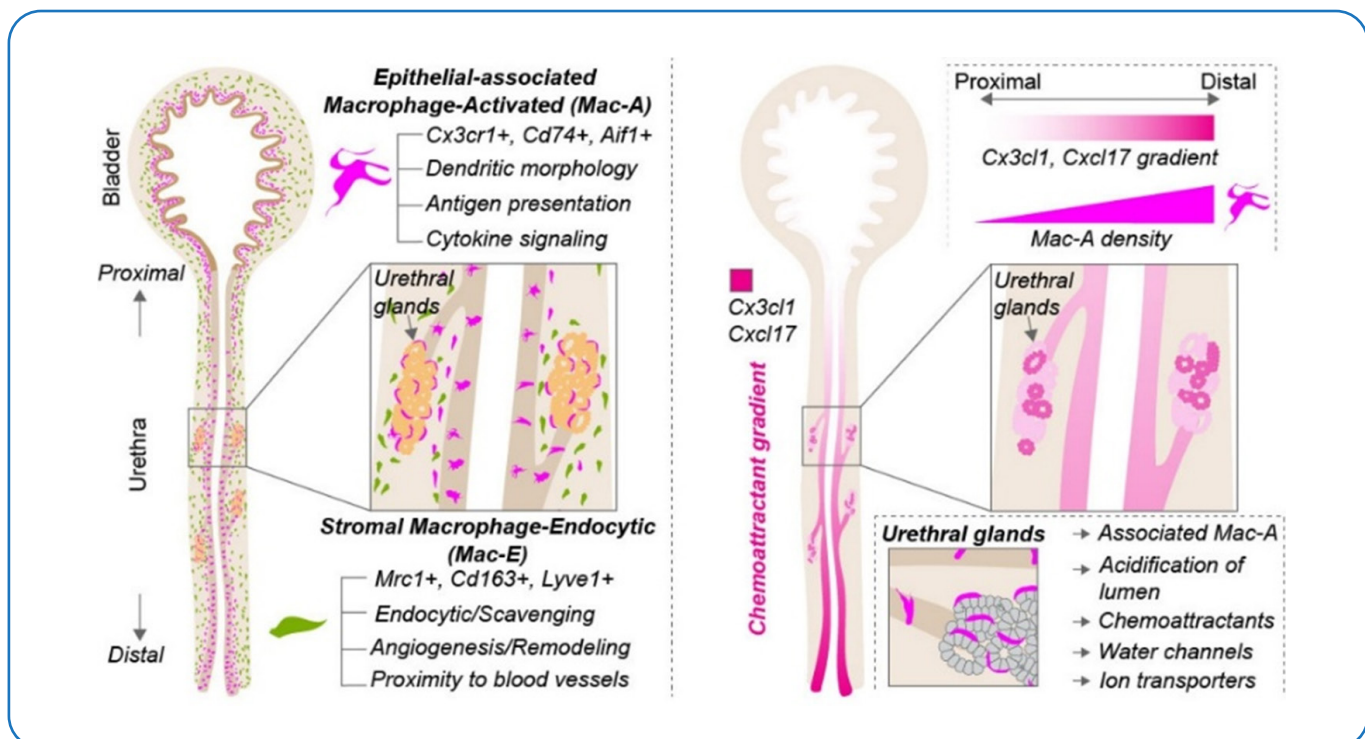


**Figure 3.11: Legend: Relationship of cellular oxidative state and mitochondrial morphology : Schematic showing whether respiration-dependent changes in cellular redox state can explain changes in mitochondrial morphology.**

**(F) BRIC-inStem creates single cell map revealing novel immune defences against urinary pathogens**

The female urethra serves a critical role in defence against incoming pathogens. Researchers at BRIC-inStem have now developed a comprehensive single-cell atlas of the adult female mouse urethra, providing unprecedented insight into its cellular makeup and immune mechanisms. The study reveals two transcriptionally and spatially distinct macrophage populations. Epithelial-associated macrophages (Mac-A) reside within the urethral lining and associated glands, extending dendritic processes between epithelial cells to actively survey the lumen. These cells express markers such as *Cx3cr1*, *MHCII* genes, *Cd74*, and *Aif1/Iba-1*, and are enriched for pathways related to antigen presentation, cytokine signalling, and inflammation. Mac-A macrophages function as frontline defences, detecting ascending pathogens and initiating immune responses. In contrast, stromal macrophages (Mac-Endocytic or Mac-E) are located deeper within the tissue,

expressing scavenger receptors including *Mrc1*, *Lyve1*, *Cd163*, and *Mgl2*. They show enrichment for endocytic processes, tissue repair, and vascular development, supporting tissue homeostasis and integrity. The study reports that spatial organization of these macrophages appears to be guided by epithelial-derived chemokines. *Cx3cl1* and *Cxcl17* are expressed along the proximal-distal axis of the urethra, corresponding with higher densities of Mac-A cells near the urethral opening. This suggests a chemokine-driven mechanism for positioning immune cells where pathogen exposure is greatest. Together, these findings establish the urethra as a highly structured and dynamic barrier, where epithelial-immune interactions orchestrate defence and tissue maintenance. The complementary roles of Mac-A and Mac-E macrophages highlight how functional specialization and spatial compartmentalization of immune cells support host protection. This cellular atlas provides a foundation for understanding susceptibility to urinary tract infections, informing future studies on immune defences and the mechanisms governing macrophage localization and function.



**Figure 3.12: Legend: Graphical Abstract of single cell map revealing novel immune defences against urinary pathogens**

**(G) PARP-16 Regulates PERK-IRE1 $\alpha$  UPR in JEV-Infected Neural Progenitors Japanese encephalitis virus (JEV) infection**

BRIC-NBRC researchers showed how the PARP-16 Regulates PERK-IRE1 $\alpha$  UPR in JEV-Infected Neural Progenitors Japanese encephalitis virus (JEV) infection is known to induce endoplasmic reticulum (ER) stress, triggering the unfolded protein response (UPR) to restore cellular homeostasis or initiate apoptosis. In their study, they investigated the role of Poly ADP-ribose polymerase-16 (PARP-16) in modulating the ER stress response during JEV infection of Neural Stem/Progenitor Cells (NSPCs) in the BALB/c mouse model. They observed that JEV infection activated key UPR sensors, including protein kinase R (PKR)-like ER kinase (PERK) and Inositol-requiring enzyme-1 $\alpha$  (IRE-1 $\alpha$ ), through PARP-16, leading to downstream signalling events characteristic of ER stress adaptation. Importantly, siRNA-mediated downregulation of PARP-16 in NSPCs significantly reduced the expression of UPR markers and their downstream effectors, indicating attenuation of the stress response. These findings underscore a critical role of PARP-16 in regulating the ER stress-UPR axis during JEV infection. Targeting PARP-16 may provide a novel avenue to modulate ER stress-mediated outcomes in neural stem/progenitor cells, with potential implications for limiting neuropathology associated with JEV infection.

**(H) The Dementia Science Programme**

BRIC-NBRC conducted two major research projects. Under the Dementia Science Programme, the lab performed MRI and fMRI studies on 270 human elderly individuals aged between 60 and 106 years. This cohort included healthy individuals, dementia patients, and those with mild cognitive impairment. In another project titled Early Diagnosis of Structural and Functional Decline in Brain Circuits Stemming from Traumatic Injuries in Professional Athletes Playing Contact Sports, the lab performed advanced MRI scans on 10 boxers and 10 healthy individuals.

Understanding the role of viral protein (Orf6) of

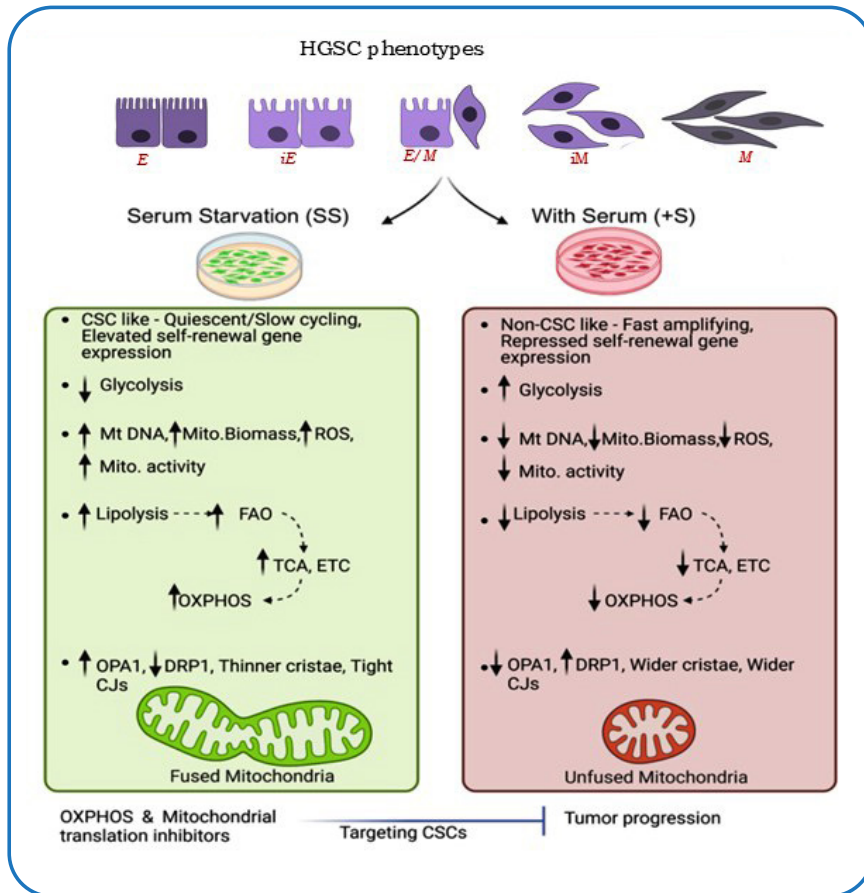
SARS CoV2 in causing neuronal damage in COVID 19 patients

**(I) The Ovarian cancer study**

Investigations done at BRIC-NCCS on a severe form of ovarian cancer revealed how cancer stem cells can survive under stress. Cells deprived of nutrients and growth signals were found to adapt by changing their energy production methods. Specifically, they switch from relying on sugar breakdown to using fats through a process called oxidative phosphorylation in the mitochondria—the cell's powerhouses. These changes are linked to the cancer cells' ability to behave like stem cells, which can renew and sustain tumor growth. This study suggests that targeting these mitochondrial functions could help eliminate cancer stem cells, thus potentially preventing tumor recurrence and improving treatment outcomes. These findings highlight a new approach to attack the resilience of ovarian cancer by disrupting its energy supply mechanisms. These studies that were published in Cell Death and Disease (Oct. 2025). (Fig 1)

**(J) Complement component C3 regulateing the differentiation of osteoblasts**

It is known that the immune system plays a role in aggravating bone loss in osteoporosis, but the underlying mechanisms were unclear. Scientists at BRIC-NCCS investigated how the complement component C3 of the immune system regulates the differentiation of osteoblasts (bone-forming cells) and osteoclasts (cells responsible for bone resorption) in the mouse model. A deficiency of C3 was found to reduce the differentiation of osteoclasts, and the decrease in osteoclast function led to increased bone health, including parameters associated with better strength. This study provides valuable insights into how the bone-immune axis contributes to the regulation of bone health, and suggests potential C3-associated therapeutic avenues for the management of bone disorders. This research was published in The Journal of Immunology (Aug. 2025), and featured online in the News & Views section of the American Association of Immunologists. (Fig 2)



**Figure3.13: Mitochondria-associated functions that support cancer stemness in serum-free media identified in ovarian cancer**  
 Source of the graphical abstract – DOI: 10.1038/s41419-025-07987-1

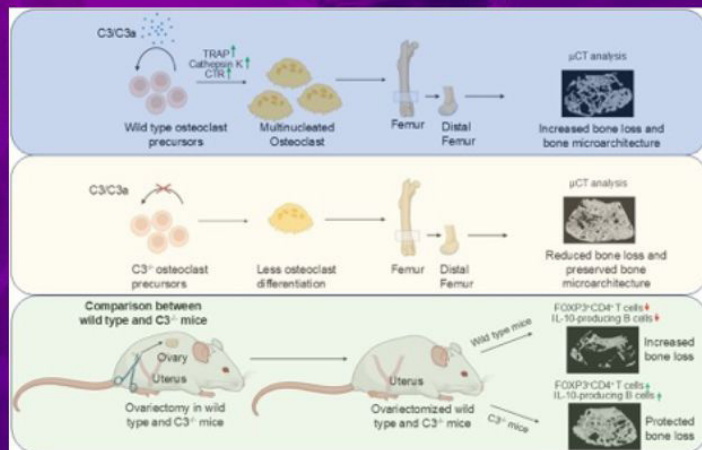
## NEWS & VIEWS

### Complement C3 Could Have Therapeutic Applications for Osteoporosis

Dr. Girdhari Lal found that a deficiency of C3 led to decreased differentiation of osteoclasts, which led to increased bone health, including bone density, trabecular space, and bone parameters associated with better strength in C3-deficient mice compared to healthy controls.

American Association of Immunologists™

The Journal of Immunology

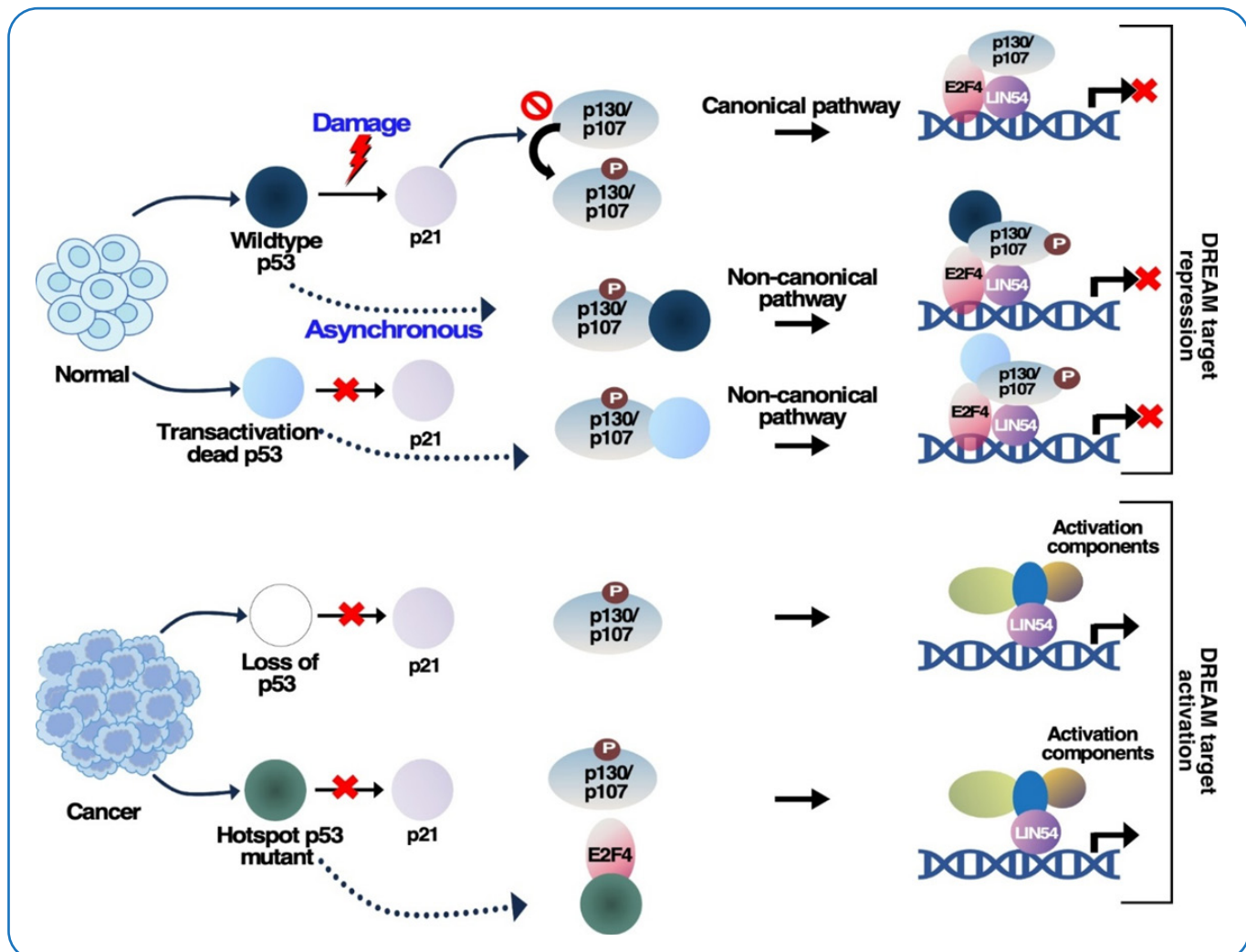


**Figure3.14: BRIC-NCCS research revealing the role played by complement C3 in bone health was featured by the American Association of Immunologists.**  
 Source of the graphical abstract – DOI: 10.1093/jimmun/vkaf180



bind with p130/p107 independently of their phosphorylation status. In contrast, the two most common p53 mutants in cancer chelate away E2F4, the DNA binding component of the DREAM complex, thereby making the complex non-functional. Meta-analysis of E2F4-p53 ReChIP seq reveals the co-recruitment of wildtype or transactivation-dead p53 and E2F4 to both known DREAM complex targets and several

newly identified promoters. The new promoters are regulated via the “non-canonical” pathway and can be considered as new DREAM complex targets. Hence, repression mediated by p53 can occur in asynchronous cells via transactivation-independent mechanisms and contributes to p53’s role in maintaining genomic integrity and preventing cancer. The early findings have been published in the prestigious EMBO journal.



**Figure 3.16: p53 can repress DREAM complex targets in a p21-independent manner.**

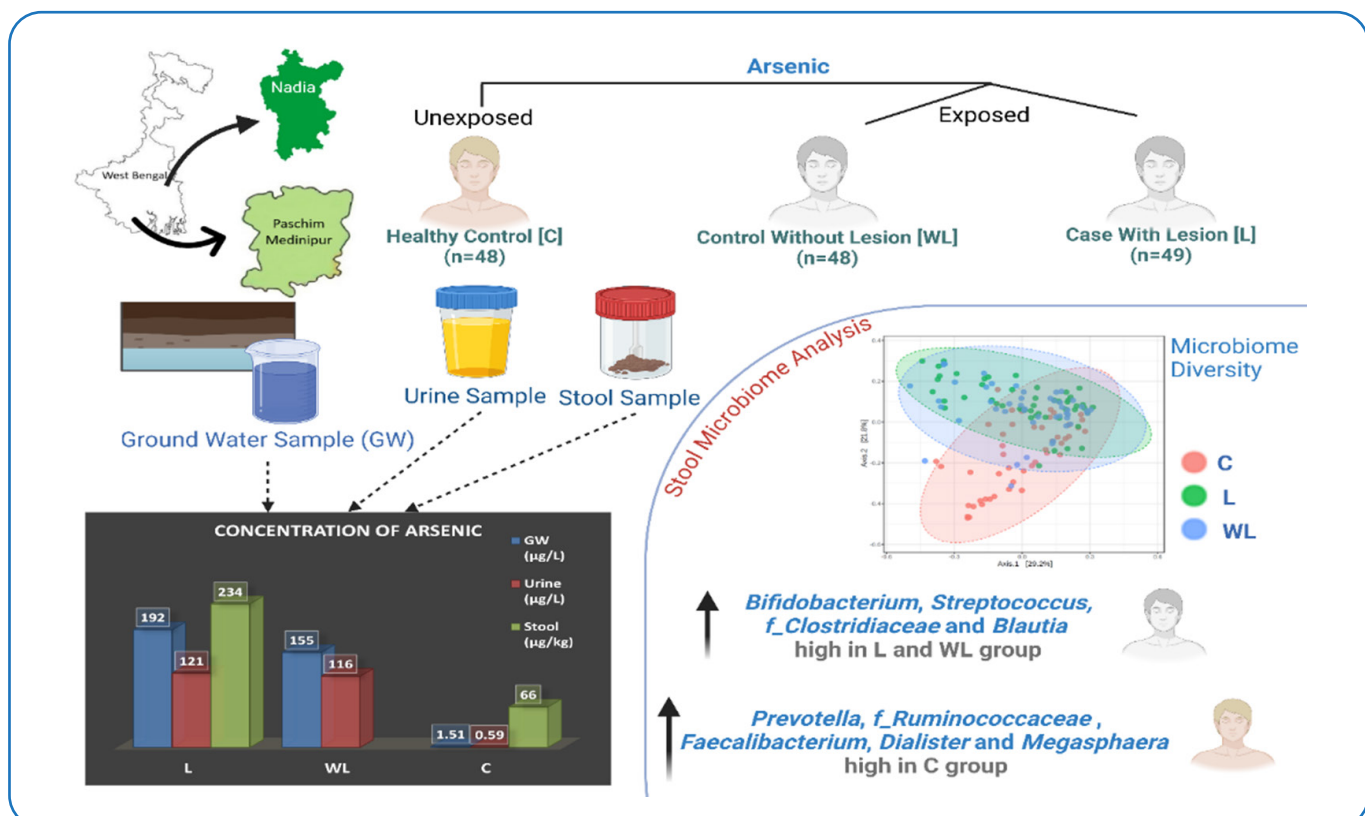
**(M) Long-term arsenic exposure perturbs gut microbial diversity, composition and predicts metabolic dysregulation**

This study from BRIC-NIBMG, published in the Journal of Hazardous Materials uncovers an important link between chronic arsenic

exposure through drinking water and significant disruptions in the gut microbiome of individuals in West Bengal. Focusing on two distinct communities—one highly exposed (Nadia) and one with minimal exposure (Paschim Medinipur)—the research highlights how prolonged environmental exposure to this toxic element

silently reshapes gut health at the microbial level. Stool samples from 150 individuals were analyzed, with the exposed group further divided into those with arsenic-induced skin lesions (n=50) and those without (n=50). Regardless of visible symptoms, arsenic-exposed individuals showed significantly lower gut microbial diversity, a marker of dysbiosis often associated with inflammation and metabolic disease. Notably, their gut microbiomes were enriched in *Clostridium*, *Blautia*, and *Streptococcus*. One of the most striking findings is the near elimination of *Prevotella copri*—a keystone species widely regarded as a hallmark of a healthy Indian gut

and involved in fibre metabolism and metabolic health— in individuals exposed to arsenic-contaminated groundwater. Its absence may severely impair the gut’s ability to process dietary fibers and maintain metabolic balance in the arsenic exposed individuals. This is the first Indian study demonstrating that arsenic affects not just physical health but also gut microbial ecosystems. It underscores the potential of microbiome shifts as early biomarkers of arsenic exposure and calls for urgent policy interventions to address this emerging microbial and metabolic health crisis.



**Figure 3.17: Prolonged arsenic-contaminated groundwater exposure alters gut microbial diversity paving way for early microbiome-based markers of arsenic toxicity.**

**(N) Unravelling a New Immune Pathway in Dengue – A Step Towards Next Generation Vaccines**

This research from BRIC-NII focuses on Dengue fever, a mosquito-borne viral infection, poses a major global health threat, with India at its epicentre. In 2024 alone, over 14 million cases and

10,000 deaths were reported worldwide. Despite its prevalence across more than 100 countries, particularly in Asia, the reasons behind the wide variation in disease severity remain unclear. A major challenge in dengue research has been antibody-dependent enhancement (ADE), where weak or non-neutralizing antibodies

worsen infection instead of protecting against it—an issue that has even led to vaccine failures. Researchers at BRIC-NII have uncovered a previously unknown immune pathway that could transform the understanding of dengue severity and guide the design of safer vaccines. By analyzing immune responses in dengue patients, they identified a specialized subset of T cells—IL-21<sup>+</sup> T cells—that are markedly elevated in severe dengue cases. These cells, instead of supporting protective immunity, drive excessive antibody production, leading to immune overactivation and worsening disease outcomes. Single-cell transcriptomic analysis revealed that these IL-21<sup>+</sup> T cells interact abnormally with B cells, promoting harmful antibody responses. Moreover, their presence in lymphoid tissues suggests that they can influence systemic immunity, not just circulating immune responses. This discovery shifts the traditional view of dengue immunity from virus-killing T cells to those that regulate antibody-producing B cells. It highlights a new cellular player in severe dengue and offers critical insights for precision diagnostics and vaccine design. Detecting this IL-21<sup>+</sup> T-cell subset could enable early prediction of severe disease, while targeting this pathway may help prevent immune overactivation. For dengue-endemic regions like India, these findings provide a foundation for developing safer, more effective vaccines and therapies, marking a significant step toward reducing the global burden of dengue.

**(O) PfPPM2 signalling regulates asexual division and sexual conversion of human malaria parasite *Plasmodium falciparum***

In a significant breakthrough in malaria research, researchers have discovered a previously unknown signalling pathway in the *Plasmodium falciparum* parasite that controls both asexual replication and sexual differentiation— key processes that determine disease progression and transmission to mosquitoes. The study, published in *Nature Communications*, identifies PfPPM2, a protein phosphatase, as a central regulator of these developmental transitions. The study by a research group at BRIC-NII demonstrated that PfPPM2 modulates the

phosphorylation of crucial proteins involved in chromatin remodeling and protein translation, which is critical for parasite development. One of the most striking findings of the study is PfPPM2's role in promoting sexual conversion—a vital step for transmission by dephosphorylating serine 33 residue of heterochromatin protein 1 (HP1). This dephosphorylation event leads to loss of HP1 interaction with H3K9me<sub>3</sub>, thereby promoting sexual conversion in the parasite. This pathway adds a new layer to our understanding of how the malaria parasite orchestrates complex developmental decisions. It opens potential avenues for targeting the parasite's life cycle at multiple stages— both to prevent disease and block transmission. The study is a collaborative effort of researchers from BRIC-NII, IISER Pune and Yenepoya University funded by SERB, DBT/ Wellcome Trust India Alliance, NII core.

**(P) Vitamin B12 Orchestrates Brain-Gut Communication to Promote Longevity**

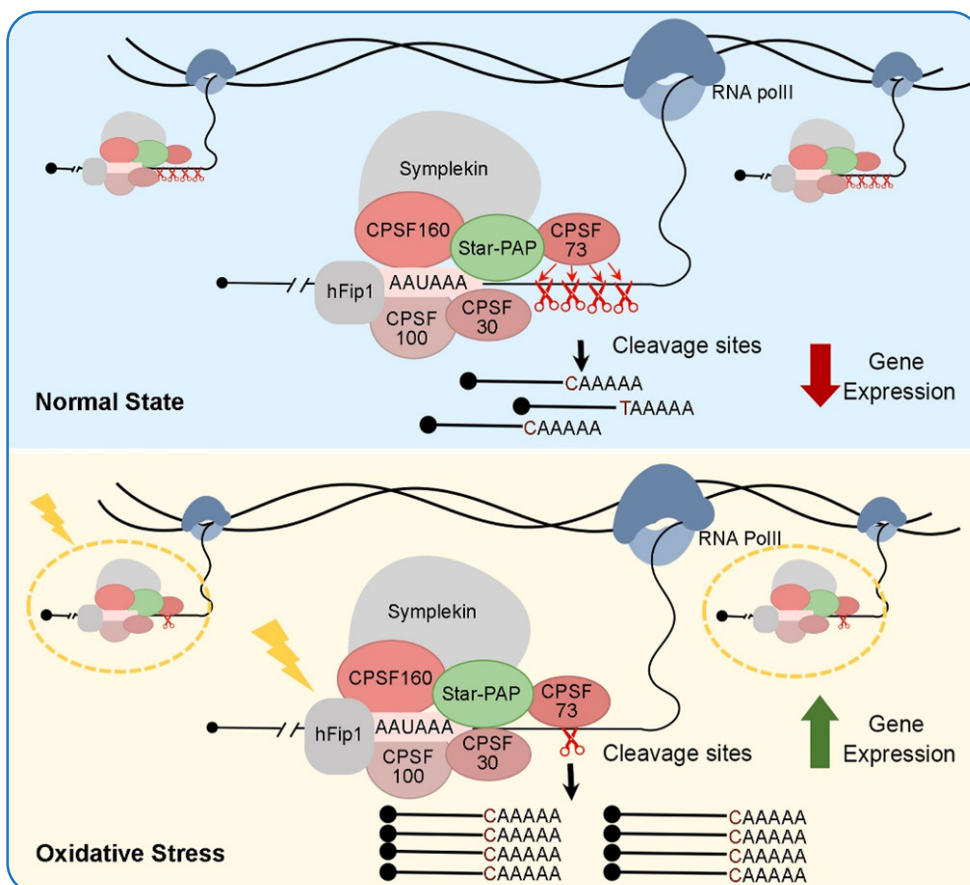
Researchers at BRIC-NII revealed a striking connection between Vitamin B12, serotonin signaling, and longevity through brain-gut communication. Published in *Nature Communications*, the research uses the model organism *Caenorhabditis elegans* to uncover how this vital micronutrient influences behavior, stress tolerance, and lifespan. Vitamin B12, an essential cofactor in the methionine cycle (Met-C), regulates methylation and gene expression and can only be obtained through diet or gut microbes. Deficiency or genetic impairments in this pathway are associated with disorders such as depression, obesity, and insulin resistance. The study found that when B12 activates the Met-C pathway in specific ADF chemosensory neurons, it enhances serotonin production—the neurotransmitter linked to mood and well-being in humans. This serotonin boost sets off a chain reaction: it stimulates other neurons to release neuropeptides that act on the gut, triggering the p38 MAP-kinase stress response pathway. This neuron-to-gut signaling improves the worm's ability to handle environmental stress and significantly extends lifespan. Remarkably, the research also uncovered a feedback loop

linking diet, brain activity, and behavior. Worms with active B12 signaling not only became more stress-resistant but also developed a preference for B12-rich foods, suggesting that the brain recognizes and rewards nutrient-rich diets by promoting behaviors that enhance survival. This work provides a molecular framework for understanding how micronutrients shape brain-gut interactions to influence aging and behavior. While conducted in worms, these findings have profound implications for humans, highlighting the ancient and conserved mechanisms through which diet and brain chemistry coordinate to maintain health and longevity.

**(Q) Regulation of Antioxidant Gene Expression through mRNA Cleavage Dynamics**

A research team at BRIC-RGCB focused on understanding how gene expression is regulated during oxidative stress. Their research aimed to explore how different cleavage sites in mRNA

can affect the expression of genes involved in antioxidant responses. They used advanced techniques like quantitative immunoprecipitation and statistical analysis to examine how mRNA processing works. They discovered that when cells face oxidative stress, the number of cleavage sites in the mRNA decreases, which actually boosts the expression of important antioxidant genes. Notably, a primary cleavage site was found to have the highest efficiency in promoting this gene expression. The study's findings underline the significance of gene regulation and its implications for diseases linked to oxidative stress, such as cancer and neurodegenerative disorders. By clarifying these mechanisms, the research could aid in developing new therapies to enhance cellular resistance to stress-related diseases. Overall, this work not only adds to our scientific knowledge but also has the potential to positively impact public health by addressing critical health challenges

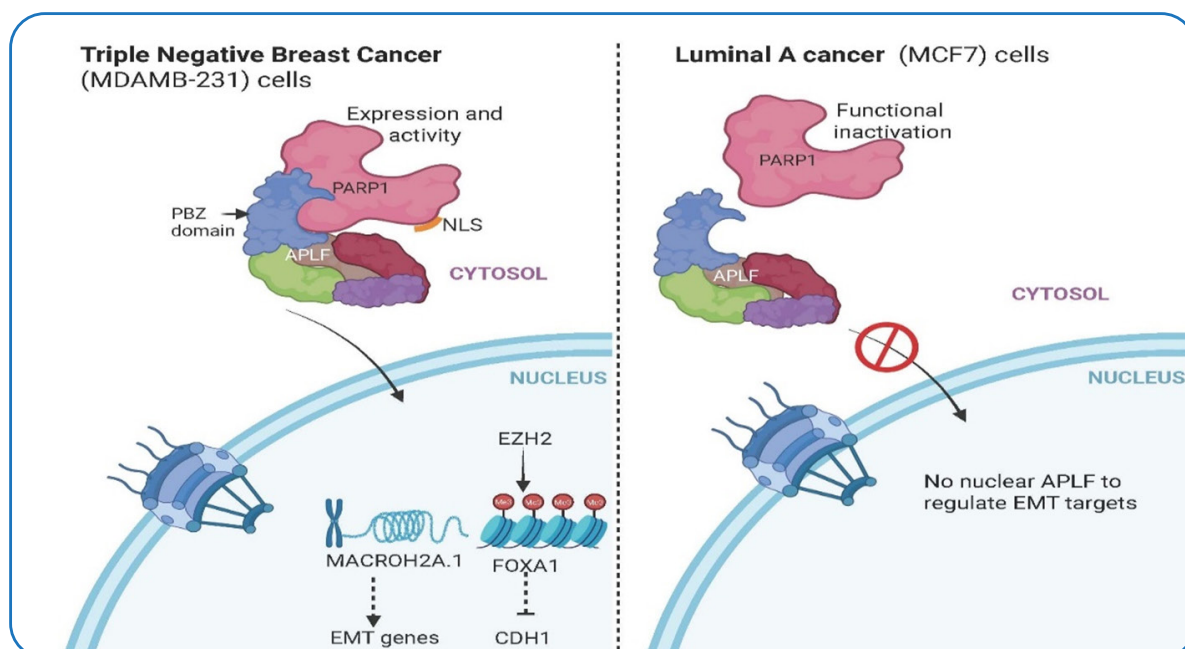


**Figure 3.18: mRNA Cleavage Dynamics regulates Antioxidant Gene Expression**

**(R) Protein localization within a cell regulate metastasis of breast cancer**

Breast cancer is the most frequently diagnosed cancer in women and the leading cause of cancer-related mortality in women. It ranks as the fourth greatest contributor of cancer mortality overall. The recent 2022 trend shows the maximum increase in death due to breast cancer and that too below the age of 50 years. When breast cancer spread from the breast to other organs of the body including lung, bones etc. it is termed as breast cancer metastasis. This stage is the major concern and cause of death due to breast cancer. The study from BRIC-RGCB on understanding and finding factors which could indicate whether a particular subtype of breast cancer would metastasize or not, at an early stage, so that necessary steps could be taken to plan for the clinical interventions. Their earlier study showed a protein named Aprataxin-PNK-like Factor or APLF is almost negligible in normal breast tissues whereas it is increased at maximum level when the breast cancer undergoes metastasis. APLF induces the phenomena of transition of cell morphology from epithelial to mesenchymal type that is responsible for the metastasis of the cancer cells breaking the barrier and invade into other

organ. Then they observed that not only the level of APLF but also the localization of this protein dictates whether the breast cancer cells should invade to other organs and undergo metastasis or not. Experimental analysis in breast cancer cell line showed the presence of APLF in the nucleus of the cells make the breast cancer cells to metastasize to other organs like lung and bones. The most aggressive and difficult to treat breast cancer subtype, triple negative for the presence of hormone receptors, show nuclear expression of APLF in patient tissue samples and in cell lines of similar origin. On the other hand, breast cancer subtype which are less aggressive and treatment has multiple options, showed cytosolic expression of APLF. They showed that a protein called PARP1 which is present in the cytosol of triple negative breast cancer patient samples is responsible for escorting the APLF protein from cytosol to the nucleus and thereby aid in the breast cancer metastasis by inducing a signaling cascade which happens in the nucleus. Hence, the differential presence of the protein molecule APLF in nucleus vs. cytosol in a breast cell could indicate the metastatic character of the breast cancer. This revelation can help in understanding, detecting and planning the treatment regimen of breast cancer in a better regulated manner.



**Figure 3.19: Metastasis of Breast Cancer is directly regulated by protein localization within a cell**

**(S) BRIC-THSTI**

**Itaconate mechanism of action and dissimilation in Mycobacterium tuberculosis.**

This research from BRIC-THSTI investigates the mechanism of action and dissimilation of itaconate, a macrophage metabolite with antibacterial and immunomodulatory properties, focusing on its effect on Mycobacterium tuberculosis. The study confirms that itaconate levels increase during infection and effectively inhibits growth in vitro and in vivo by targeting multiple metabolic enzymes, including aldolase and IMP dehydrogenase, in addition to the known target, isocitrate lyase. Furthermore, the researchers identified the remaining enzymes responsible for itaconate degradation in , demonstrating that a defect in one of these enzymes (strain) leads to attenuation of the bacteria's growth and pathogenesis.

**(T) Invasive Salmonella Typhimurium colonizes gallbladder and contributes to gallbladder carcinogenesis through activation of host epigenetic modulator KDM6B.**

This study at BRIC-THSTI investigated the role of chronic microbial infection, particularly Salmonella, in gallbladder cancer (GBC), as gallbladder stones alone don't explain the risk. Researchers found an increased abundance of Salmonella in the gut and culturable S. Typhimurium in GBC tissue. Comparative genomics revealed the tissue isolate to be highly invasive. Using mouse and cellular models, the study demonstrated that chronic S. Typhimurium infection promotes GBC carcinogenesis by causing chronic inflammation and activating the host epigenetic modulator KDM6B, a mechanism confirmed in both human GBC tissue and the mouse model. Inhibition of KDM6B reduced tumor size, supporting its role in the bacterial-driven pathology.

**BRIC-National Institute of Immunology (BRIC-NII):**

**AdFalcivax: A Multistage Malaria Vaccine Candidate**

AdFalcivax is an innovative multistage malaria vaccine candidate designed to target two critical developmental stages of Plasmodium falciparum: the pre-erythrocytic (liver) stage, which is essential for preventing infection in humans, and the sexual (transmission) stage, which enables parasite spread via mosquitoes. The vaccine leverages Lactococcus lactis, a safe, food-grade bacterium, as an expression platform. AdFalcivax incorporates full-length PfCSP, a key pre-erythrocytic antigen with established roles in infection-preventive immunity. This is fused with PfsPro6C, a construct comprising subdomains from two major transmission-blocking antigens, Pfs230 and Pfs48/45, both produced in Lactococcus lactis. By combining antigens from distinct parasite stages, the vaccine aims to achieve both infection-blocking and transmission-blocking immunity. Collaborating Institutes: ICMR-RMRC Bhubaneswar, BRIC-National Institute of Immunology, ICMR-National Institute of Malaria Research

## IV. Computational, Machine learning, Informatics

### (a) Machine Learning-Based Prediction of Biological Activity from Biosynthetic Gene Clusters

Microorganisms such as bacteria and fungi have been used for natural products that translate to drugs. However, assessing the bioactivity of extract from culture to identify novel natural molecules remains a strenuous process due to the cumbersome order of production, purification, and assaying. Thus, extensive genome mining of microbiomes is underway to identify biosynthetic gene clusters or BGCs that can be profiled as particular natural products, and computational methods have been developed to address this problem using machine learning. However, existing tools are ineffective due to a small training data set, dependence on old genome mining tools, lack of relevant genomic descriptors, and prevalent class imbalance. This work carried

at NABI presents a new tool, NPBdetect, that can detect multiple bioactivities and has been designed through rigorous experiments. First, at BRIC NABI composed a larger training set using the MIBiG database and a test set through literature mining to build and assess the model, respectively. Second, the latest antiSMASH genome mining tool was used to obtain BGCs and introduced new sequence-based descriptors. Third, neural networks are used to build the model by dealing with class imbalance issues through the class weighting technique. Finally, the NPBdetect tool was compared with an existing tool to show its efficacy and real-world utility in detecting several bioactivities with high confidence.

The article was published in Journal of Chemical Information and Modeling (Impact factor of 5.3) <https://doi.org/10.1021/acs.jcim.5c00465>.

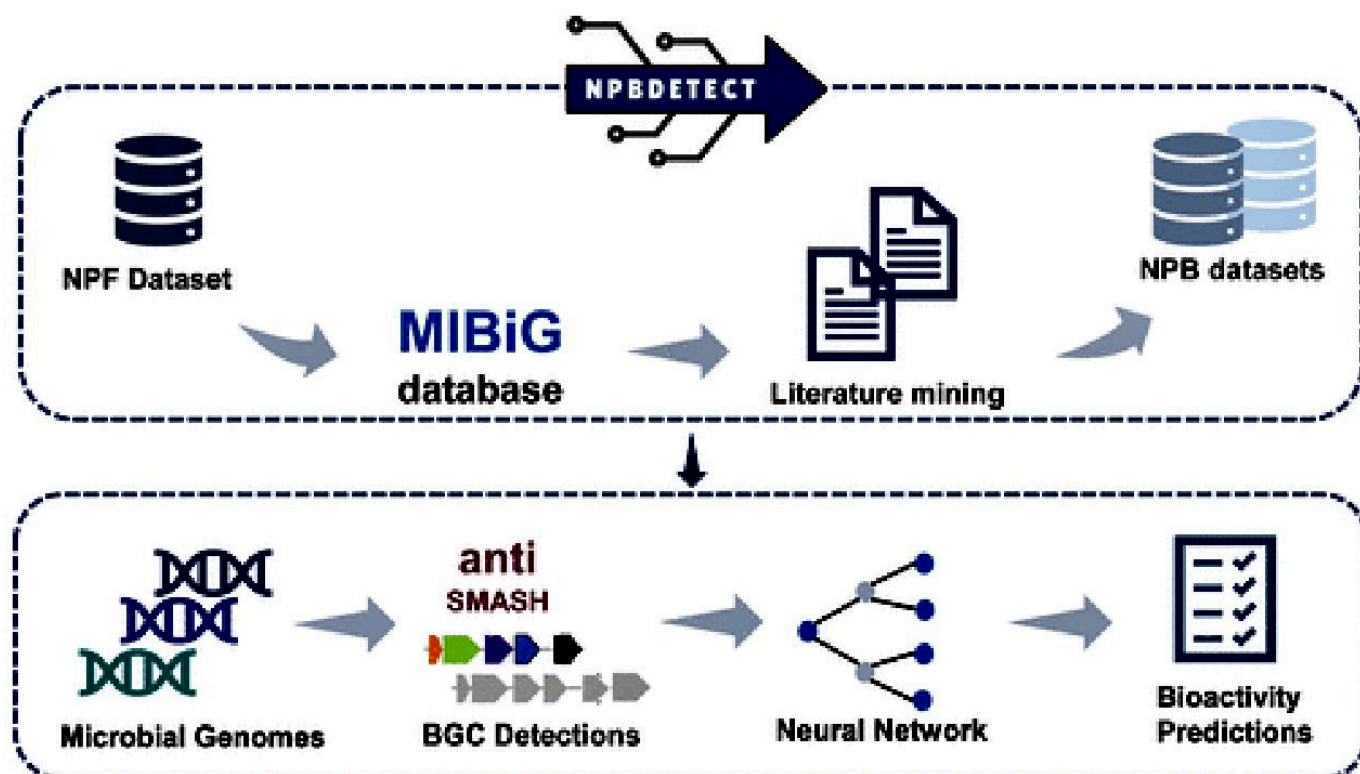


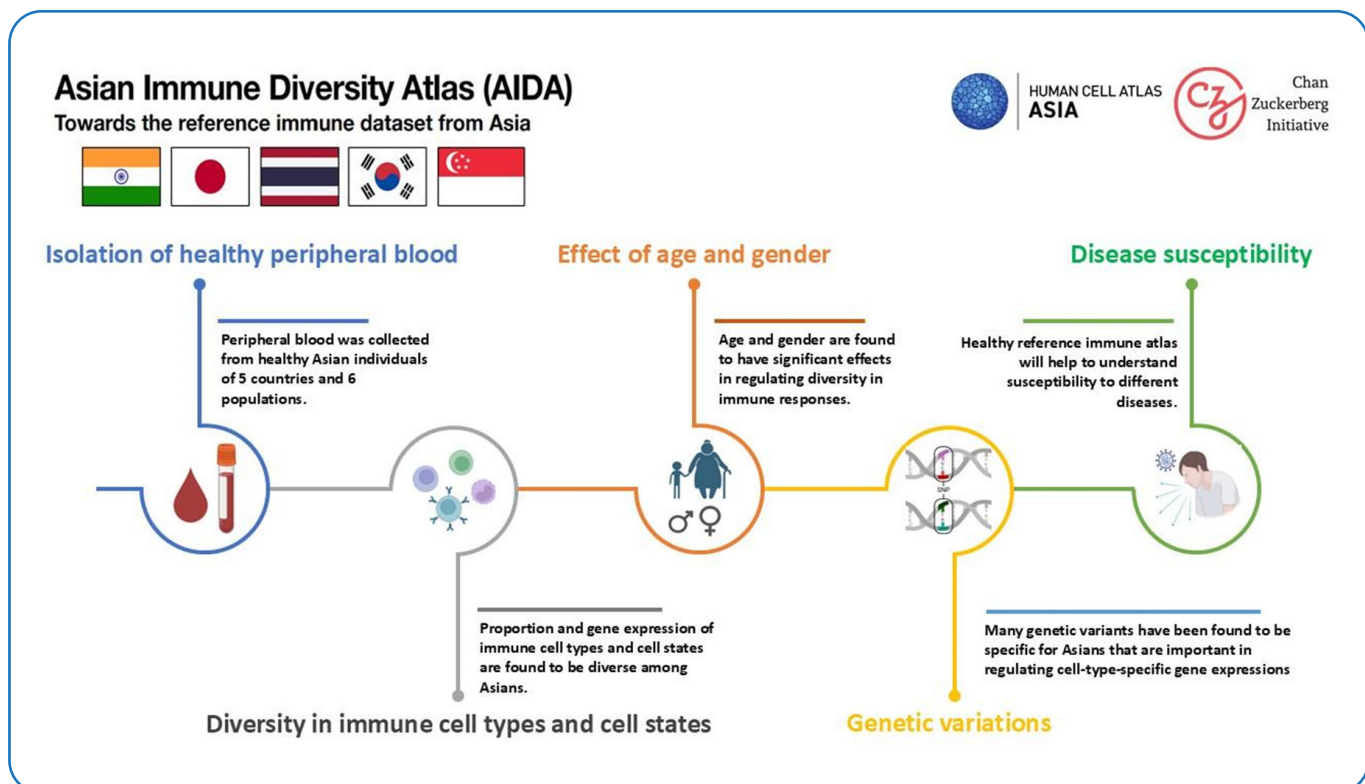
Figure 3.20. Overview of NPBdetect, that can detect multiple bioactivities and has been designed through rigorous experiments.

(B) BRIC-NBRC lab has conducted two major research projects. Under the Dementia Science Programme, the lab performed MRI and fMRI studies on 270 human elderly individuals aged between 60 and 106 years. This cohort included healthy individuals, dementia patients, and those with mild cognitive impairment. In another project titled Early Diagnosis of Structural and Functional Decline in Brain Circuits Stemming from Traumatic Injuries in Professional Athletes Playing Contact Sports, the lab performed advanced MRI scans on 10 boxers and 10 healthy individuals.

(C) A research group at NIAB has been working on the isolation and characterization of bacteriophages targeting pathogens of importance to livestock and public health. Initially, they isolated approximately thirty phages against Escherichia coli and a dozen phages against Staphylococcus aureus of animal and aquatic origin. These phages were characterized for strain tropism, growth kinetics, temperature/pH stability, morphology and genome fingerprinting; a select few were

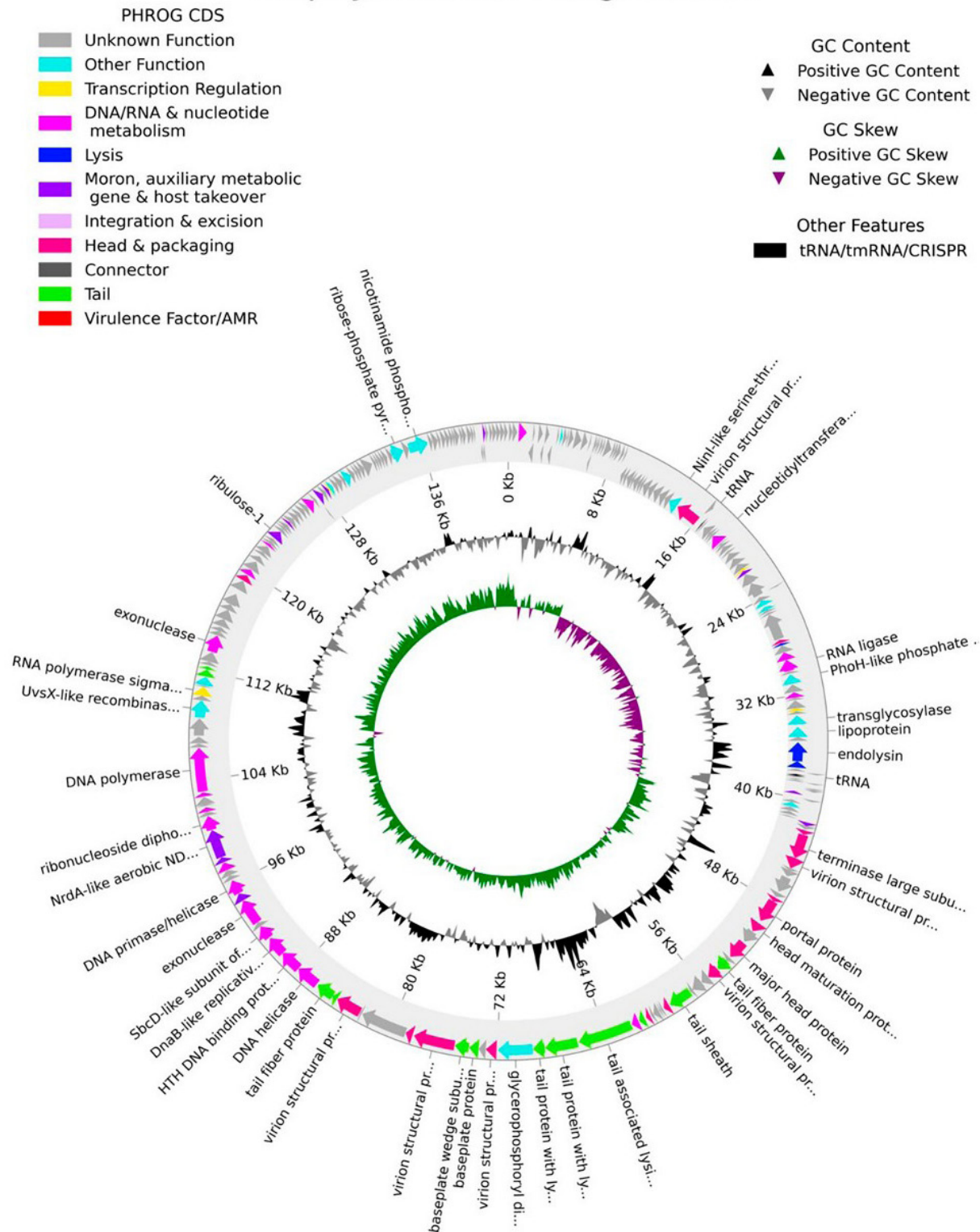
subjected to whole genome sequencing. In silico and experimental analyses suggest that some of the phages have therapeutic potential and could serve as alternatives to antibiotics in treating bacterial infections of animals and humans.

(D) The Asian Immune Diversity Atlas (AIDA) aims to characterize the nature and extent of variation in immune cell types from ancestrally diverse Asian populations. BRIC-National Institute of Biomedical Genomics is a key member of this initiative. The study sequenced over 1.2 million blood cells from 619 healthy individuals in six different Asian groups across five countries. An initial analysis identified unique differences in the immune cells within the members of these populations. These differences affect how the body defends itself and disease susceptibility as well as disease detection by available diagnostic tests. The way age and gender affect these differences was also elucidated. The findings have been published in the prestigious journal Cell (doi: 10.1016/j.cell.2025.02.017)..



**Figure 3.21. Diversity in immune cell types and states**

## Staphylococcus Phage NHSP6

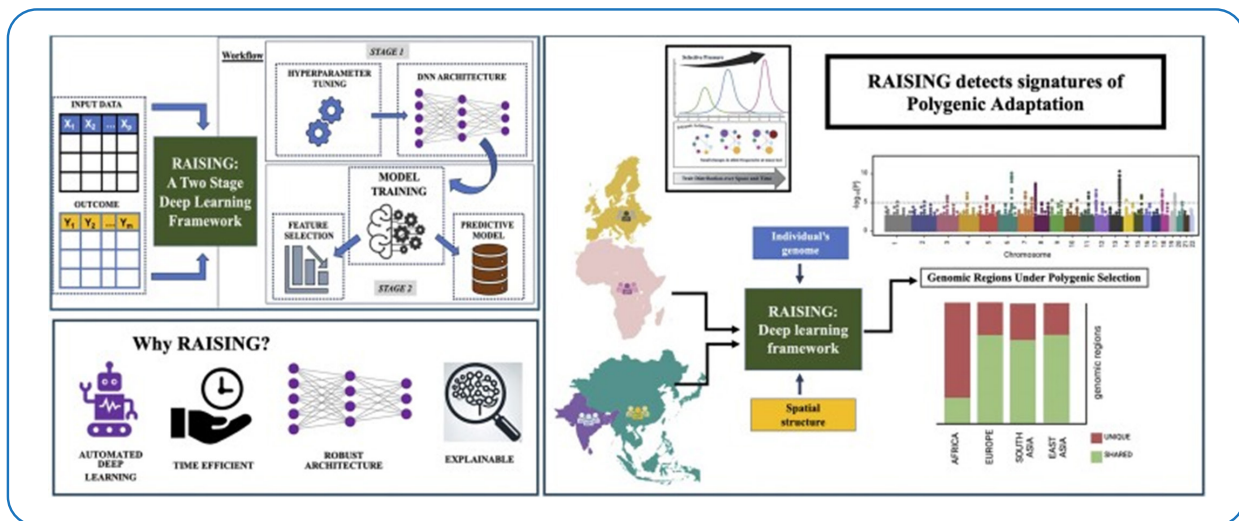


**Figure 3.22: Genome map of *Staphylococcus* phage NHSP6. The outermost arrow shows the predicted CDS and transcriptional direction in different colours. The inner two circles represent GC content (black) and GC skew (green for +, purple for -).**

- People across the world look different or have different physical traits partly due to our ancestors, who survived in a variety of environments. Over time, these environmental challenges led to the evolution of population-specific traits. These changes in human traits do not happen due to a single gene but rather are the result of small changes in many genes across the genome. This process is known as polygenic adaptation.
- BRIC-NIBMG has developed a powerful and versatile AI tool, RAISING, designed to discover

genomic regions involved in polygenic adaptation. Through extensive simulations, we found RAISING hugely outperformed existing methods.

- Applying RAISING on global genomic datasets reveals that 70% of the signatures of Polygenic adaptation in Africans, were unique to them. This highlights encounter with diverse and changing environments of the first thousand millennium of evolutionary history when anatomically modern humans lived only in Africa. These findings have been published in the Nucleic Acids Research (<https://doi.org/10.1093/nar/gkae1027>).

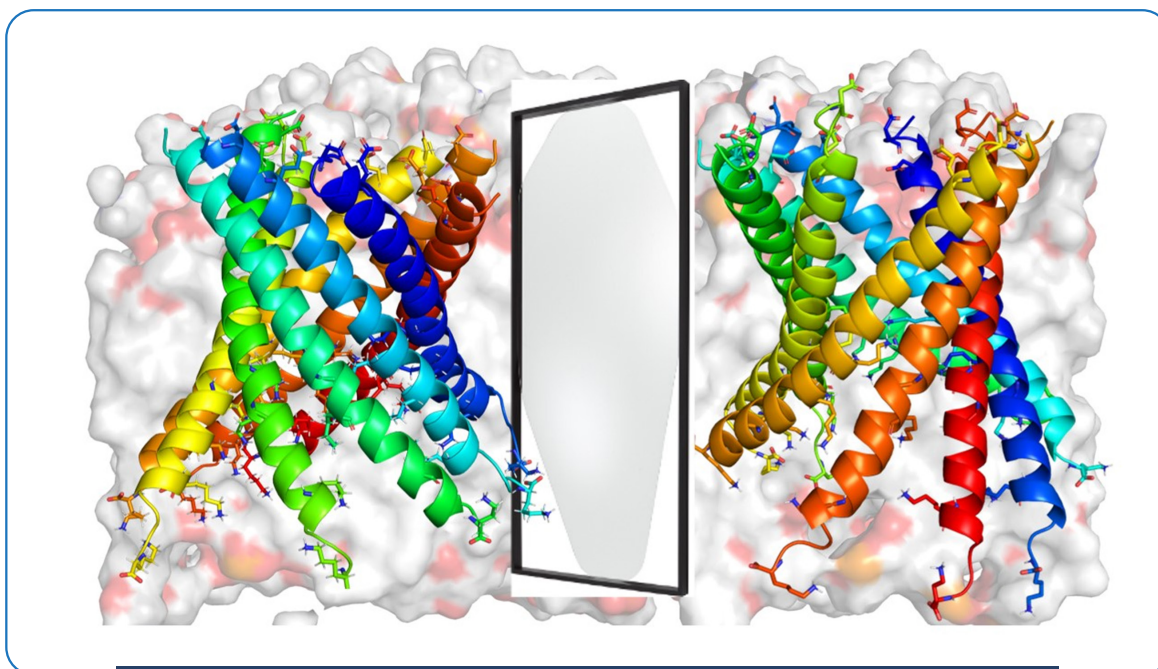


**Figure 3.23. RAISING is a deep learning framework that robustly detects polygenic adaptation across human genomes.**

### (E) Fabrication of cytotoxic mirror image nanopores

The team at BRIC-RGCB focused on creating and studying DpPorA, peptide pores made from D-amino acids, to explore their functionality and potential therapeutic uses, particularly in cancer treatment. Using a combination of solid-phase synthesis and high-performance liquid chromatography (HPLC), they synthesized these peptides and assessed their properties through techniques like circular dichroism spectroscopy and single-channel electrical recordings. Their results showed that DpPorA successfully formed stable and functional pores in lipid membranes, demonstrating charge selectivity and significant ion conductance, particularly for potassium and

chloride ions. These pores also indicated selective permeability for anions. The research suggests that DpPorA could be used in targeted drug delivery systems due to its precise interactions with biological targets. Molecular dynamics simulations further confirmed the structural characteristics and transport pathways of these mirror-image peptides, solidifying their potential for practical applications in biomimetic materials, biosensors, and cancer therapies. Overall, this work highlights an innovative approach in peptide engineering that not only advances scientific understanding but also addresses significant health challenges, paving the way for future therapeutic innovations and sustainable bioproduct development.



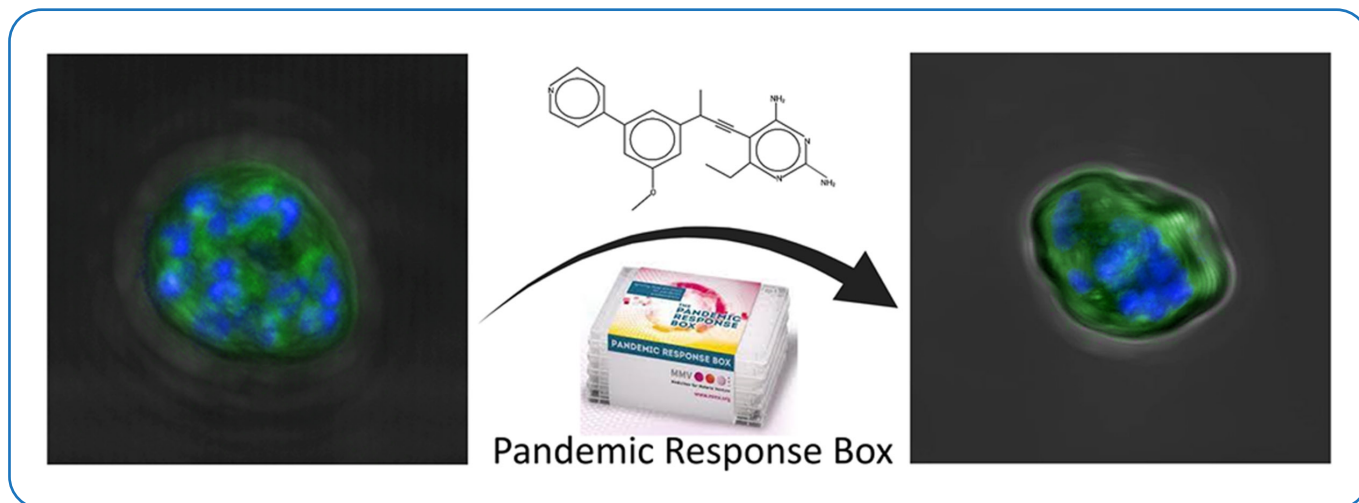
**Figure 3.24. Cytotoxic mirror image nano pores promising candidate sfor targeted drug delivery**

**(F) Novel Antimalarial Drug Discovery from the MMV Pandemic Response Box**

The team at BRIC-RGCB conducted an important study to find new treatments for malaria, a disease caused by the Plasmodium falciparum parasite. This research is vital because current treatments, especially those based on artemisinin, are becoming less effective due to drug resistance. The study utilized a special collection of 400 diverse compounds from the Medicines for Malaria Venture (MMV), which are part of an initiative to quickly find new drugs to fight infectious diseases. These compounds have low toxicity and vary in structure, making them ideal candidates for discovering novel antimalarials. One of the key goals was to identify compounds that specifically target different stages of the parasite's life cycle in the bloodstream. This is crucial as effective treatments can either kill the parasites or stop them from spreading. The researchers found 60 promising compounds that worked against both standard and resistant strains of the malaria parasite, with 28 showing significant activity at very low concentrations. Importantly, one compound, MMV001014, was discovered to

irreversibly affect the early stage of the parasite, preventing it from returning even after treatment stopped. The study's findings have major implications for public health. Malaria continues to be a significant health threat, with millions of cases and deaths every year, especially in tropical regions. By targeting the issue of drug resistance and developing new therapies, this research aligns with the goals outlined by the World Health Organization (WHO) to eradicate malaria. The potential to discover effective new drugs can seriously impact how we treat malaria, potentially saving countless lives.

In summary, the work is a critical advancement in the fight against malaria. By identifying new drug candidates and exploring their unique mechanisms, this study not only sheds light on the challenges of drug resistance but also paves the way for future research geared toward effective treatments. As malaria affects nearly half of the global population, the significance of this research cannot be overstated. The anticipation of uncovering new and effective treatments is a hopeful step in reducing the burden of this devastating disease and improving health outcomes in affected regions worldwide.



**Figure 3.25. MMV Pandemic Response Box**

(G) Distinct region-specific neutralization profiles of contemporary HIV-1 clade C against best-in-class broadly neutralizing antibodies. : This study assessed the effectiveness of best-in-class broadly neutralizing antibodies (bnAbs) against contemporary HIV-1 Indian Clade C viruses, comparing them head-to-head with South African Clade C. Researchers found that Indian Clade C was best neutralized by V3 glycan-directed and select CD4 binding site (CD4bs)-directed bnAbs (10-1074, BG18, VRC07, N6, 1-18), but showed resistance to V1/V2 apex bnAbs. Crucially, the neutralization sensitivity differed significantly between Indian and South African Clade C due to variations in Env residues, suggesting regional evolution. Predictive analysis indicated that a combination of BG18, N6, and PGDM1400 could achieve over 95% neutralization coverage for Indian Clade C. The findings underscore the importance of considering regionally relevant HIV-1 forms and bnAb combinations for effective clinical intervention.

### Summary

The research highlights presented across BRIC institutions underscore the depth, diversity, and transformative potential of the science being carried out under the DBT ecosystem. From advancing sustainable bio-based solutions and strengthening agricultural resilience to deepening our understanding of human diseases and leveraging computational intelligence, these contributions reflect a unified commitment to national priorities and global scientific excellence. Together, they demonstrate how coordinated innovation, multidisciplinary collaboration, and mission-driven research can generate tangible societal impact-fueling India's progress toward a robust bioeconomy, improved public health, and technological self-reliance. The achievements showcased here not only mark significant scientific milestones but also lay the foundation for future breakthroughs that will continue shaping the country's biotechnological landscape.

04

# RESEARCH INFRASTRUCTURE AT iBRIC

## High-End Instrument Facilities for Biotech Research & Development

The Biotechnology Research and Innovation Council (BRIC) operates a network of premier research institutes across India, each equipped with state-of-the-art facilities for cutting-edge biotechnology research. These institutes are equipped with sophisticated instruments, facilitating groundbreaking studies in genomics, proteomics, cell biology, and numerous other areas of contemporary biotechnology. The BRIC network exemplifies India's dedication to establishing a world-class biotechnology research infrastructure. Spanning 13 distinguished institutes, these facilities support innovative research in genomics, proteomics, cell biology, structural biology, and translational medicine. From DNA sequencing to cryo-electron microscopy, and from flow cytometry to mass spectrometry, BRIC institutes offer researchers access to the most recent technologies. Continuous updates to equipment and expansions of facilities across these institutes

guarantee that Indian researchers stay at the leading edge of global biotechnology research.

### 1. Genomics and DNA Sequencing Technologies

The BRIC-AI network institutes maintain one of Asia's most comprehensive genomic sequencing infrastructures. The Illumina NovaSeq 6000 platforms at BRIC-NIBMG (National Institute of Biomedical Genomics), BRIC-RGCB (Rajiv Gandhi Centre for Biotechnology), and BRIC-ILS (Institute of Life Sciences) deliver ultra-high throughput data exceeding 6000GB per dual run, supporting whole genome sequencing, exome sequencing, and transcriptomics studies.

Automated sequencing systems are strategically distributed across institutes: the ABI 3730xl DNA Analyzer at BRIC-NIPGR (National Institute of Plant Genome Research), BRIC-RGCB, and BRIC-CDFD (Centre for DNA Fingerprinting and Diagnostics) enables high-capacity capillary sequencing.



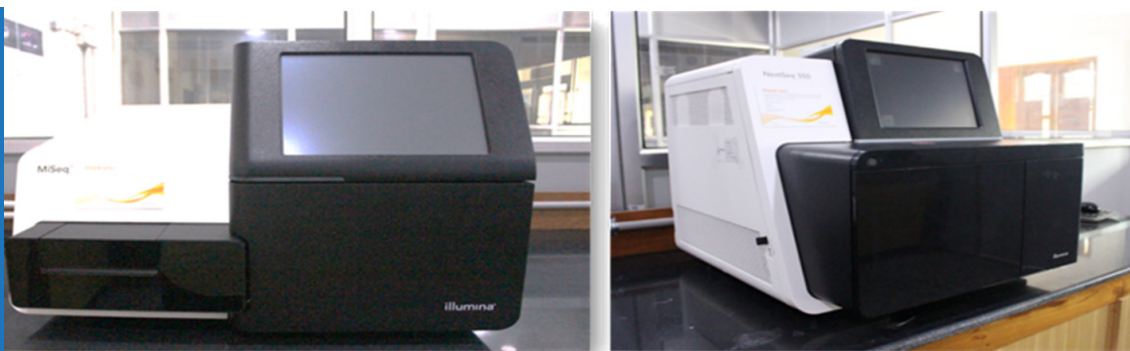
ABI3730xl DNA analyzer

The ABI 3500 Genetic Analyzer at BRIC-IBSD (Institute of Bioresources and Sustainable Development), BRIC-NABI (National Agri-Food Biotechnology Institute) supports targeted DNA analysis and SNP genotyping.



**ABI 3500 Genetic Analyzer**

Short-read sequencing platforms include the Illumina NextSeq 550 and Illumina MiSeq System deployed across BRIC-NIPGR, BRIC-IBSD, BRIC-ILS, BRIC-NABI, and BRIC-NCCS (National Centre for Cell Science) for targeted resequencing and amplicon analysis. Long-read sequencing capabilities through Oxford Nanopore Technologies platforms (MinION, GridION, PromethION) at BRIC-NIBMG and BRIC-RGCB enable detection of structural variants and real-time sequencing.



**MiSeq**

**NextSeq 550**

The National Genomics and Genotyping Facilities at BRIC-NIPGR provide four integrated platforms: fluorescent SNP genotyping with LGC Array Tape/KASP, array-based SNP genotyping with Affymetrix GeneTitan, NGS-based genotyping using NovaSeq 6000, and high-performance computing infrastructure. Additional capabilities include the 10X Genomics Single Cell Platform at BRIC-RGCB for single-cell genomics and spatial genomics applications.



## 2. Mass Spectrometry and Proteomics Infrastructure

Mass spectrometry facilities span multiple complementary technologies across institutes. High-resolution systems include the Thermo Scientific Orbitrap Fusion Lumos at BRIC-ILS and BRIC-NCCS, the Orbitrap Eclipse Tribrid at BRIC-RGCB for phosphoproteomics, and Q-Exactive HF/Plus instruments at BRIC-NIAB (National Institute of Animal Biotechnology and BRIC-NIBMG).

Triple TOF systems deliver high-resolution LC-MS/MS capabilities: the AB Sciex TripleTOF 6600 at NABI, NCCS, and ILS, the TripleTOF 5600 at BRIC-NABI, and the cutting-edge Zeno TOF 7600 at BRIC-inStem (Institute for Stem Cell Biology and Regenerative Medicine) for advanced protein and metabolite analysis.



Zeno-TOF 7600

Targeted proteomics and metabolomics are supported by Triple Quadrupole systems including the Thermo Scientific TSQ Quantis Plus at BRIC-RGCB and BRIC-ILS, AB Sciex QTRAP 6500+ at BRIC-NIPGR, BRIC-ILS, and BRIC-NABI for MRM analysis. Gas Chromatography-Mass Spectrometry systems at BRIC-NABI, BRIC-NIPGR, BRIC-IBSD, and BRIC-NCCS enable volatile compound and metabolite profiling.

Elemental analysis capabilities include the PerkinElmer NexION 5000 ICP-MS/MS at BRIC-NABI, Agilent 7800 ICP-MS at BRIC-NIPGR, and Thermo Scientific iCAP TQ at BRIC-CDFD for comprehensive elemental profiling of biological samples.

### 3. Advanced Microscopy and Imaging Technologies

Electron microscopy infrastructure represents state-of-the-art imaging capability. The Titan Krios G3 cryo-TEM at BRIC-inStem operates at 300kV for atomic resolution structure determination. Additional transmission electron microscopes include the Thermo Scientific Talos F200i S/TEM at BRIC-RGCB, JEOL JEM-2100plus at BRIC-ILS, and JEOL JEM-1400 systems at BRIC-IBSD and BRIC-NABI for biological and materials science studies.

Scanning electron microscopy platforms include the Carl Zeiss EVO LS 10/EVO 18 environmental SEMs at BRIC-NIPGR, BRIC-NCMR, and BRIC-NIAB,

Thermo Fisher Apreo-S FESEM at BRIC-NABI and BRIC-ILS. Supporting equipment includes Leica UC7 ultramicrotomes at BRIC-ILS and BRIC-NIAB for TEM sample preparation.

Confocal laser scanning microscopy systems provide advanced optical imaging: Zeiss LSM 880 with Airyscan at BRIC-NABI and BRIC-NCCS enabling super-resolution imaging to 140nm, Leica TCS SP8 with white light laser at BRIC-NIAB, BRIC-RGCB, and BRIC-NCCS, Leica SP8 FALCON for FLIM/FRET measurements at BRIC-RGCB, Nikon A1R si with 32-array spectral detector at BRIC-RGCB, and Olympus FV3000 at BRIC-RGCB and BRIC-NCCS for weak emission samples.



EVO LS 10 of Carl Zeiss NTS, Germany



**Confocal LASER Scanning Microscope**

Super-resolution and specialized imaging includes the Carl Zeiss Elyra P.1 with LSM 880 at BRIC-NIAB and BRIC-NCCS combining SIM and STED capabilities, Olympus SPIN SR 10 at BRIC-NCCS, and Nikon SIM at BRIC-RGCB. Multiphoton imaging is available through the Nikon AIR MP at BRIC-RGCB and Leica THUNDER Imager Tissue at BRIC-NABI. High-content screening systems include the Perkin Elmer Operetta CLS at BRIC-NIAB and Molecular

Devices ImageXpress Confocal at BRIC-RGCB.

In vivo imaging capabilities include the Xenogen IVIS Spectrum at BRIC-RGCB and BRIC-NII (National Institute of Immunology), Lago X small animal imaging at BRIC-THSTI (Translational Health Science and Technology Institute), and Metasystem-Zeiss Axiolmager spectral karyotyping at BRIC-RGCB.



**Perkin Elmer: Operetta CLS**



Multiphoton Confocal Nikon A1R MP

Laser Scanning Confocal (Leica SP8 WII)

ImageXpress® Confocal HT.ai High-Content Imaging System



In Vivo Small Animal Imager (IVS Spectrum, Perkin Elmer)



Spectral Karyotyping Platform: Metasystem -Zeiss AxioImager

#### 4. Flow Cytometry and Cell Analysis

High-speed cell sorting systems enable single-cell isolation and analysis. The BD FACS Aria series (II, III, Fusion) platforms at BRIC-NIAB, BRIC-RGCB, and BRIC-NIBMG feature 4-laser configurations with 14-18 parameters and multi-way sorting capabilities. The BD FACS Melody at BRIC-NIAB provides 3-laser configuration with 10 parameters and single-cell sorting.

The Beckman Coulter MofloAstrios EQ at BRIC-RGCB, BRIC-ILS, and BRIC-NCCS represents cutting-edge 6-way sorting with 7 lasers (355/405/488/532/561/592/640nm) and 22 fluorescent colors. Additional analyzers include the BD LSR Fortessa/Fortessa SORP at BRIC-NIAB, BRIC-ILS, and BRIC-NCCS with 18-parameter capacity, Beckman Coulter CytoFLEX S at BRIC-ILS, BD Accuri C6 Plus and BD FACS Calibur at BRIC-NCCS, and the Cytex Aurora 5-laser 64-parameter system at BRIC-NCCS and BRIC-ILS.

Specialized systems include the Helios CyTOF mass cytometry system at BRIC-ILS for high-dimensional

analysis and ImageStream X imaging flow cytometry at BRIC-ILS combining microscopy with flow analysis.



BD FACS ARIA

## 5. Structural Biology and Analytical Instruments

X-ray crystallography infrastructure supports protein structure determination. The Rigaku FRX Rotating Anode System at BRIC-NCCS delivers high-flux X-ray generation with 67kW/mm<sup>2</sup> brightness.

The Rigaku-Synergy Custom System at BRIC-ILS features RA-Micro 7HF X-ray generator with HyPix6000 detector for protein crystallography. The SPT LabTech Mosquito XTal 3 robotic crystallization system at BRIC-ILS enables rapid crystallization setups.

Analytical ultracentrifugation through the Beckman Coulter Optima AUC at BRIC-ILS supports protein complex characterization via sedimentation velocity and equilibrium experiments.

Complementary analytical instruments include the Bruker AVANCE NEO 500MHz NMR at BRIC-CDFD for solution-state NMR studies, QuantStudio systems at BRIC-IBSD and BRIC-RGCB for real-time PCR and Bio-Layer Interferometry systems at BRIC-THSTI for label-free binding kinetics analysis.



Rigaku FRX

## 6. Computational Biology and Biorepository Services

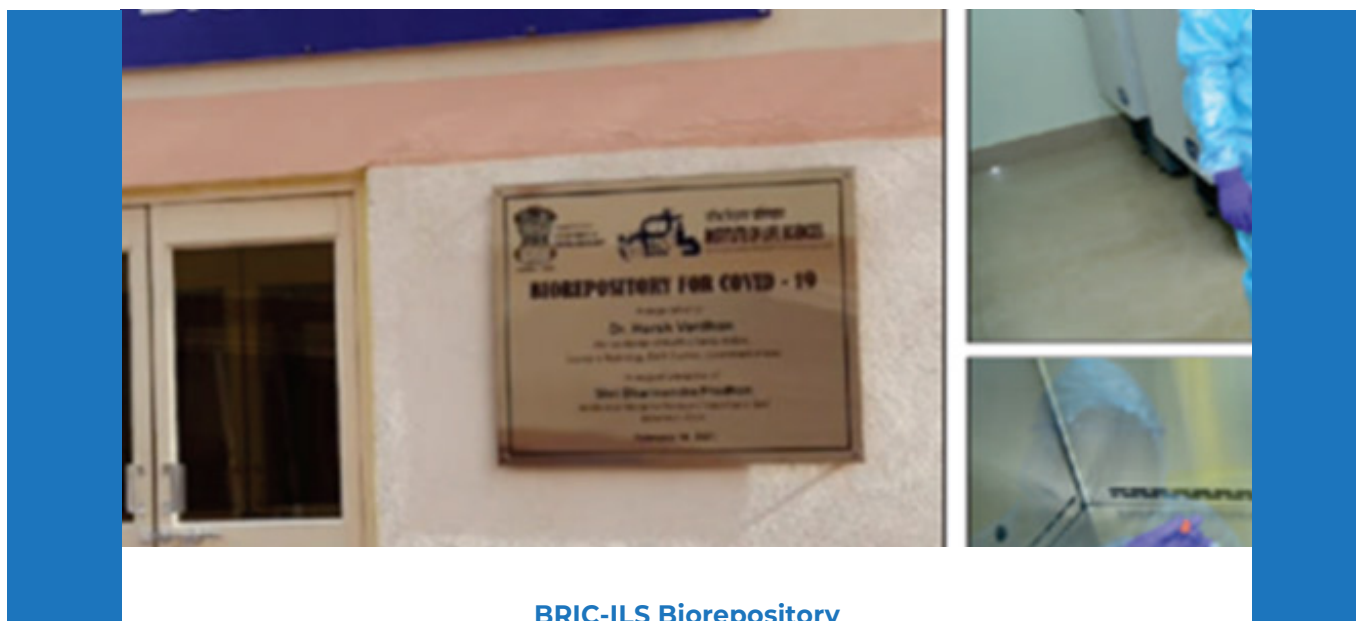
High-performance computing infrastructure enables large-scale data analysis. The BRIC-NIPGR National Plant Computational Biology Facility operates HPC clusters with hundreds of parallel processors and 100GBPS Ethernet connectivity for 24/7 operations. The BRIC-NIBMG Data Centre maintains over 3.5 petabytes of storage with peta-scale DDN central storage, GPU-enabled HPC clusters, and Infiniband high-speed networks supporting AI-driven data mining and multi-omics analysis.

The BRIC-NCCS Computational Facility includes 160-core GPU computing clusters with IBM Power8/Power9 CPUs, HP workstations, and comprehensive bioinformatics software including AMBER18, GROMACS, GATK, and NCBI-BLAST for RNA-seq, ChIP-seq, and molecular dynamics simulations.

Bioinformatics services encompass genome assembly and annotation, RNA-seq analysis, whole genome and exome sequencing analysis, phylogenetic analysis, metagenomics, molecular docking simulations, and single-cell data analysis across institutes.

Biorepository facilities include the BRIC-ILS Biorepository with SARS-CoV-2 isolation capabilities, BRIC-THSTI Biorepository with -80°C and -196°C LN<sub>2</sub>

storage, and the BRIC-NCCS National Cell Repository maintaining approximately 200 continuous cell lines with STR profiling and mycoplasma testing services



**BRIC-ILS Biorepository**

## 7. Animal Models, Biosafety, and Bioprocessing

Small animal facilities across BRIC-AI institutes maintain diverse species including Balb/c, C57BL/6, NOD SCID mice, Wistar and Sprague Dawley rats, hamsters, rabbits, and guinea pigs. Infrastructure includes individually ventilated caging systems, transgenic and immunodeficient mouse rooms, and CCSEA registration with 24/7 surveillance.

The BRIC-NIAB Large Animal Facility maintains indigenous cattle and goat breeds with veterinary ultrasound and operation theatre capabilities.

Experimental Animal facility: A state-of-the-art facility, at BRIC-THSTI includes the first Ferret Facility in India, which has established various animal model platforms that support pre-clinical research in the area of both communicable and non-communicable diseases.

To enhance preparedness for the emergence and spread of infectious diseases, as well as to evaluate vaccines, drugs, and other treatments under preclinical

conditions on Non-Human Primates prior to human trials, the BRIC-NII has established an ABSL3 facility for Non-Human Primates. Its the second ABSL3 facility for Non-Human Primates in India, capable of accommodating 18 Macaques at any given time. This ABSL3 facility is designed to facilitate the testing of vaccines and therapeutics to verify their safety and effectiveness.

The BRIC-inStem Mouse Genome Engineering Facility provides comprehensive CRISPR-based knockout/knock-in services, transgenic models, sperm cryopreservation, and embryo transfer services.

BSL-3 laboratory infrastructure includes the BRIC-ILS BSL-3 facility with virus and bacterial culture labs and SARS-CoV-2 animal challenge platform, and the BRIC-RGCB BSL-3 Laboratory in Kerala—India's first comprehensive modular BSL-3 facility with two research suites and animal holding capacity for Risk Group 3 pathogen research.

Bioprocessing infrastructure includes benchtop

bioreactors (7L and 14L) at BRIC-THSTI for mammalian cells, bacteria, and yeast cultivation, cross-flow filtration systems, high-pressure homogenizers, and the CELLINK BioX6 3D bioprinter featuring 6 printing slots with pneumatic extrusion, inkjet printing, photocuring, and thermoplastic extrusion capabilities.

Immunogenicity testing services include multiplex immunoassay platforms (Bio-Plex 200 at BRIC-NII, MSD SQ120mm at BRIC-ILS), COVID-19 antibody testing, pseudo-virus neutralization assays, cytokine profiling, and comprehensive PBMC profiling with 38-panel tests for vaccine development and immunological studies.



**BRIC-RGCB BSL-3 Laboratory**

**CELLINK BIO X6**

**Conclusion**

The BRIC-AI network institutes represent India's commitment to world-class biotechnology research infrastructure. These integrated facilities—spanning genomics, proteomics, advanced imaging,

computational biology, and translational research capabilities—position India as a global leader in biomedical research, supporting discoveries in human health, agricultural genomics, vaccine development, and innovative therapeutic approaches.

# 05 TECHNOLOGIES DEVELOPED AT iBRIC

## CELEBRATING OUTSTANDING SCIENTIFIC ACHIEVEMENTS

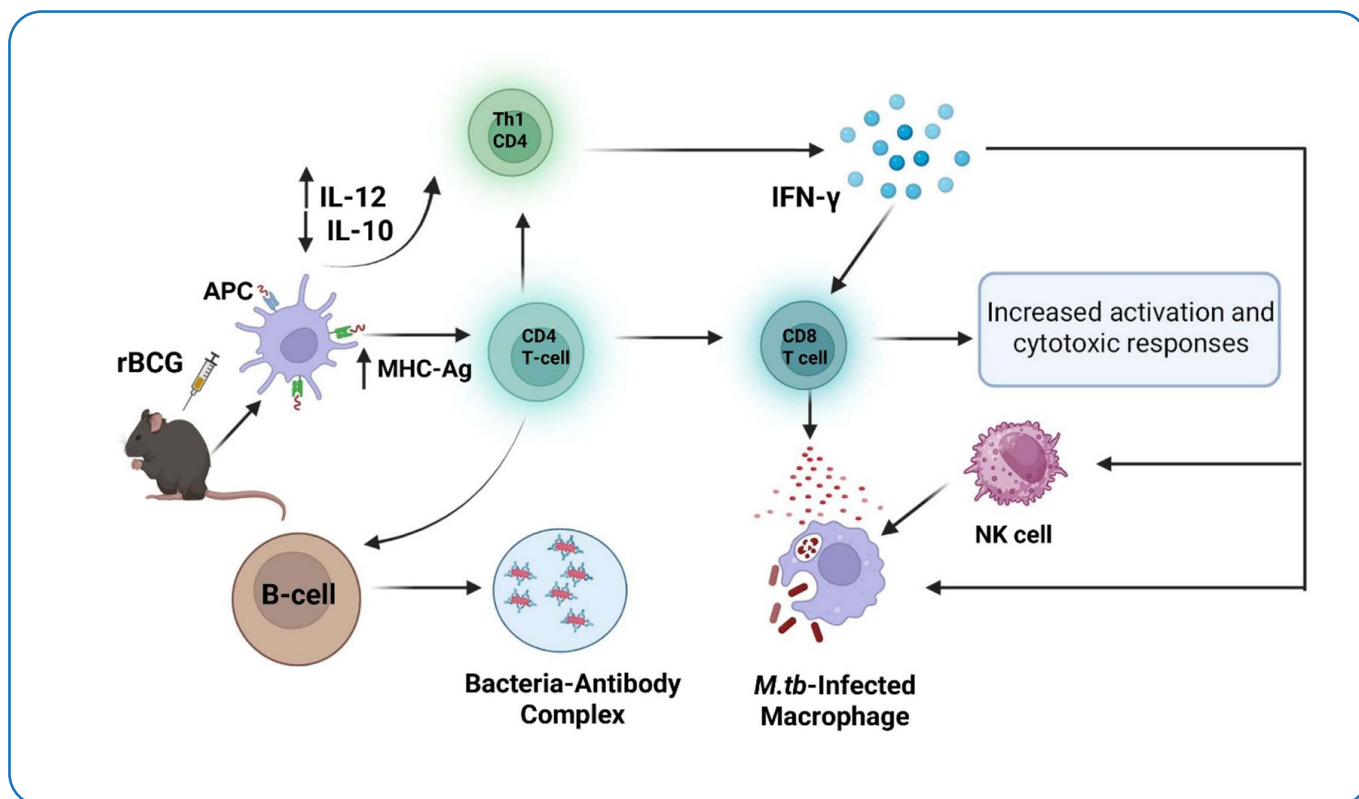
### BRIC-CDFD

#### BRIC-Center for DNA Fingerprinting and Diagnostics Major Technologies developed

- **Recombinant BCG as a vaccine candidate against tuberculosis**

The currently used BCG vaccine is controversial for its efficacy to control tuberculosis (TB) epidemic. The reduced efficacy of BCG vaccine could be due to its deficiency in achieving higher immunogenicity, demanding creation of a new promising BCG vaccine with a superior protective capacity to that of BCG. Engineering the BCG vaccine to induce high IL-12/IL-10

cytokine ratio can activate more T-cell response and a skewed Th1-type immune phenotype that are important for anti-TB immunity. The recombinant BCG vaccine (rBCG) generated by us induces higher IL-12/IL-10 ratio as compared to the conventional BCG. Also, rBCG showed improved antigen presentation, T-cell activation and a skewed Th1-type immune-response than BCG in mice model. Thus, rBCG could increase the efficacy of BCG vaccine to better protect against *M. tuberculosis*. This study is likely to describe the creation of a new promising vaccine for TB (Indian patent filing is under process)



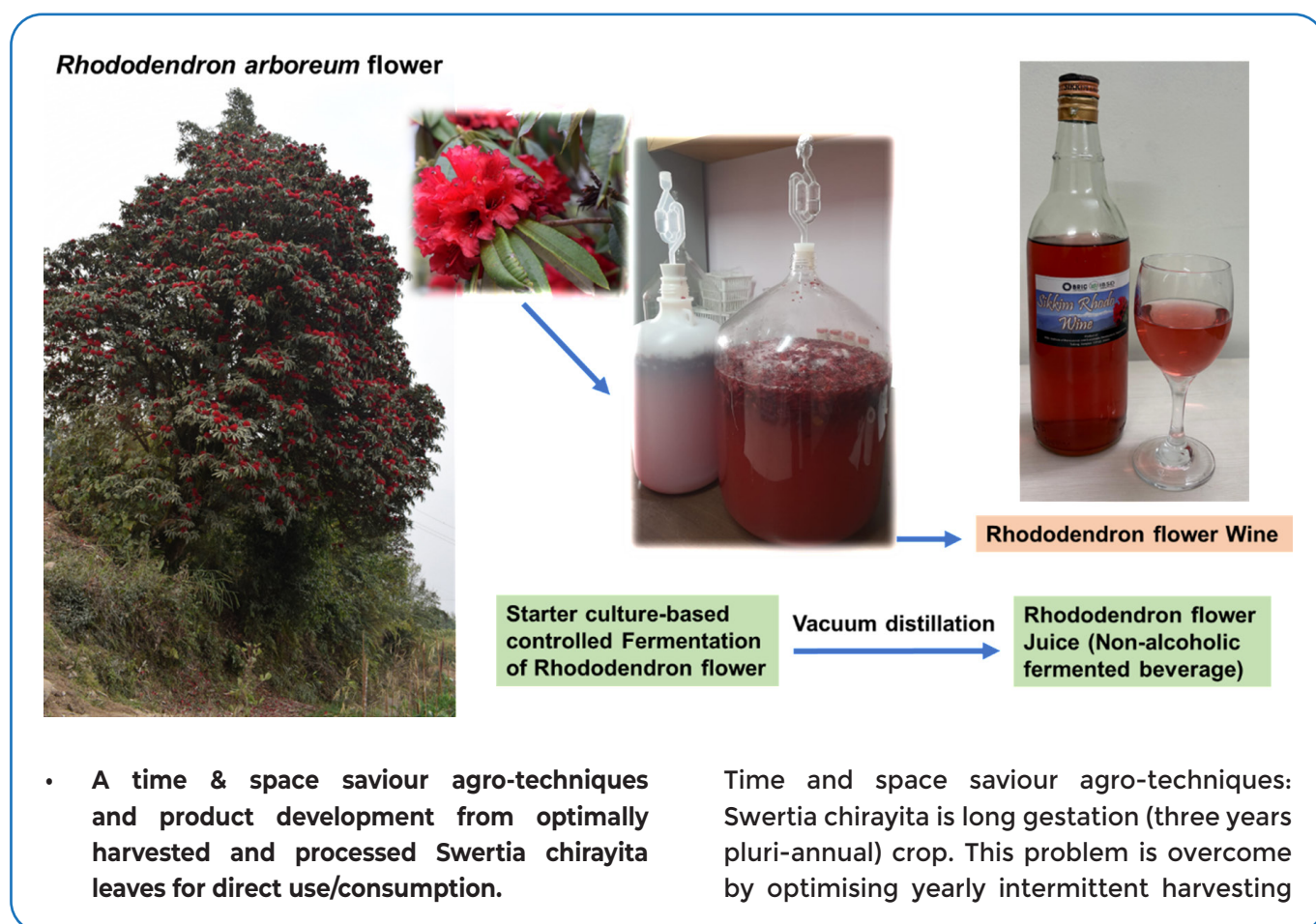
## BRIC- IBSD

### BRIC- Institute of Bioresources and Sustainable Major Technologies Transferred

- A process for Rhododendron flower wine production using a starter culture, and a process for producing non-alcoholic fermented beverages (less than 0.5% ethanol v/v).

The Himalayan region is home to a rich diversity of Rhododendron species, with more than 100 species in India alone. The flower of Rhododendron arboreum is traditionally used as a source of food-grade natural colourant and flavouring agent. In addition, Rhododendron flowers are naturally fermented into wine, which is in high demand in this region. As natural fermentation results in non-reproducible wine quality, its commercialisation is very much limited. BRIC-IBSD developed a starter culture (an enologically

superior *Saccharomyces cerevisiae* strain H30Y4, selected from Hamei, a traditional starter used for rice wine fermentation in Manipur) and a process for making Rhododendron flower wine with high acceptability during sensory analysis. Fermentation resulted in effective colour extraction from Rhododendron flowers. As the alcohol content in Rhododendron wine (more than 8% v/v) limits its health claims (as per FSSAI guidelines), BRIC-IBSD optimised a vacuum distillation process to reduce the alcohol content to less than 0.5% v/v without compromising its sensory properties. The reduction in alcohol content makes it a non-alcoholic fermented beverage with health benefits. By this biomanufacturing approach, the Rhododendron flower resources available in the Himalayan region can be processed through fermentation to value-added products for economic benefits.



in minimum space. Optimized intermittently harvested leaves assessed for metabolite content. Time saviour agro-technique showed successful leaves harvesting with high metabolites content during first and second growth years, which are value added for product development. Metabolites amarogentin, mangiferin and swertiamarin ranged from 6.96 to 7.94 µg/mg, 107.5 to

132.46 µg/mg and 118.22 -200.00 µg/mg, respectively. Space saviour agro-techniques utilize the cliff area between the tiers of land (in hilly/mountainous regions) for *S. chirayita* raising to yield additional farmer income. The average yield of dry leaves, stem, flower and fruits was about 9g, 32g, 21g and 5 g per square meter, respectively.

***Gaultheria fragrantissima* oil extraction optimization for high methyl salicylate content and product development**



*G. fragrantissima* optimized agro-technique



Farmers with their field & yield



Farmers field training



Field training of aromatic oil extraction

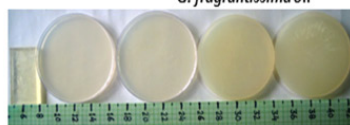
S.No.	Sample ID	Compound Name	%
1	Wintergreen I	Methyl salicylate	96.72
2	Wintergreen II	Methyl salicylate	99.10
3	Wintergreen III	Methyl salicylate	100.27

Methyl salicylate content in *G. fragrantissima* oil



*G. fragrantissima* oil

- oil percentage was evaluated to maximum content of 1.5%
- methyl salicylate content ranging from 96.72% to 100.27% in the extracted oil



*G. fragrantissima* soap

Evaluation, value addition and product development form aromatic oil of *G. fragrantissima*

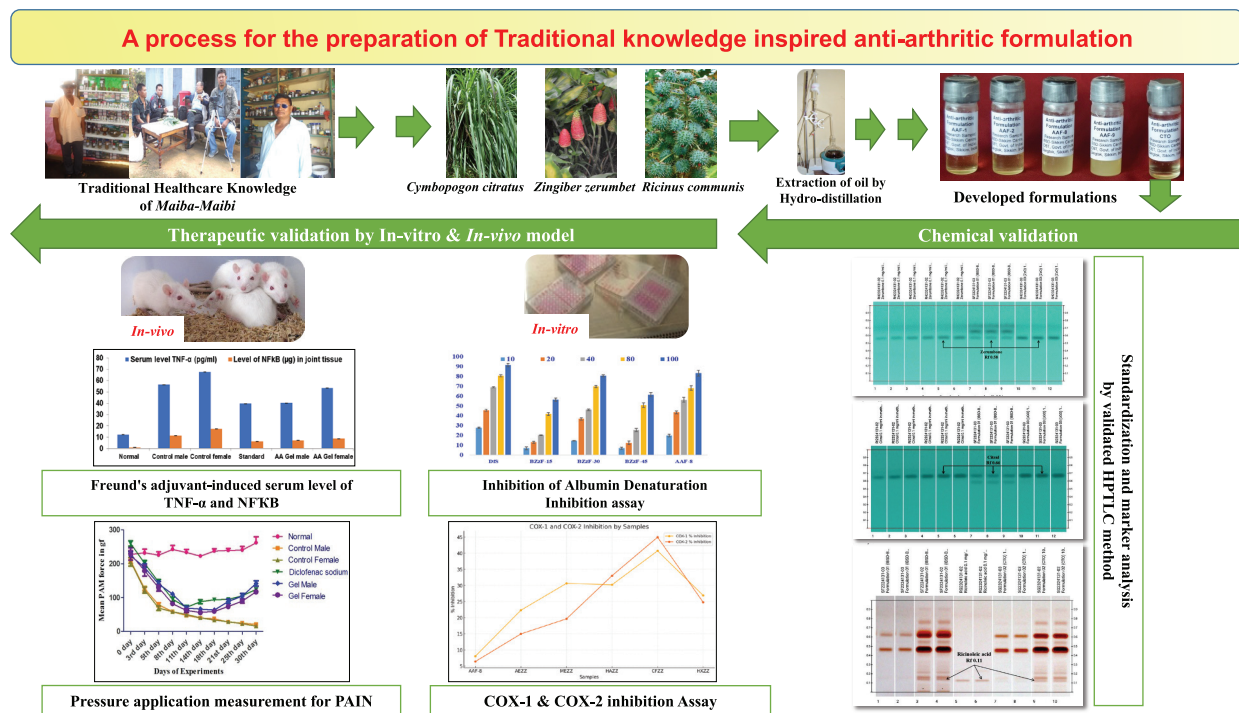
- **Traditional knowledge guided oil-based Anti-arthritic gel developed for the treatment of arthritis/joint inflammation.**

The invention presents a standardized plant-derived anti-arthritic formulation developed from traditional medicinal knowledge of Manipur. The formulation combines bioactive chemically

characterized essential oil from Zingiber zerumbet rhizome, Cymbopogon flexuosus leaves and Ricinus communis seeds. The formulation demonstrates strong anti-inflammatory and anti-arthritic properties, evidenced by reduced edema, decreased pain response, and lowered TNF-α/NF-κB expression in CFA-induced arthritic rat models. HPTLC analysis confirms

three key therapeutic phytoconstituents: zerumbone, citral, and ricinoleic acid. This safe, chemically characterized topical formulation

offers an effective, traditional knowledge-based alternative therapeutic for managing joint and muscle pain.



## BRIC-ILS

BRIC-Institute of Life Sciences  
Major Technologies developed

### A. Protein Subunit Vaccine Composition against Mycobacterium tuberculosis.

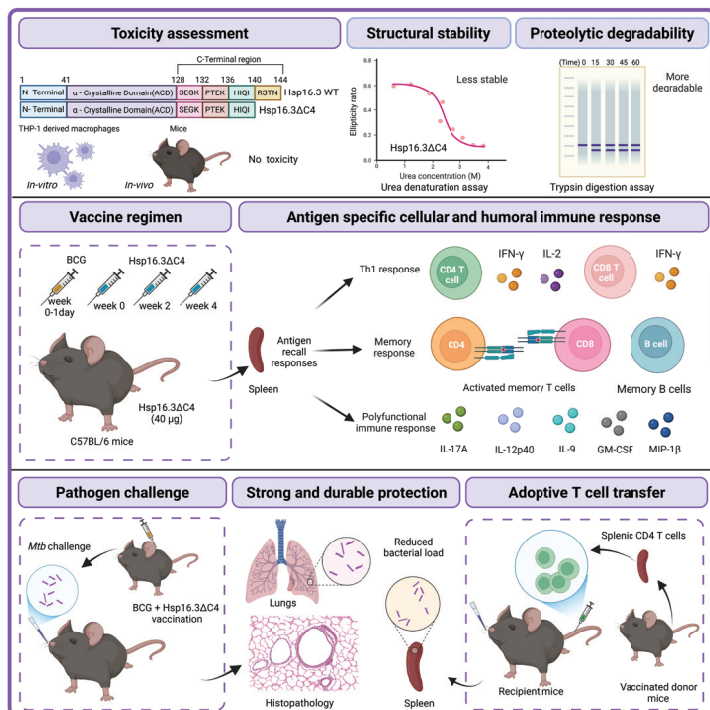
Name of the patent	:	Protein Subunit Vaccine Composition against <i>Mycobacterium tuberculosis</i>
Inventor	:	Sunil Kumar Raghav, Ashis Biswas, Subhasish Prusty, Subhashree Barik and Alok Kumar Panda
Patent Application Number	:	202531019685

#### Summary of the technology:

Tuberculosis (TB) is one of the world's deadliest infectious diseases and the currently available BCG vaccine, developed a century ago, offers limited protection primarily to infants and does not sufficiently protect adolescents and adults from pulmonary TB. This next-generation

vaccine is composed of novel recombinant subunit protein, designed to more effectively target *Mycobacterium tuberculosis*. This vaccine addresses the limitations of BCG by triggering a more robust, targeted, and long-lasting immune response.

## Protein Subunit Vaccine Composition against *Mycobacterium tuberculosis*



### Key Preclinical Findings

Promising results from successful preclinical evaluation

- Robust **IFN- $\gamma$**  & **IL-2** mediated **Th1 response**
- Enhanced Cellular & Humoral response
- Strong **Memory B and T cells** responses
- Can be used **stand alone** or **co-administered with BCG**
- CD4<sup>+</sup> T cell** confers protection against tuberculosis

## B. Cinnamic acid-derived N-heterocyclic compounds (TPDM and TF) inhibit SARS - CoV-2 infection and its method of preparation.

Name of the patent	:	Cinnamic acid-derived N-heterocyclic compounds (TPDM and TF) inhibit SARS- CoV-2 infection and its method of preparation
Inventor	:	Soma Chattopadhyay, Bharat Bhusan Subudhi, Tompe Krishna Vitthalrao, Koustav Chatterjee, Ipsita Mohant and Soumyajit Ghosh
Patent Application Number	:	202531031984

### Summary of the technology:

This invention reports the development of cinnamic acid-derived N-heterocyclic compounds with a thiadiazole moiety, namely TF and TPDM, that exhibit strong antiviral activity against SARS- CoV-2. While cinnamic acid itself lacks efficacy against SARS-CoV-2, derivatization with thiadiazole generated novel compounds that significantly reduced viral copy numbers

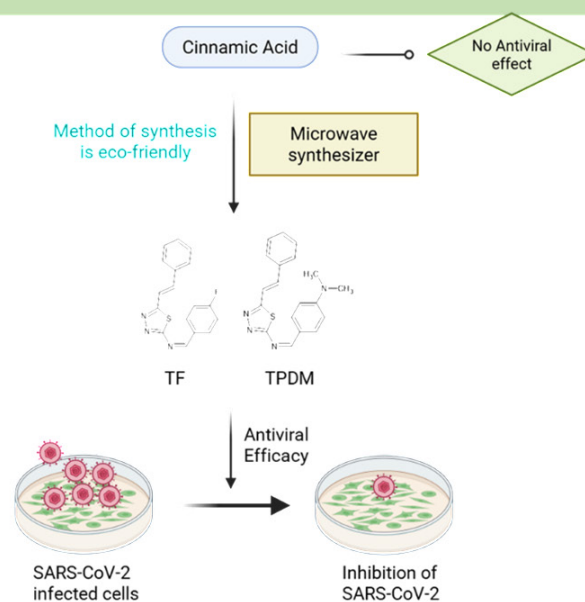
(>94%) at non-toxic concentrations (25  $\mu$ M). TF and TPDM showed IC50 values of 19.62  $\mu$ M and 17.5  $\mu$ M, with selectivity indices of 2.53 and 3.85, respectively, indicating potent inhibition of viral replication. The compounds were synthesized using a novel microwave irradiation method, which proved eco-friendly and highly efficient. Compared to conventional methods (reflux: 47%, stirring: 59%), the microwave approach achieved a higher yield (72%), reduced solvent

use (2 mL ethanol), and shortened reaction time (11 minutes). The purity of the final products exceeded 95%. Antiviral efficacy was confirmed through qRT-PCR and plaque assays in Vero cells, showing significant reductions in viral RNA

copies and plaque formation. Overall, TF and TPDM represent promising antiviral candidates against SARS-CoV-2, supported by an efficient, green synthesis strategy with potential scalability for therapeutic development.

### Cinnamic acid-derived N-heterocyclic compounds (TPDM and TF) inhibit SARS-CoV-2 infection and its method of preparation.

- The synthesized compounds (TF & TPDM) effectively reduced SARS-CoV-2 viral copy number by more than 90% at non-cytotoxic concentrations, with an IC<sub>50</sub> of 19.52 μM and 17.8 μM, respectively.
- The synthesis method is a green and efficient (rapid, cost-effective, and readily scalable) alternative to traditional approaches.



### C. Salicylic acid derived carbon dots (SA-CDS) inhibiting SARS-COV-2 infection and its method of preparation

Name of the patent	:	Salicylic acid derived carbon dots (SA-CDS) inhibiting SARS-COV-2 infection and its method of preparation
Inventor	:	Soma Chattopadhyay, Bharat Bhusan Subudhi, Tompe Krishna Vitthalrao, Koustav Chatterjee, Ipsita Mohant and Soumyajit Ghosh
Patent Application Number	:	202531031962

#### Summary of the technology:

Since the global outbreak of COVID-19 caused by the SARS-CoV-2 virus, no single antiviral drug has been universally approved as a definitive cure for SARS-CoV-2 infection.

Several repurposed drugs have been used under emergency and there is an ongoing need for novel antiviral agents.

This invention presents a novel approach involving the synthesis of water-soluble

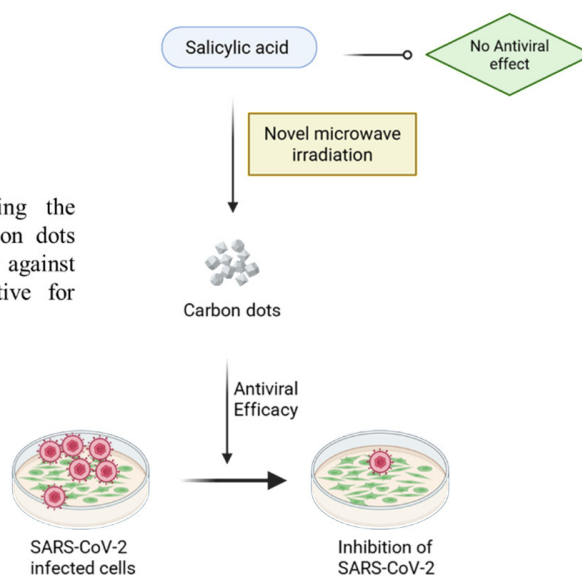
salicylic acid- derived carbon dots (SA-CDs), which demonstrate potent antiviral activity

against SARS-CoV-2, thereby offering a promising alternative for antiviral therapy.

**Salicylic acid derived carbon dots (SA-CDS) inhibiting SARS-CoV-2 infection and its method of preparation.**

**Key Findings**

This invention presents a novel approach involving the synthesis of water-soluble salicylic acid-derived carbon dots (SA-CDs), which demonstrate potent antiviral activity against SARS-CoV-2, thereby offering a promising alternative for antiviral therapy.



**D. Triptolide and composition thereof for inducing insulin production.**

Name of the patent	:	Triptolide and composition thereof for inducing insul production
Inventor	:	Amaresh Chandra Panda and Susovan Sadhukhan
Patent Application Number	:	202531047374

**Summary of the technology:**

The worldwide frequency of hyperglycemic/ diabetic patients is increasing day by day. Diabetes, which leads to multi-organ disability, is still a headache for clinicians to get rid of the disease completely. This ultimately creates a very high demand for novel therapeutic inventions for the treatment of diabetes. Our present invention relates to a novel use of Triptolide for inducing a high level of insulin from pancreatic beta cells. In contrast to the well-established role of Triptolide as a global transcription blocker, we discovered its

effect on beta cell function and activity in terms of insulin expression and secretion. This unexpected pharmacological effect of Triptolide opens a new avenue in the therapeutics of diabetes mellitus. Our invention also encompasses the formulation of Triptolide with the globally used anti-diabetic drug Metformin, providing a combinatorial strategy to treat diabetes, as it results in a marked increase in insulin expression from beta cells. Overall, this discovery redefines the role of Triptolide at the cellular level, enhancing blood glycaemic control by stimulating beta-cell activation and insulin secretion.

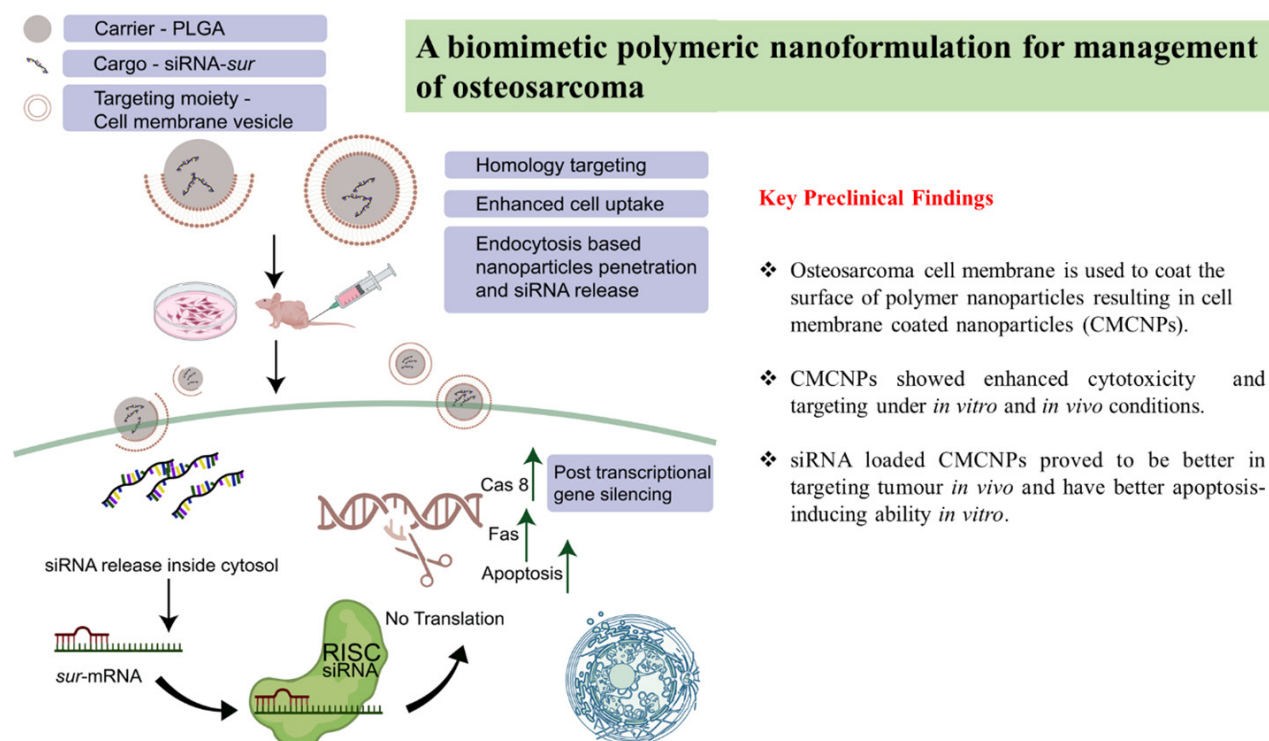
### E. A biomimetic polymeric nanoformulation for management of osteosarcoma.

Name of the patent	:	A biomimetic polymeric nanoformulation for management osteosarcoma
Inventor	:	Mamoni Dash and Pratigyan Dash
Patent Application Number	:	202531048304

#### Summary of the technology:

Osteosarcoma is a fast-growing malignant bone tumor with early metastasis, requiring early diagnosis and precise treatment. Conventional therapies often fail due to drug resistance and poor targeting, risking damage to healthy tissues. This invention

presents a biomimetic nanoformulation using PLGA nanoparticles coated with K7M2 osteosarcoma cell membranes. These Cell Membrane-Coated Nanoparticles (CMCNPs) deliver siRNA against the Survivin gene, achieving tumour-specific uptake via homotypic recognition.



## F. Infectious clones of chikungunya virus.

Name of the patent	:	Infectious clones of chikungunya virus
Inventor	:	Soma Chattopadhyay, Eshna Laha, and Sharad Singh
Patent Application Number	:	202531053475

### Summary of the technology:

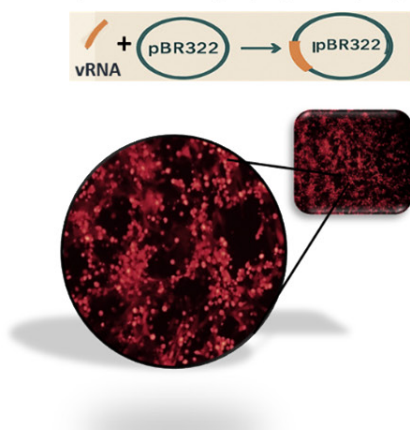
The invention titled “Infectious Clones of Chikungunya Virus” (Provisional Patent Application No. 202531053475) relates to the development of infectious cDNA clones of Indian strain (IS; GenBank Accession: PP349434.1) and African prototype strain (PS; GenBank Accession: AF369024.2) of Chikungunya virus (CHIKV). Viral genomes (~12 kb) were divided into fragments and sequentially cloned into a pBR322 backbone, yielding icIS-pBR322 and icPS- pBR322. Clone-derived viruses were successfully rescued in mammalian cells and deposited at the Korean Collection for Type Cultures (KCTC) with

accession numbers: KCTC 16310BP (icIS virus), KCTC 16311BP (icIS-mCh virus), KCTC 16312BP (icPS virus), and KCTC 16313BP (icPS-mCh virus). These viruses demonstrated replication kinetics and cytopathic effects comparable to parental strains, with mCherry fluorescence evident within 24–48 hours post transfection. The disclosed system enables generation of attenuated strains, vaccine candidates, subgenomic replicons for drug screening, and antiviral assays. It further provides a reverse genetics platform for studying CHIKV replication, host-pathogen interactions, and molecular determinants of virulence and pathogenesis.

## INFECTIOUS CLONES OF CHIKUNGUNYA VIRUS

### Infectious cDNA clones of Indian strain (IS) and African prototype strain (PS)

12 Kb viral genome cloned into vector pBR322 to generate infectious clones of IS (icIS) and PS (icPS)



### Key Findings

- ❖ Mutational studies to understand disease transmission
- ❖ Screening of antiviral agents
- ❖ Generation of attenuated strains for vaccine research
- ❖ Real time *in vivo* tracking of tagged-virus to monitor virus dissemination
- ❖ Studying host-pathogen interactions and molecular determinants for understanding virulence and pathogenesis

**G. Pharmaceutical compositions comprising sertaconazole or oxiconazole as efflux pump inhibitors for treating multidrug-resistant Staphylococcus aureus infections.**

Name of the patent	:	Pharmaceutical compositions comprising sertaconazole or Oxiconazole as efflux pump inhibitors for treating multidrug-resistant Staphylococcus aureus infections
Inventor	:	Tushar Kant Beuria and Suvendu Ojha
Patent Application Number	:	202531053455

**Summary of the technology:**

This invention highlights the novel repurposing of the FDA-approved antifungal agents sertaconazole and oxiconazole as efflux pump inhibitors (EPIs) to combat multidrug-resistant Staphylococcus aureus (MDR-S. aureus). Overexpression of efflux pumps such as norA, norB, and abcA is a major cause of resistance in S. aureus, as these systems expel antibiotics and reduce their intracellular concentrations. The present study demonstrates that sertaconazole and oxiconazole exert strong EPI activity, enhancing the effectiveness of fluoroquinolones (norfloxacin, moxifloxacin) and  $\beta$ -lactams (cefotaxime). In vitro results revealed significant synergistic effects, with greater than fourfold reductions in minimum inhibitory concentrations (MICs) and marked

increases in intracellular drug accumulation. In vivo experiments further confirmed a more than two-log reduction in bacterial load. Mechanistic investigations showed that both agents depolarize the bacterial membrane potential, disrupting the proton motive force required for efflux pump function, thereby improving antibiotic retention without damaging membrane integrity. Notably, sertaconazole synergized most effectively with norfloxacin and cefotaxime, while oxiconazole showed strong synergy with moxifloxacin and cefotaxime. Given the growing global threat of MDR-S. aureus and the challenges in developing new EPIs, the discovery of clinically approved drugs with inherent antibacterial properties offers a cost-effective and rapid strategy to restore antibiotic efficacy.

**H. A kit-based method for evaluating and monitoring the efficacy of tuberculosis treatment to develop personalized therapy**

Name of the patent	:	A kit-based method for evaluating and monitoring the efficacy tuberculosis treatment to develop personalized therapy
Inventor	:	Sunil Kumar Raghav, Subhasish Prusty and R. Divya
Patent Application Number	:	202531072431

**Summary of the technology:**

The present invention relates to the field of tuberculosis therapy. More particularly the present invention provides a kit-based method for evaluating and monitoring the efficacy of tuberculosis treatment to develop and generate personalized therapy plans. The present invention presents a flow cytometry-based assay kit for

measuring Nuclear Receptor Co-Repressor 1 (NCOR1) protein levels in macrophages and dendritic cells in the blood and sputum of tuberculosis patients during their treatment regimen to predict the therapy response and its effectiveness, enabling real-time, personalized therapy decisions for both pulmonary and extrapulmonary tuberculosis (TB) disease to generate effective personalized therapy plans

**Major Technologies transferred**

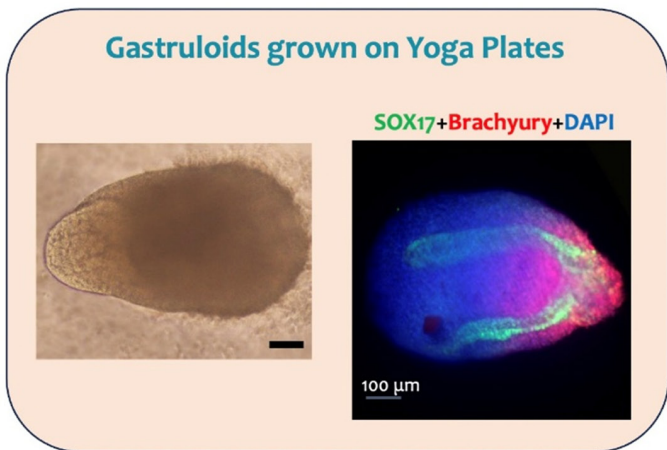
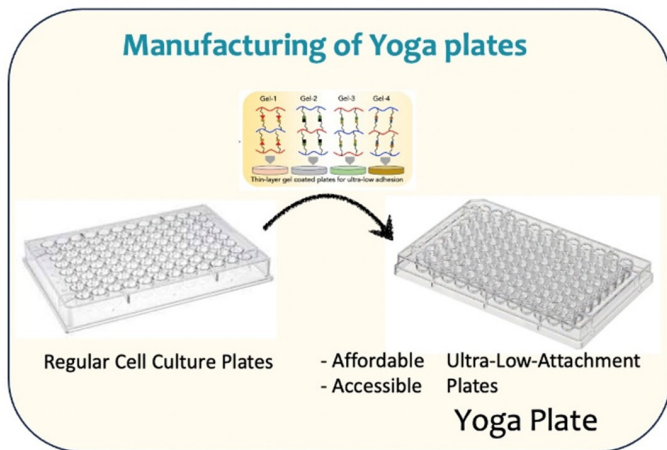
Enhancing intra- cellular nitric oxide generation. Transferred to Byonox Private Ltd., on November 18, 2024. Name of the Inventor : Dr. B. Ravindran

**BRIC-inStem**

**BRIC- Institute for Stem Cell Science and Regenerative Medicine**  
**Major Technologies developed**

Yoga plates technology (ultra-low-attachment plates) for stem cell and organoid research: BRIC-

inStem is focused on developing alternative and affordable reagents/consumables to accelerate research in India. As a part of this effort, ultra-low-attachment plates have been developed that can be used in stem cell research, drug screening and 3D-cultures.



## BRIC-NABI

**BRIC- National Agri-Food Biotechnology Institute  
Regenerative Medicine  
Major Technologies developed**

- **Dr. Monika Garg has successfully registered two innovative wheat plant germplasms with the Protection of Plant Varieties and Farmers' Rights Authority (PVPFRA). These biofortified varieties are rich in anthocyanins, providing antioxidant benefits that can help combat lifestyle-related disorders.**

Colored rice and corn are naturally available in India, but colored wheat has been generated by NABI for the first time in India using wide introgression and breeding. In a significant achievement NABI's anthocyanin rich germplasm has been registered by Protection of Plant Varieties and Farmers'

Rights Authority (PVPFRA), India. Black wheat has been registered as Shyam Kanak, Purple wheat line as Jamwant and Blue wheat line-Neelkanth. These varieties have already been registered with the National Bureau of Plant Genetic Resources (NBPGR) and the Food Safety and Standards Authority of India (FSSAI) approved as antioxidant rich wheat. Jamwant has anthocyanin in outer pericarp seed coat layer, while Neelkanth has its color due to anthocyanin deposition in inner seed coat layer i.e. aleurone layer. Black wheat is combination of both. Studies from Indian and several countries have found antioxidant, anti-inflammatory properties of colored wheat. Several studies have discovered that they can aid in preventing obesity, diabetes, and metabolic disorders by improving gut health and microbiota.

### Achievement

#### Variety Registration by PVPFRA

Black wheat line- Shyam Kanak  
Purple wheat line- Jamwant  
Blue wheat line- Neelkanth



#### Major Technologies transferred

- A non-disclosure agreement and material transfer agreement (NDA-MTA) has been signed with Gowriz Skincare, Mohali, on 22nd August 2025 for the process of developing lignin-based ZnO nanocomposites for cosmeceutical applications (Patent appl no. 201811048498).
- "Edible fruit coating technology to increase shelf life of fruit crops (Indian Patent No: 498929 and 555384)" was transferred to Cirkla Technologies Private Limited, Mumbai on 3rd October, 2025.

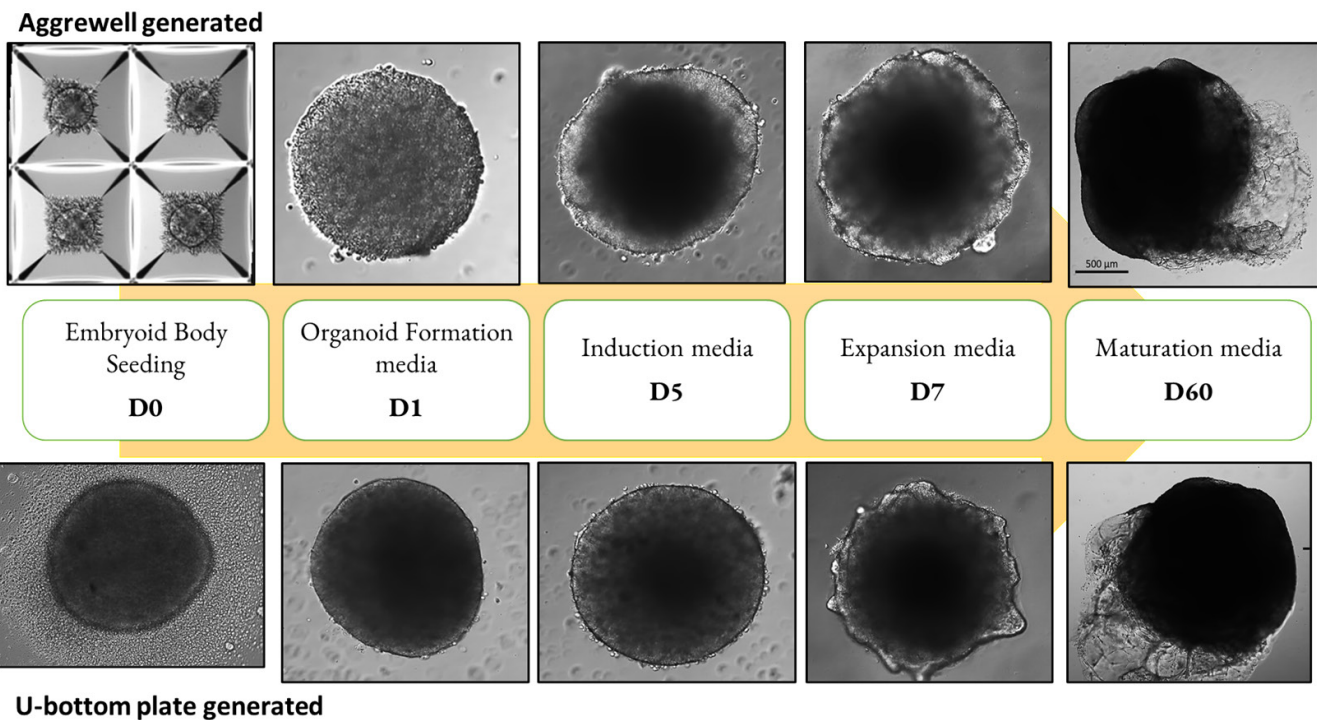
## BRIC-NBRC

### BRIC- National Brain Research Centre Major Technologies developed

- **Human Brain Organoids model that can be scaled up. (Dr Pankaj Seth)**

Our study addresses the major limitations of current animal and 2D models in capturing human-specific viral neuropathogenesis by generating advanced hiPSC-derived 3D cerebral and forebrain organoids containing microglia. This uniquely human, physiologically relevant platform recapitulates cortical layer formation

(PAX6, BRN2, CUX1, Ctip2 and ROR $\beta$ ) and supports productive viral infection, enabling precise investigation of DENV-2/3 and SARS-CoV-2-induced neurodevelopmental disruptions. By integrating single-cell transcriptomics and high-resolution mass spectrometry, our approach provides an unprecedented multi-omic view of virus-driven cellular and molecular alterations. Importantly, the use of patient-specific hiPSCs positions this organoid system as a promising tool for future personalised diagnostics and therapeutic interventions.

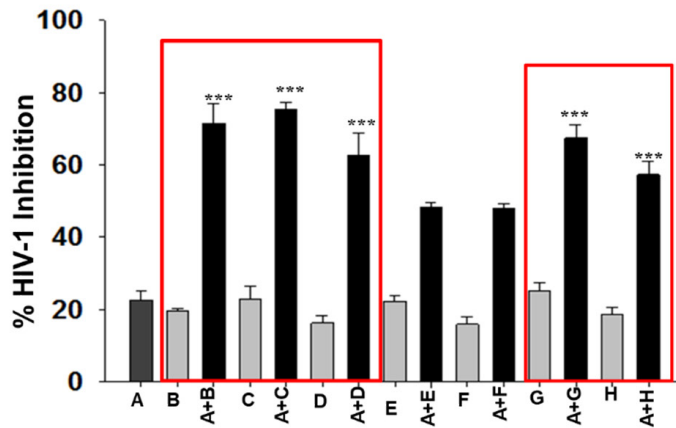


## BRIC-NCCS

### BRIC- National Centre for Cell Science Major Technologies developed

- **A Nanohybrid, Its Method of Preparation and Use: Patent granted in India**
- **Antiviral Drug Compounds and Composition Thereof: Patent granted by EPO (Germany, France, UK)**

**Synergistic activation of antiviral activity with combination of MTX-HYD with existing Reverse Transcriptase and Protease inhibitors: Potential for adjunct therapy in HIV/AIDS**



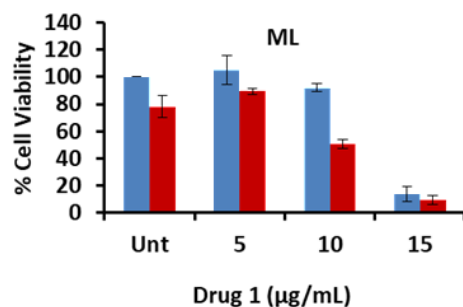
A- Methotrexate Hydrate (MTX-HYD) 20 nM  
 B- Tenofovir disoproxil fumarate (TDF) 20 nM  
 C- Lamivudine (LMD) 75 nM  
 D- Nevirapine (NVP) 25 nM  
 E- Raltegravir (RLT) 200 nM  
 F- Elvitegravir (ELVT) 20 nM  
 G- Indinavir (IND) 250 nM  
 H- Ritonavir (RTN) 200 nM

- A Novel Anti-Cancer Combination and a Method of Therapy Using the Combination: Patent granted by EPO (Germany, France, UK)

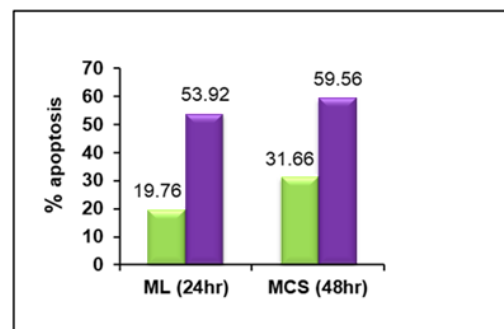
**Sensitizing Human Glioblastoma (GBM) cells with combination of Drugs.**

Valproic acid (VPA) sensitizes Tamoxifen (TAM) –induced cell death in Glioblastoma cells

Cell viability assessed by MTT assay in GBM cells

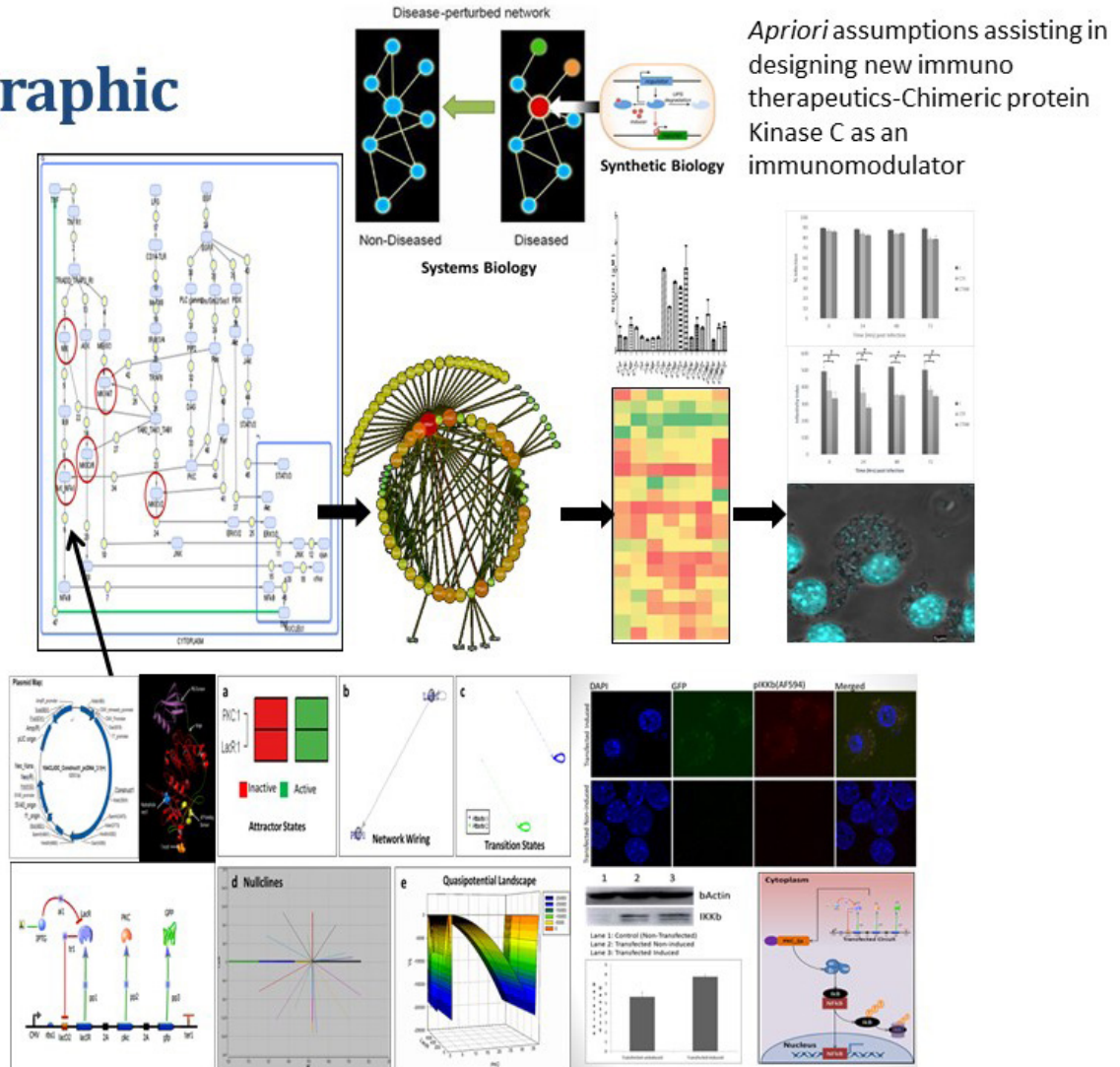


VPA sensitizes TAM -induced apoptosis in monolayer and multicellular spheroids GBM cells assessed by flowcytometry.



- **A Novel Chimeric Protein Kinase C as an Immunomodulator: Patent granted in Brazil.**

## Infographic



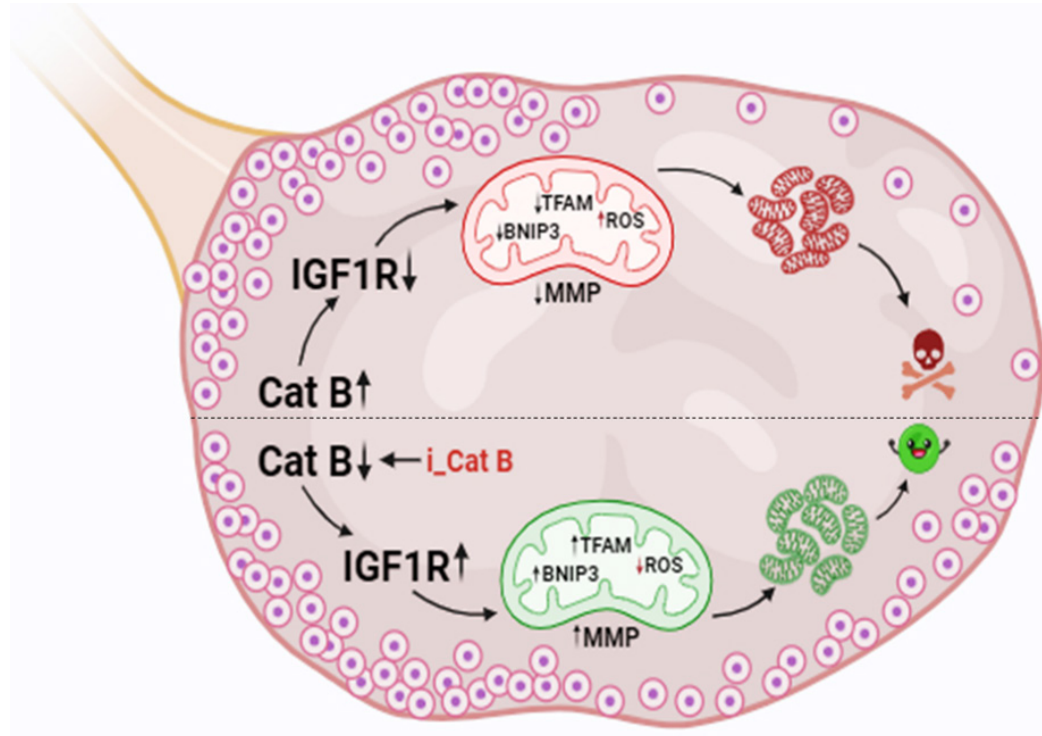
## BRIC-NIAB

### BRIC- National Institute of Animal Biotechnology Major Technologies developed

1. **Developed small-molecule and genetic tools to fine-tune Cathepsin B activity, providing a framework for fertility-preserving interventions:**

tested selective small-molecule inhibitors, including CA-074Me and E-64d, to modulate Cathepsin B (CatB), a lysosomal protease that

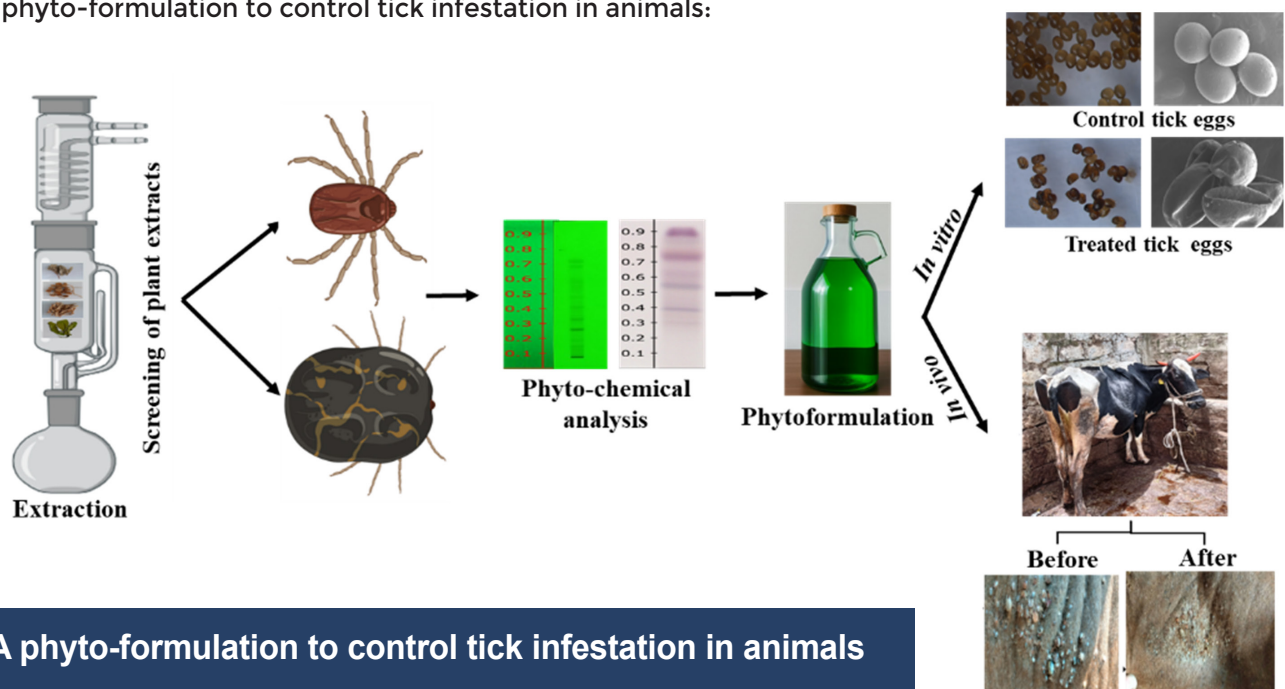
regulates ovarian reserve quality and quantity. Controlled inhibition of CatB enhanced follicle count and improved mitochondrial function without compromising fertility, primarily through upregulating the IGF1R-AKT-mTOR signalling pathway. This study presents a practical framework for examining the balance between autophagy and apoptosis in ovarian maintenance, providing a potential strategy for developing fertility-preserving interventions.



**Cathepsin B regulates ovarian reserve quality and quantity via mitophagy by controlling IGF1R turnover. Targeting Cathepsin B could preserve oocyte health, delay ovarian aging, and boost breeding outcomes!**

**2. phyto-formulation to control tick infestation in animals.**

A phyto-formulation to control tick infestation in animals:



**A phyto-formulation to control tick infestation in animals**

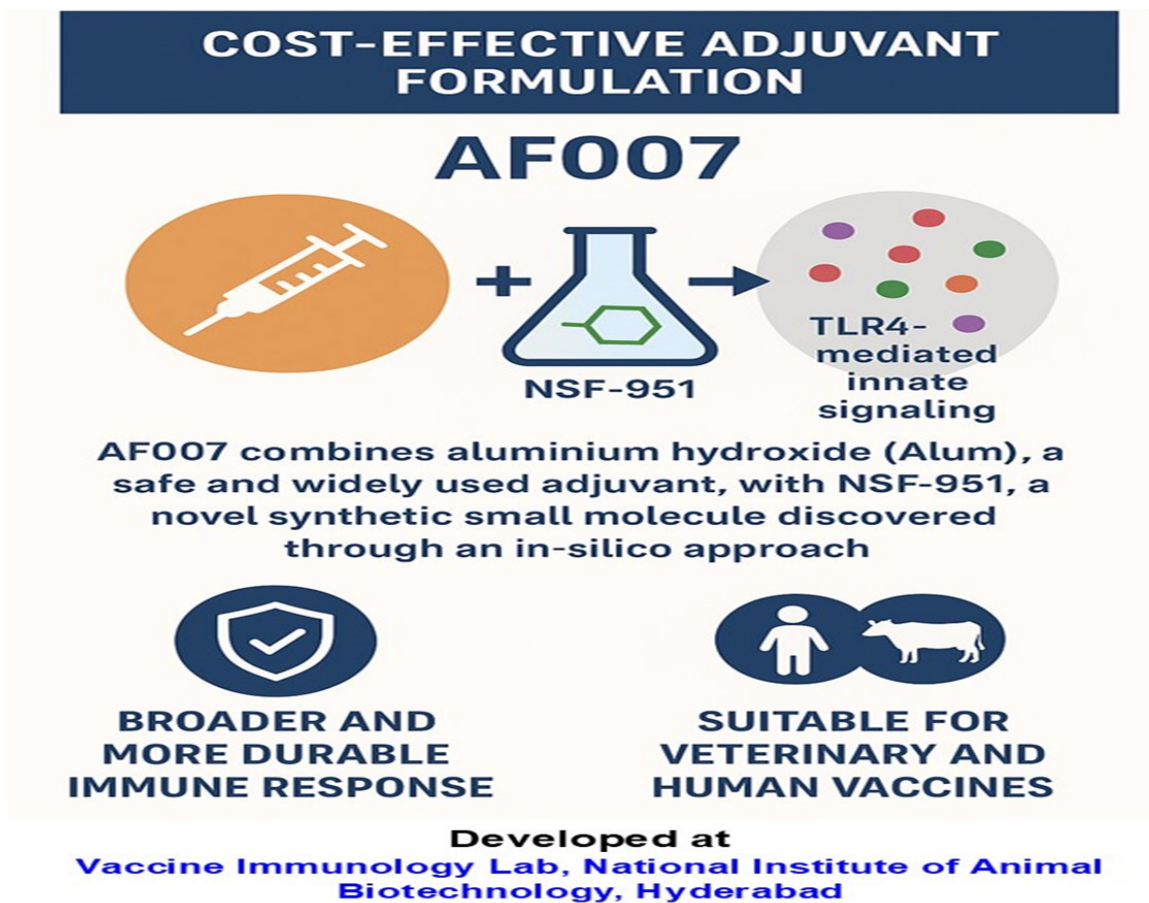
### 3 Multi-epitope protein-based vaccine candidates for Brucellosis:

technology comprises two novel multi-epitope vaccine (MEV) candidates, Bru-MEV1 and Bru-MEV2, which harbor T-cell and B-cell epitopes derived from serodominant Brucella proteins identified through high-throughput immunoprofiling. Both MEVs incorporate cholera toxin B (CTB) as an adjuvant. Preliminary studies indicate that Bru-MEV1 and Bru-MEV2 confer protection against challenges with virulent Brucella melitensis and Brucella abortus in mice. These safe and non-infectious vaccine candidates are expected to mitigate the risks associated with human infectivity, abortion in pregnant animals, and environmental transmission, while offering adaptability across multiple delivery platforms, including protein, DNA, and mRNA.

#### iv) Cost-effective Adjuvant Formulation:

AF007 is a low-cost vaccine adjuvant formulation

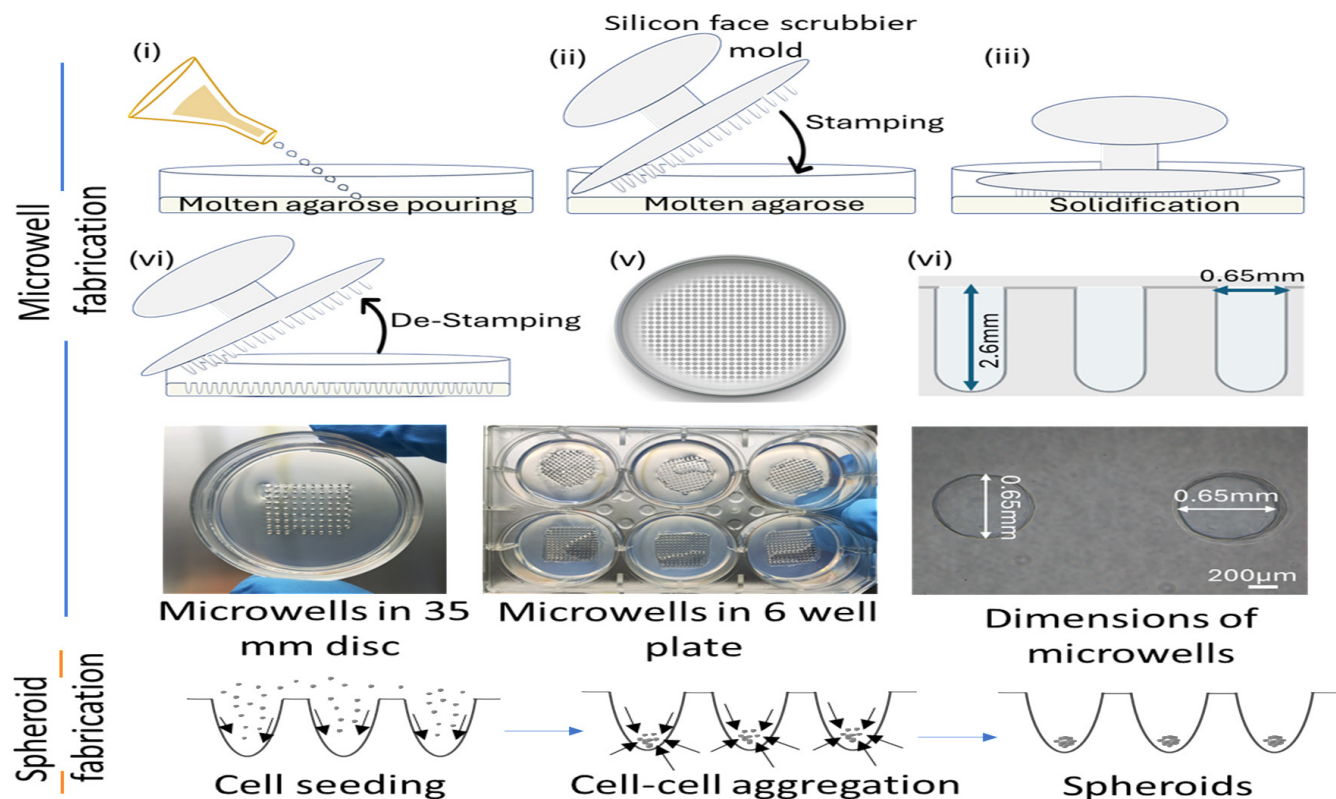
developed at NIAB. It combines the safest and widely used adjuvant, aluminium hydroxide (Alum), with NSF-951, a novel synthetic small molecule discovered through an in-silico approach. The formulation leverages Alum's proven depot and antigen-presentation properties, combined with TLR4-mediated innate signalling by NSF-951, to produce a broader and more durable immune response than Alum alone. NSF-951 engages TLR4 on antigen-presenting cells, enhancing cytokine and costimulatory signals that promote stronger B-cell help and improved CD4 T-cell responses, while Alum supports antibody generation. AF007 not only amplifies primary immune activation but also enhances long-term immunological memory. It didn't induce any significant toxicity. AF007 works well with both whole-killed antigens and protein or subunit antigens. It may offer dose-sparing potential (lower antigen requirement per dose) and is suitable for both veterinary and human vaccines.



### 5. In-house developed microwells for 3D cultures:

2D cell culture systems fail to mimic the complex biological signals between cells and their matrix as they occur in vivo, and the obtained results cannot be fully translated into clinical practice. Part of the problem is that data collected from 2D monolayer culture tests, in which the cellular response to chemical compounds or drugs is altered due to their unnatural microenvironment. On the other hand, the 3D-cell culture system recapitulates in vivo-like cell interactions, division, and morphology, thereby more closely resembling the natural habitat of cells.

Commercially available microwells, which are frequently used for 3D cell culture, particularly for generating spheroids and organoids, are expensive and take several hours to days to fabricate. NIAB has used a commonly available 'Silicon Face Scrubber (SFS)' for the quick and cost-effective fabrication of ultra-low attachment microwell devices for spheroid and organoid culture. The method is simple, rapid, flexible, customizable, eco-friendly, and inexpensive, making it suitable for point-of-need applications that do not require expert personnel or sophisticated machines.



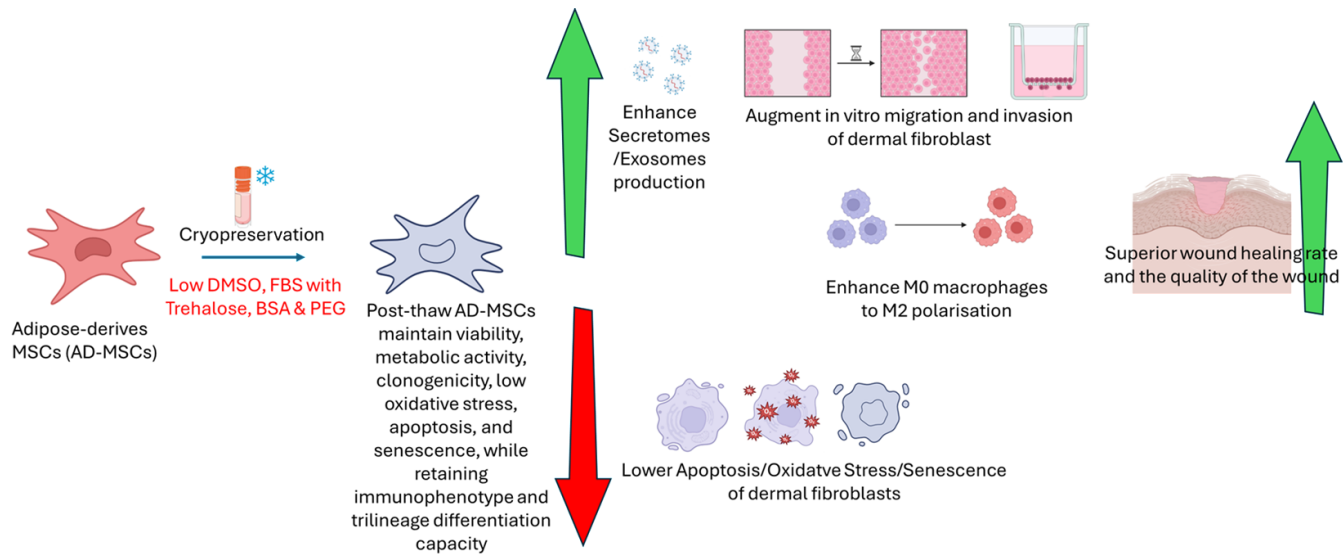
### 6. A cryo-medium that enhances stem cell therapeutic efficacy:

A low DMSO-FBS cryomedium was developed to address the limitations of conventional cryopreservation formulations, which contain high DMSO (10%) and FBS (20-90%) and raise concerns about toxicity, epigenetic modification,

immunogenicity, and high cost. By incorporating a minuscule quantity of polyethylene glycol (PEG), trehalose, and bovine serum albumin (BSA) at less than 3% level, the DMSO and FBS concentrations were reduced to 3-5%, without compromising post-thaw viability, recovery, metabolic activity, immunophenotype, clonogenicity and differentiation potential. Cryopreserved

adipose-derived mesenchymal stem cells (AD-MSCs) exhibited superior wound-healing efficacy compared to fresh AD-MSCs. Thus, this cryomedium not only preserves but enhances AD-

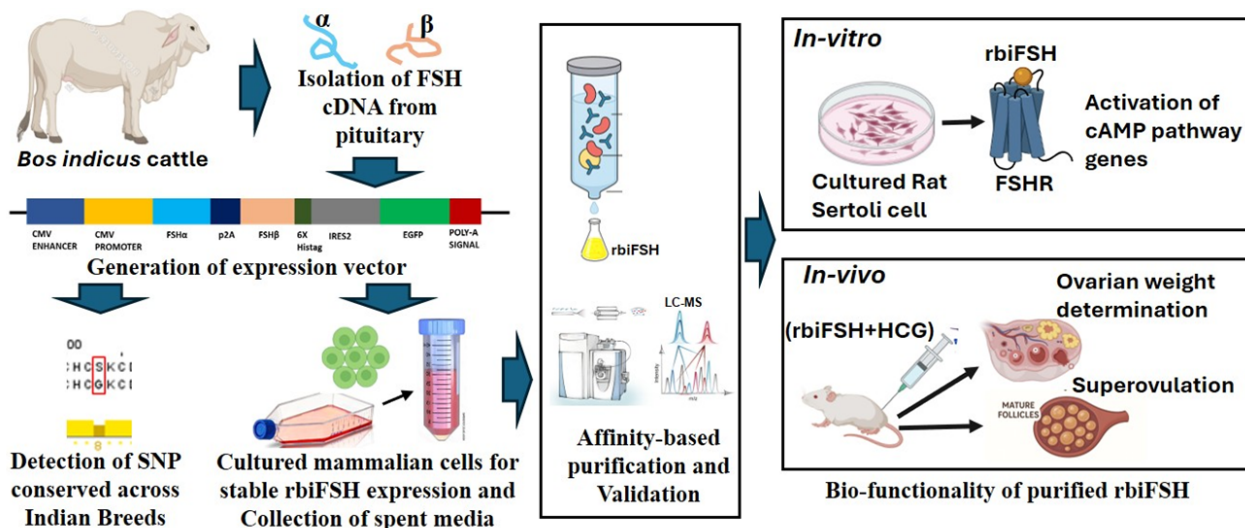
MSC therapeutic potential, offering a safer, cost-effective, and translationally relevant biobanking solution for regenerative applications.



### 7. CHO cell-based production of recombinant bovine FSH of *Bos indicus* origin:

Heterodimeric follicle-stimulating hormone (FSH) is a critical component required for assisted reproductive technologies in cattle for superovulation and oestrous synchronisation. Currently, no recombinant bovine FSH is available due to several limitations, including inefficient post-translational modifications leading to improper heterodimerization and

loss of bioactivity when expressed with linker proteins. The ovine or porcine pituitary-extracted FSH is most commonly used, but it is inefficient and expensive. NIAB established the isolation and cloning of the cDNA for FSH $\alpha$  and FSH $\beta$  into a bicistronic mammalian expression vector for simultaneous expression and dimerisation in an in vitro production system, followed by purification. The expressed rbiFSH was biofunctional in both in vitro and in vivo studies.

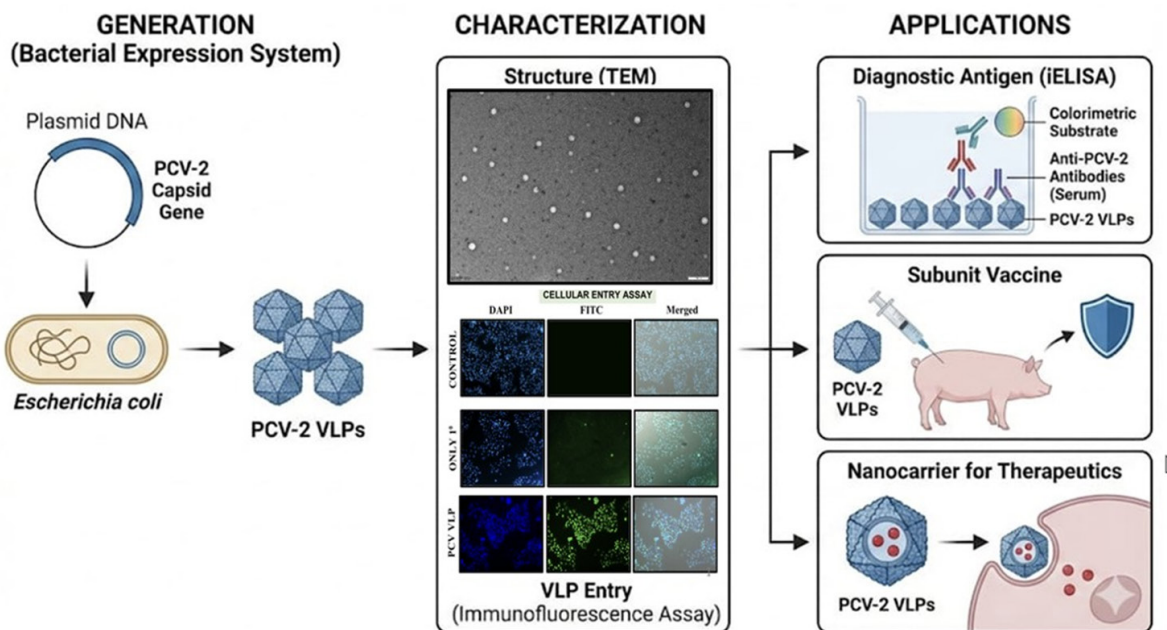


**8. Recombinant Virus-Like Particles (VLP) of Porcine Circovirus Type 2 (PCV-2) and its application in in-vitro studies (VLP entry) and as antigen in iELISA:**

Researchers have optimised the generation of VLP of PCV-2 through a bacterial expression system. The VLPs were characterised for

structure by TEM, their ability to enter cells was assessed by immunofluorescence assay, and their use as an antigen for diagnostics through indirect ELISA. Additional applications include possible use as a subunit vaccine against PCV2, nanocarriers for delivery of therapeutics etc.

**Recombinant PCV2 Virus Like Particles: Versatile Tool for Diagnostics and Therapeutics**



**9. A Method for Affinity Purification of Native Venom Toxin Complexes Using Synthetic ssDNA Aptamers and Applications Thereof:**

production involves hyperimmunizing animals with crude venom, generating antibodies that target both toxic and non-toxic components. This results in low toxin-neutralizing efficiency, high therapeutic doses, and potential side effects. Efforts to develop toxin-specific immunotherapy have been constrained by the inability to isolate native toxin complexes. Current approaches face issues such as loss of protein conformation, the absence of post-translational modifications (PTMs), and high production variability or cost. NIAB's method employs single-stranded DNA (ssDNA) aptamers for the affinity purification

of native Three-Finger Toxin-Phospholipase A<sub>2</sub> (CTX-PLA<sub>2</sub>) complexes from crude venom. The technique offers: (a) preservation of native conformation, PTMs, and bioactivity, (b) highly pure, scalable, and synthetic aptamers with consistent performance, (c) reusable (>10 cycles) streptavidin magnetic microparticles, and (d) rapid, single-step purification within two hours. It achieves high purity (<5% contaminants), enhanced yield, and substantial cost reduction (>80%) compared to conventional methods. The system's robustness, lyophilization compatibility, and long-term storage capability make it suitable for industrial-scale deployment, offering a standardized platform for venom purification for research, pharmaceutical, and antivenom manufacturing sectors.

## **10. Single-Stranded Oligonucleotides as Antivenoms and Uses Thereof:**

A major challenge in snakebite management is the limited efficacy and safety of current antivenoms, which use polyclonal antibodies produced by immunizing animals with crude venom cocktails. These antivenoms exhibit variable potency, require high doses, and have side effects. Moreover, they poorly neutralize local tissue damage and neurotoxicity, leading to long-term complications or death when treatment is delayed. An NIAB laboratory has designed high-affinity aptamers that target the dominant functional toxin complex, Three-Finger Toxin-Phospholipase A<sub>2</sub> (3FTX-PLA<sub>2</sub>),

with selective ability to neutralize the toxin. It demonstrates superior tissue diffusion and penetration compared to bulky IgG antibodies, enabling effective intramuscular administration near the bite site. The aptamer offers > 95% purity, negligible batch variation, and eliminates ethical issues associated with animal use. It is thermostable, lyophilization-compatible, and retains function after storage at 40°C, making it ideal for deployment in resource-limited tropical regions. Its DNA composition ensures very low immunogenicity, reducing risks of serum sickness or anaphylaxis. The aptamer can be rapidly adapted into affordable diagnostic formats for species identification and treatment guidance.

## **11. Cystathionine Biosensor and its Applications for NEB-Associated Infertility Detection:**

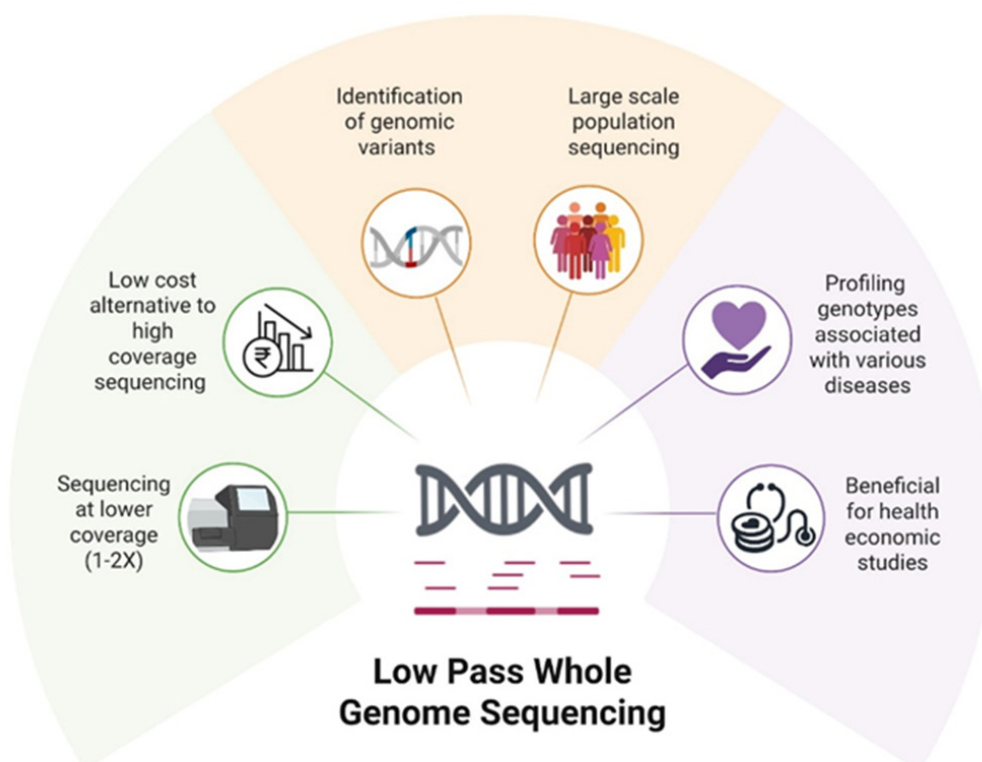
Point-of-care (POC) diagnostics for rapid metabolite detection are crucial across agriculture, livestock, healthcare, and environmental monitoring to enable timely intervention. In livestock, particularly dairy cattle, selective breeding for high milk yield often leads to negative energy balance (NEB) during lactation—a major metabolic disorder responsible for subfertility and economic loss. Early detection of NEB is crucial for preventing long-term reproductive dysfunction. Conventional methods for detecting NEB-associated metabolites rely on costly, time-intensive methods and require specialized laboratory facilities. Moreover, the targeted

biomarkers show measurable changes only after the 10th day of NEB, limiting early intervention. NIAB has developed a prototype electrochemical biosensor for the rapid detection of cystathionine, which exhibits alteration as early as the 5th day of NEB. The assay operates efficiently in both buffer and biological samples, requires minimal sample volume, and delivers results within 10 minutes. This method is simple, cost-effective, user-friendly, and field-deployable, offering high specificity and sensitivity without requiring complex instruments or specialized expertise. It represents a significant advancement in early-stage metabolic health monitoring, supporting sustainable livestock productivity through the rapid on-site detection of NEB.

## BRIC- NIBMG

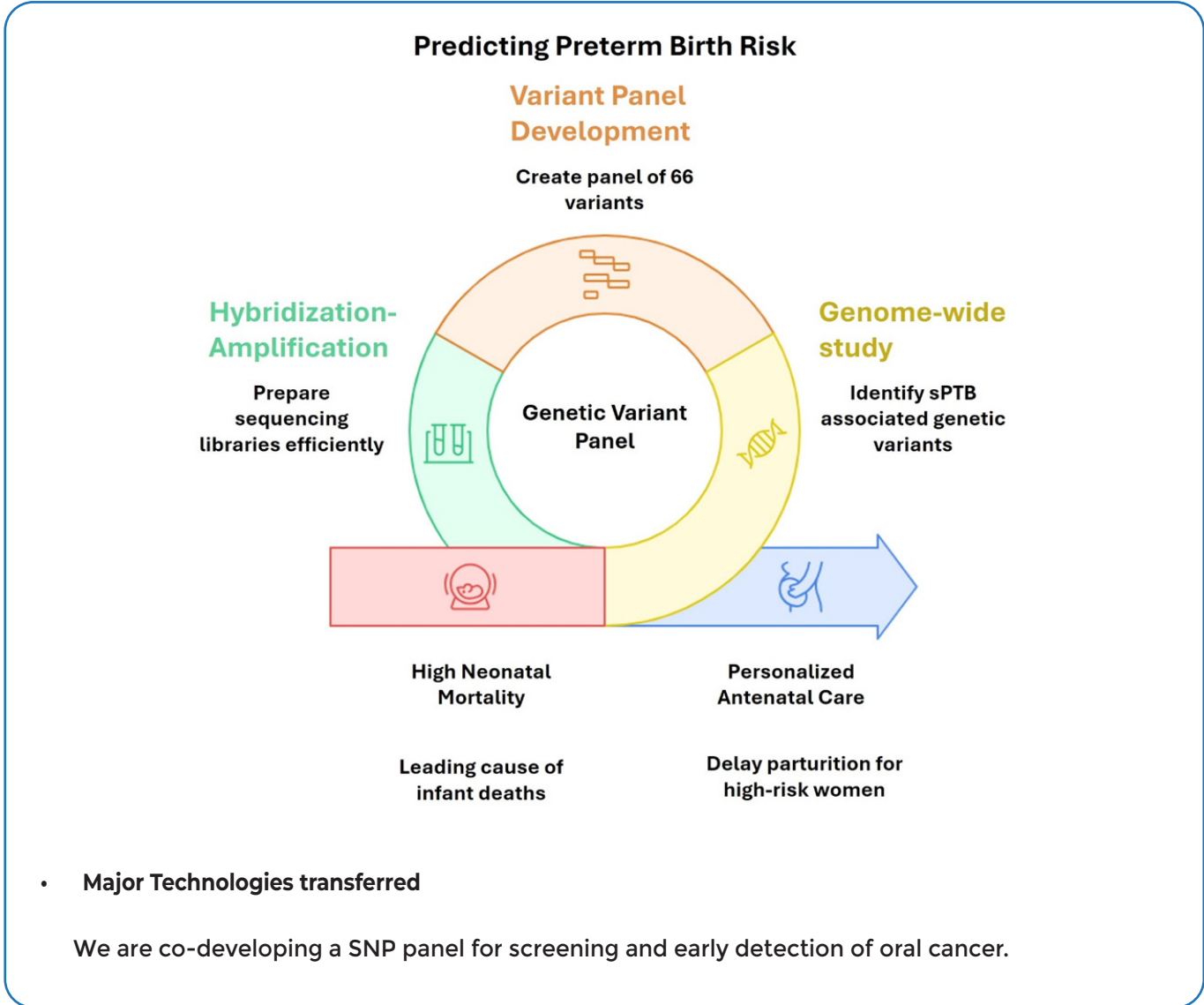
### BRIC- National Institute of Biomedical Genomics Major Technologies developed

- **Low pass genome profiling (1.7X autosomal and X, 200X mito) which captures 125M variants. It shows 99.28% concordance with Global Screening Array – at a low cost of ₹3,500 per individual. This technology will enable low cost yet comprehensive genomic profiling in disease studies - Result in development of population specific genetic marker panels for risk prediction, diagnosis and prognostication**



- **SNP Panel for preterm birth**

Spontaneous preterm birth (sPTB) is the leading cause of neonatal mortality, and health complications in the survivors. Thus, predicting which women have high risk of delivering preterm is important to provide them with personalised antenatal care. We conducted a genome-wide association study of sPTB in Indian women from GARBH-Ini cohort along with transethnic replication in European datasets. From the findings, we developed a sequencing panel of 66 genetic variants which are able to predict preterm birth using DNA from peripheral blood, dried blood spot and saliva. This panel, which can be easily used in clinical and molecular diagnostic labs to screen and identify women at risk of preterm birth.



## BRIC- NII

### BRIC- National Institute of Immunology Major Technologies developed

#### AdFalcivax: A Multistage Malaria Vaccine Candidate

AdFalcivax is an innovative multistage malaria vaccine candidate designed to target two critical developmental stages of Plasmodium falciparum: the pre-erythrocytic (liver) stage, which is essential for preventing infection in humans, and the sexual (transmission) stage, which enables parasite spread via mosquitoes.

The vaccine leverages Lactococcus lactis, a safe, food-grade bacterium, as an expression platform. AdFalcivax incorporates full-length PfCSP, a key pre-erythrocytic antigen with established roles in infection-preventive immunity. This is fused with PfsPro6C, a construct comprising subdomains from two major transmission-blocking antigens, Pfs230 and Pfs48/45, both produced in Lactococcus lactis. By combining antigens from distinct parasite stages, the vaccine

aims to achieve both infection-blocking and transmission-blocking immunity. Collaborating Institutes: ICMR-RMRC Bhubaneswar, BRIC-National Institute of Immunology, ICMR-National Institute of Malaria Research

(Filed, 04/12/2024): “Producing a Chimeric Recombinant Multi-Stage Vaccine for Preventing Plasmodium falciparum Infection and Its Community Transmission” by Susheel Singh et al., co-invented by Dr. Agam Singh (NII) and owned by ICMR.

Reference: Patent Application No. 202411095679

## BRIC- NIPGR

### BRIC- National Institute of Plant Genome Research Major Technologies developed

- A superior drought tolerant high-yielding desi chickpea variety “ADVIKA (NC 7)” i has been approved and released by the Central Sub-committee on Crop Standards (CVRC), Ministry of Agriculture Farmers Welfare, Government of India, as a Central Variety for National use and Cultivation, especially in the Central Zone of India vide notification in The Gazette of India on September 25, 2023 and announced by the Honorable Minister of State (IC), Ministry of Science and Technology, Govt. of India on November 29, 2023. Being popular among farmers, 50 quintal breeder seed indents have been received recently from different National agencies for its cultivation in the upcoming Rabi season 2025-26.
- A new superior climate smart drought tolerant high-yielding desi chickpea variety “SAATVIK (NC9)” is approved by the CVRC, Ministry of Agriculture Farmers Welfare, Government of India, and Notified in The Gazette of India on March 27, 2024, for Release as a Variety for large-scale National use and Cultivation especially in the Central Zone of India. Being popular among farmers, 30 quintal breeder seed indents have been received currently from different National agencies for its cultivation in the upcoming Rabi season 2025-26.
- Low glucosinolate gene edited lines of oilseed mustard has been developed: Low glucosinolate gene edited mustard lines with mutations in 10 glucosinolate transporter genes developed at the Institute. Upon obtaining the regulatory approvals, two LOW-seed, HIGH-leaf glucosinolate mustard lines have undergone the ICAR-coordinated AICRP trials during the rabi growing season 2024-25 and will be re-evaluated in 2025-26.
- NIPGR Flagship programme - Imparting sheath blight tolerance in rice: Two sheath blight resistant rice donor lines have been developed by molecular breeding. The registration of the donor lines is under progress. The resistant QTL has been introgressed in to high-yielding rice mega varieties DRR Dhan and Swarna and the material has entered in ICAR-AICRP trial. The first phase of the project has been completed. An MOA has been signed with ICAR\_IIRR, Hyderabad, for transfer of the identified loci in elite rice cultivars and release of the lines, subject to successful completion of field trials.
- Development of hypoxia inducing nanoparticles to enhance plant resistance: Developed hypoxia inducing nanoparticles coupled with nitrite. Application of these nanoparticles leads to enhanced resistance to Pseudomonas infection in tomato and Xanthomonas axanopoides (XAP) infection in pomegranate plants. PCT (PCT/IN2021/051056) USA and European

patents have been filed. The US Application 18/252,017 has been published. UK patent has been granted for this technology (GB 261531)

- A modified peanut globin gene and protein have been developed to be used as a coloring, flavoring, and iron supplementing agent for plant-based meat. This protein has also been pre-patented (PD059998IN-SC) for its use in the food industry.

#### Major technologies transferred

- Technology Transfer of Indian Rice panArray (IndRA): A first-ever 90K Pan-genome SNP Genotyping Array, “Indian Rice panArray (IndRA)” developed by BRIC-NIPGR has

been transferred to a private industry for commercialization. This array has diverse genotyping applications in Indian agriculture and commerce. It would enable researchers to target novel trait-associated genomic variations and assist in genomics-assisted breeding for accelerated crop improvement of rice. Towards this, Licence Agreement has been executed on October 23, 2024.ii. Shelf life increasing devise.

- One of the Technologies developed at BRIC-NIPGR, ‘System for delaying ripening of agricultural produce’ has been transferred to a private partner for commercialization. Towards this Licence Agreement has been executed on September 11, 2025.

## BRIC- RGCB

### BRIC- Rajiv Gandhi Centre for Biotechnology Major Technologies developed

#### 1. Development of an Exosome-Laden, Antibacterial Hydrogel for Enhanced Burn Wound Healing:

Dr. G S Vinodkumar’s laboratory at BRIC-RGCB has developed an advanced sprayable, thermosensitive hydrogel system, ADA-aPF127@LL18/Exo, synthesized through a Schiff base reaction that combines alginate dialdehyde (ADA) and aminated Pluronic F127 (aPF127). This novel hydrogel integrates an antibacterial peptide (LL18) and exosomes derived from adipose mesenchymal stem cells (Ad MSCs) to address challenges in burn treatment, such as infection control and limited adaptability, which often hinder wound healing. The hydrogel exhibits strong antibacterial efficacy against *Staphylococcus aureus* and *Pseudomonas aeruginosa*, alongside significantly promoting

cell proliferation and migration in vitro. In vivo experiments conducted on Sprague Dawley rats demonstrated accelerated wound closure rates and superior tissue regeneration compared to traditional treatments. Histological analysis further confirmed enhanced collagen deposition and reduced inflammation, emphasizing its capability to effectively treat deep partial-thickness burns while fostering natural healing processes. This innovative research underscores the clinical potential of exosome-laden hydrogels in revolutionizing burn injury management, offering refined therapeutic outcomes for patients with severe skin injuries.

#### 2. CymAKp - The Dynamic Nanopore Revolutionizing Antibiotic Delivery:

In a groundbreaking study on bacterial porins, Dr.

K R Mahendran and his team from BRIC-RGCB, characterized a novel porin named CymAKp from the pathogen *Klebsiella pneumoniae*. This research emphasizes the dynamic nature of CymAKp, featuring a specialized segment in its pore that allows for both symmetrical and asymmetrical gating, crucial for its functionality. Utilizing molecular dynamics simulations and electrical recordings, the team demonstrated CymAKp's ability to selectively transport cyclic hexasaccharides while excluding larger sugars. Remarkably, they identified distinct pathways for antibiotic translocation, revealing that aminoglycoside antibiotics could exploit this sugar-selective route for transport. Their findings emphasize the role of charged residues and the constricted segment in regulating molecular transport, providing crucial insights for developing nanopore-based drug delivery systems aimed at combating antibiotic resistance. Practical applications of this research could enhance targeted antibiotic delivery through natural transport mechanisms, thus addressing critical challenges in treating bacterial infections. The methodology involved overexpressing CymAKp in *E. coli*, purifying outer membrane vesicles, and conducting electron microscopy and electrical recordings to analyze pore functionality. This comprehensive study not only advances our understanding of porin dynamics but also opens avenues for innovative solutions in antibiotic therapies.

### **3. Engineering Safer CAR T Cells: A breakthrough in targeted cancer therapy:**

Dr. Sunil Martin and his team from BRIC-RGCB have made significant advancements in the field of Chimeric Antigen Receptor (CAR) T cell therapy, focusing on making it safer and more cost-effective for cancer treatment. They developed a novel protocol for the serum-free expansion of CD19 CAR T cells using self-inactivating lentiviral vectors, which are known for their safety. The methodology involved engineering T cells from peripheral blood with a specific CAR construct, optimizing the transduction efficiency while minimizing risks like insertional mutagenesis. They incorporated a CD8 $\alpha$  hinge and the CD28

co-stimulatory domain in their CAR design to reduce toxicity without compromising effectiveness. Key findings showed that the CAR T cells effectively targeted and killed cancer cells while maintaining a favorable memory phenotype. This research addresses significant challenges in current CAR T therapies, such as the high manufacturing costs and toxicity. The team's innovations hold promises for making CAR T therapy more accessible in clinical settings, potentially transforming treatment options for patients with blood cancers and improving overall patient outcomes. Furthermore, their work exemplifies the importance of developing treatments that are both efficacious and safe for broader use in healthcare, paving the way for future clinical applications.

### **4. Neur Ally: A Deep Learning Approach for Predicting Regulatory SNPs in Neurological Disorders:**

Neur Ally is a deep learning model developed by BRIC-RGCB Scientist Dr. Moinak Banerjee and team to predict regulatory variants in brain-related neurological conditions by leveraging genomic and epigenomic features. As the cost of sequencing has decreased, quantitative genetic studies such as genome-wide association studies (GWAS) and expression quantitative trait locus (eQTL) analyses have increased, highlighting the significant role of noncoding single nucleotide polymorphisms (SNPs) in gene regulation. These noncoding SNPs often exhibit regulatory functions but are frequently overlooked, complicating the identification of actual causative variants. Neur Ally addresses this challenge by utilizing a variety of epigenomic datasets to model chromatin accessibility, histone modifications, and transcription factor binding, ultimately predicting the regulatory impact of SNPs linked to neurological disorders. The model has shown a high degree of efficiency in discerning the complex relationships between SNPs and their biological implications, underscoring the necessity of functional screening of these variants. Its advancements may significantly contribute to understanding genetic influences on various neurological conditions and facilitate future research directions in genomic medicine.

### Major Technologies transferred

- The technology developed by BRIC-RGCB “innovative apoptosis detection assays and kits using stable cells expressing recombinant fluorescent conjugate of Annexin V” has been transferred to Primordia Lifesciences Pvt Ltd through a formal Transfer Agreement. In return, RGCB received an upfront payment of ₹ 1,00,000. These innovative cells, created by Dr. T.R. Santhosh Kumar and his team at RGCB, allow for cost-effective purification of next-generation apoptosis detection agents with varied color palettes, essential for cancer research and drug discovery. The technology enables real-time monitoring of cellular processes and cell death across multiple platforms, overcoming limitations posed by

conventional commercial kits. Primordia will utilize this technology to develop affordable, real-time compatible apoptosis detection kits in various formats, facilitating multiplexing for target-specific drug discovery.

- RGCB has formally transferred several inventions to the faculty startup, VinMax Biotech Pvt. Ltd., including a xeno-free extracellular matrix (ECM) hydrogel for 2D and 3D cell culture, tissue engineering, and organoid applications; a sprayable system for bleeding arrest in surgical procedures; a sprayable system targeting melasma and UV-induced hyperpigmentation for skincare; and a topically applicable ointment along with a sprayable system for the treatment of diabetic wounds and burns.

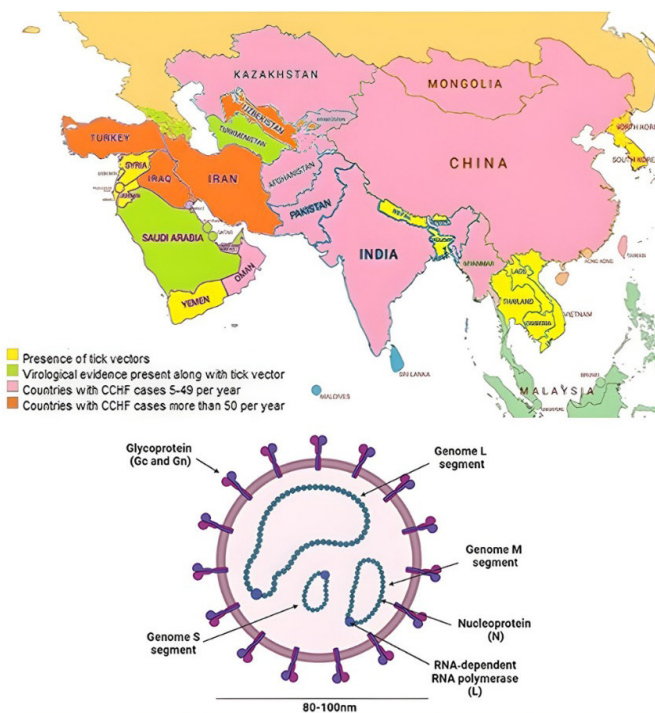
## BRIC- THSTI

### BRIC- Translational Health Science and Technology Institute Major Technologies developed

S. No.	Technology	Patent Application No.	Filing Date	Inventors
1.	AN ENGINEERED POLYPEPTIDE COMPLEX FOR GENERATING PROTECTIVE IMMUNE RESPONSES AGAINST CRIMEAN-CONGO HEMORRHAGIC FEVER VIRUS (CCHFV)	202511071862	29.07.2025	Sweety Samal, Shubbir Ahmed, Amit Awasthi

BRIC THSTI scientists have developed a promising recombinant nanoparticle-based vaccine candidate against Crimean-Congo hemorrhagic fever virus (CCHFV), a deadly tick-borne pathogen with no approved vaccines. Using E. coli expression, they engineered a multimeric immunogen by fusing the CCHFV Gc ectodomain to a self-assembling NSP10

nanoscaffold and a potent neutralizing epitope. This design enabled efficient antigen display and strong immune activation in preliminary preclinical study. The process—optimized at 5-L scale—achieved ~5 g/L purified protein with correct folding and high stability. This scalable, cost-effective platform offers a viable path toward an affordable CCHFV vaccine.



### AN ENGINEERED NANOCAGE BASED VACCINE CANDIDATE AGAINST CRIMEAN-CONGO HEMORRHAGIC FEVER VIRUS (CCHFV)



#### CCHFV Vaccine

Scalable and affordable recombinant nanoparticle-based immunogen



#### Displays Viral Antigens

Gc ectodomain and a neutralizing epitope arrayed on an NSP10 nanocage



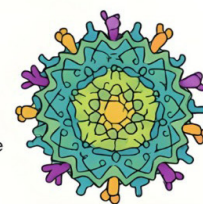
#### Induces Antibody Responses

High immunogenicity demonstrated in animal model



#### High-Yield Production Process

*Escherichia coli* expression with approximately 5 g/L purified immunogen



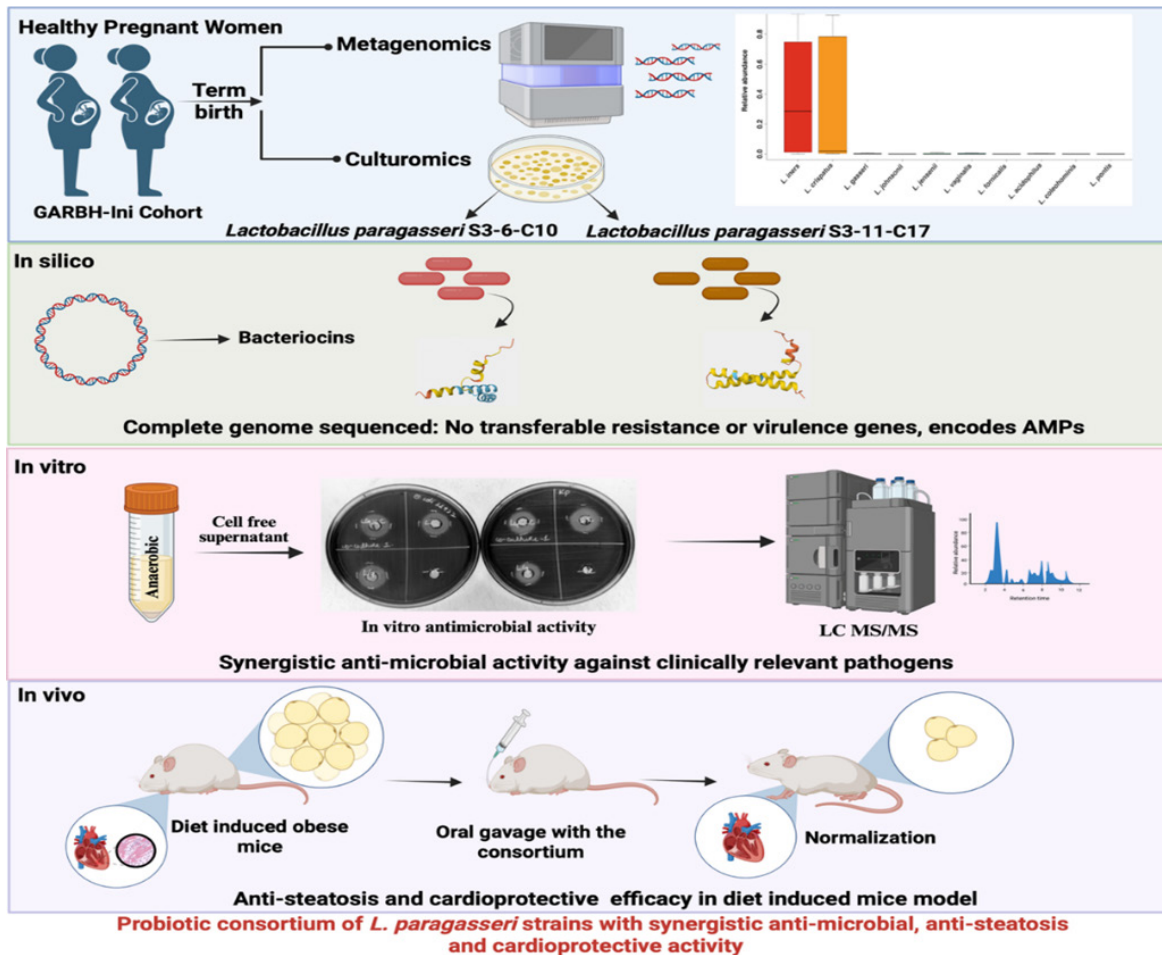
Engineered nanocage based vaccine candidate against Crimean-Congo hem-

S. No.	Technology	Patent Application No.	Filing Date	Inventors
2.	GENETICALLY DEFINED CONSORTIUM OF LACTOBACILLUS PARAGASSERI STRAINS WITH ANTIMICROBIAL, ANTI-STEATOSIS, CARDIOPROTECTIVE PROPERTIES AND DEVELOPMENT METHOD	202511069724	22.07.2025	Bhabatosh Das, Lekshmi N, Nitya Wadhwa, Sanjay Banerjee

A genetically defined consortium of *Lactobacillus paragasseri* strains isolated from the reproductive tract of Indian women with antimicrobial, anti-steatosis and cardioprotective activity for nutraceutical, cosmetic and therapeutic applications.

A genetically defined consortium of *Lactobacillus paragasseri* strains isolated from the reproductive tract of Indian women

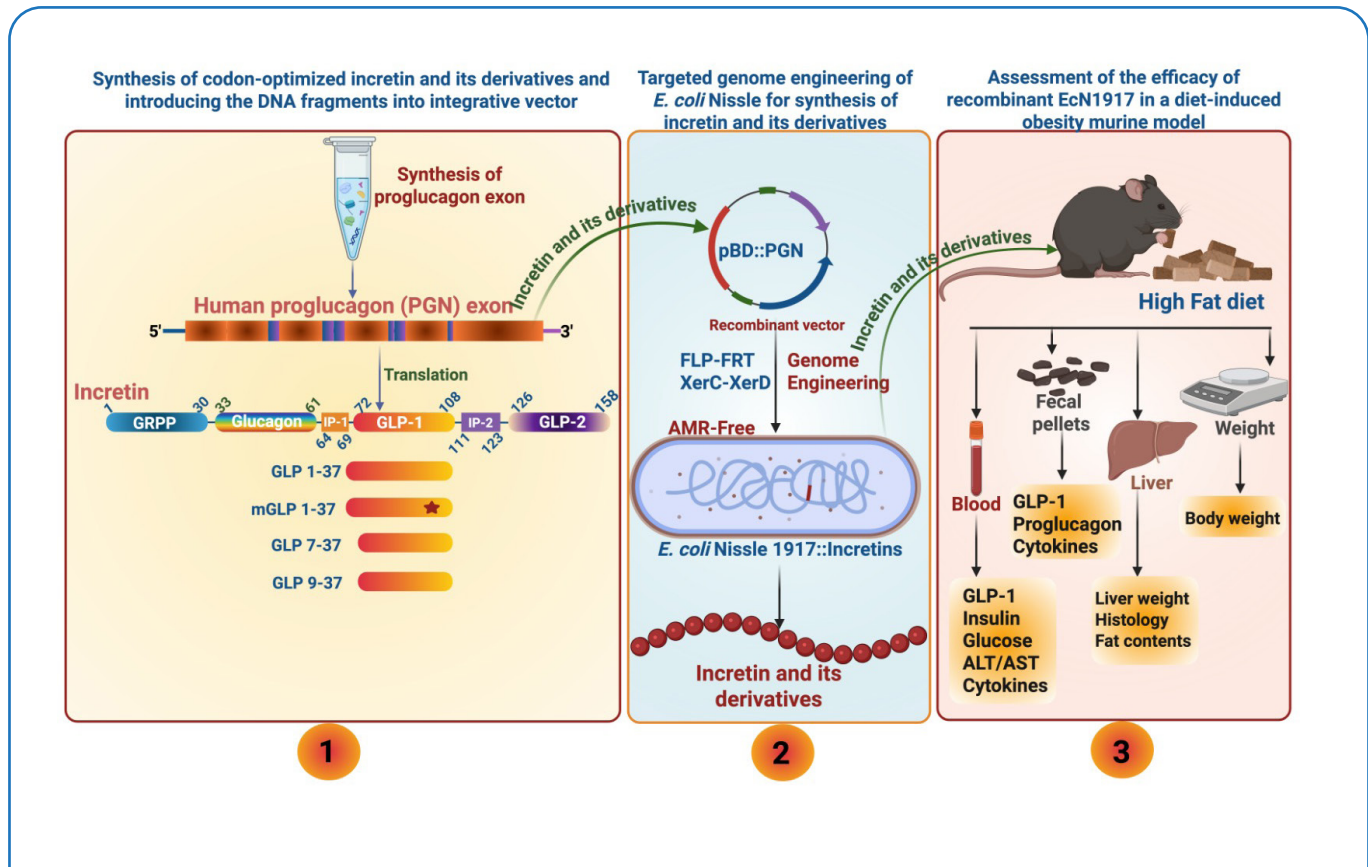
exhibits potent antimicrobial, anti-steatosis and cardioprotective activities, supporting its use in nutraceutical, cosmetic and therapeutic applications. In vitro assays demonstrate robust metabolic and protective functions, which were further validated in a diet-induced MASLD preclinical model. Administration of the consortium significantly improved metabolic parameters, indicating its potential as a targeted microbial intervention for metabolic health.



S. No.	Technology	Patent Application No.	Filing Date	Inventors
3.	GENETICALLY ENGINEERED LIVE BIOTHERAPEUTICS WITH PROPHYLACTIC AND THERAPEUTIC APPLICATIONS AND A METHOD OF PREPARING THE SAME THERE OF	202511067807	16.07.2025	Bhabatosh Das, Deepjyoti Paul, Manjari Gupta, Lekshmi N, Dinesh Mahajan, Prajwal S. Gowda

Genetically engineered live biotherapeutics are designed for targeted prophylactic and therapeutic applications, enabling in situ synthesis and delivery of peptide drugs within the human colon and other organs. These engineered microbial systems offer precise, sustained, and localized release of therapeutic

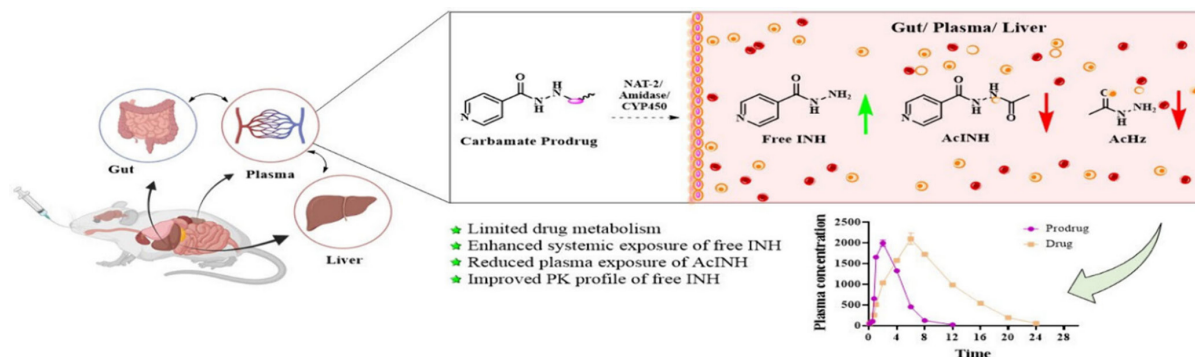
molecules, enhancing efficacy while minimizing systemic side effects. The associated preparation method ensures stable genetic modification, controlled expression, and safe colonization, demonstrating strong potential for next-generation biologics.



S. No.	Technology	Patent Application No.	Filing Date	Inventors
4.	PRODRUGS OF ISONIAZID WITH ENHANCED PLASMA EXPOSURE AND METHOD OF DEVELOPMENT THEREOF	202511000544	2.01.2025	Dinesh Mahajan, Jishnu Sankar

Tuberculosis treatment relies heavily on INH, but the drug's effectiveness is limited by how fast the body breaks it down and by its side effects. THSTI researchers developed new "carbamate" prodrugs of INH, chemical versions that keep INH inactive until it reaches the bloodstream and then slowly release it. In animal studies, these

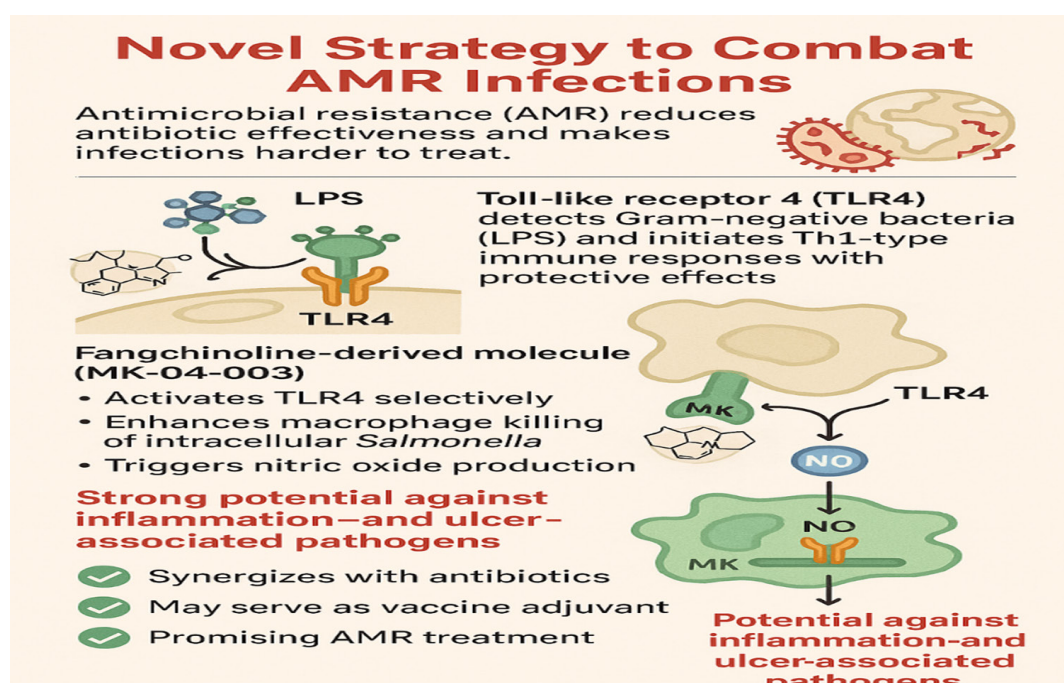
prodrugs showed higher levels of active drug, a longer time in the body, and fewer unwanted breakdown products. This suggests that such prodrugs could lead to safer treatments with fewer doses and better patient compliance for TB therapy. <https://pubs.acs.org/doi/full/10.1021/acscentsci.5c00576>



S. No.	Technology	Patent Application No.	Filing Date	Inventors
5.	BIS(BENZYLISOQUINOLINE) ALKALOIDS AS TLR4 AGONIST	202411088715	16.11.2024	Srikanth Sadhu, Rajdeep Dalal, Deepak Salunke, Aashima Batra, Amit Awasthi

Antimicrobial resistance (AMR) threatens global health by reducing antibiotic effectiveness and making infections harder to treat. Toll-like receptor 4 (TLR4) plays a key role in detecting Gram-negative bacteria through lipopolysaccharide (LPS) and initiating protective Th1-type immune responses. The invention introduces a novel Fangchinoline-derived molecule (MK-04-003) that selectively

activates TLR4, enhances macrophage killing of intracellular *Salmonella*, and triggers nitric oxide production through the TLR4 pathway. This compound shows strong potential against inflammation associated pathogens, synergizes with existing antibiotics, and may serve as a vaccine adjuvant, offering a promising strategy to combat AMR infections.



#### Major Technologies transferred

Technology transferred	Name of company
cleverCUP - Midstream Urine Collecting Device for Women (Indian Patent Application No. 202311085431)	Arundhati Healthcare Pvt. Ltd
Composition of Lactobacillus Crispatus for nutraceutical uses (Indian Patent Application No. 202411066896)	Sundyota Numandis Probiocetical Pvt. Ltd.

# 06 iBRIC COLLABORATIONS

## Strengthening Global Science: BRIC's International and National Collaboration Ecosystem

### Executive Summary

The Biotechnology Research and Innovation Council (BRIC) has established itself as a cornerstone of India's biotechnology landscape through an expansive network of international and national collaborations. In 2025, BRIC's 13 constituent institutes have cultivated strategic partnerships spanning 41 countries, representing a diverse portfolio of academic institutions, government organizations, funding agencies, and private sector enterprises. This chapter provides a comprehensive overview of BRIC's collaborative ecosystem, demonstrating how institutional

synergies drive innovation, enhance research capacity, and accelerate the translation of scientific discoveries into tangible health, agricultural, and industrial biotechnology solutions.

## 1. INTERNATIONAL COLLABORATION NETWORK

### 1.1 Overview of Global Partnerships

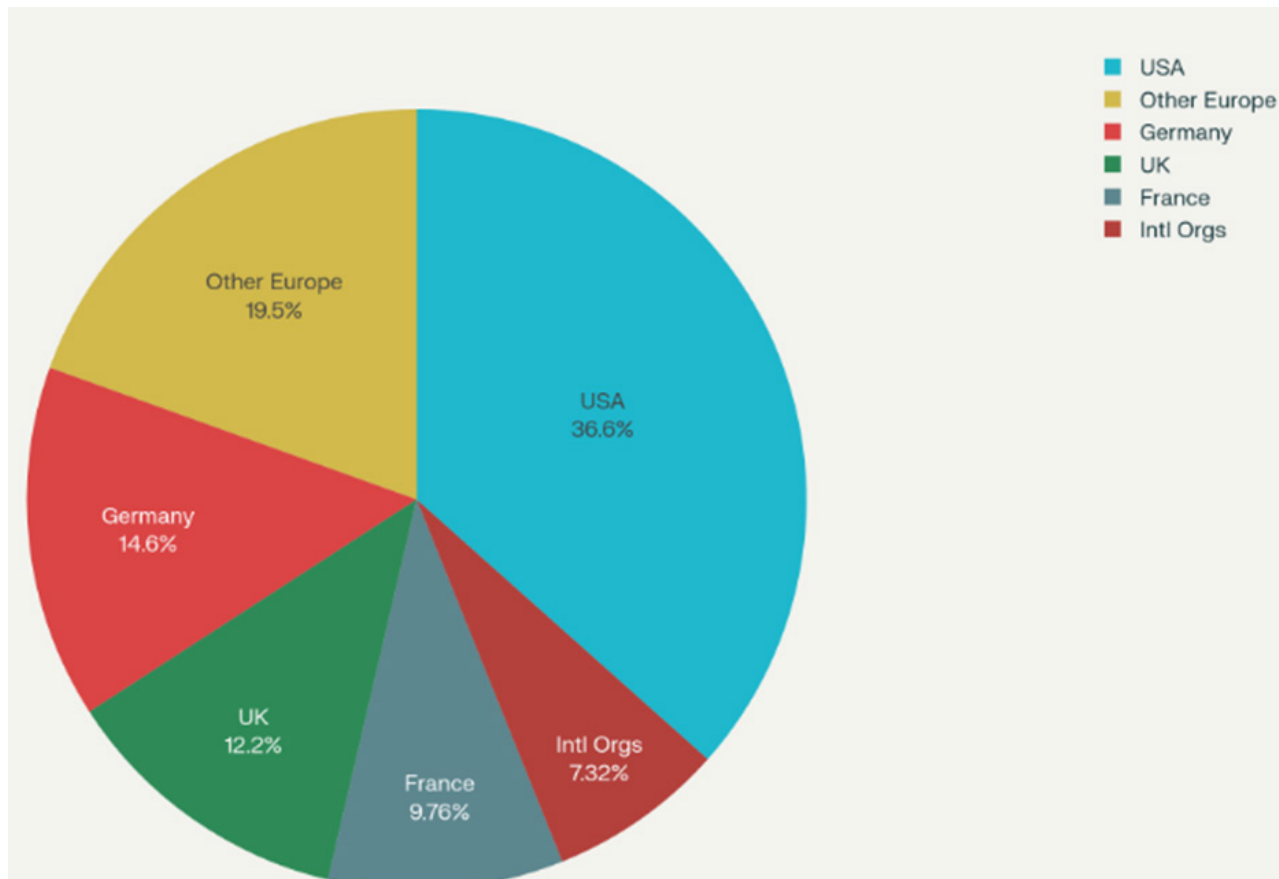
BRIC's international collaboration strategy reflects a commitment to positioning Indian biotechnology research within the global scientific community. The network encompasses 13 BRIC institutes with collaborations spanning North America, Europe, Asia-Pacific, and international organizations.

## BRIC INTERNATIONAL COLLABORATIONS



### 1.2 Geographic Distribution of Collaborators

The geographic spread of international collaborations reveals a strong Atlantic orientation, with substantial engagement across North America and Western Europe.



**Figure 6.1: Geographic Distribution of International Collaborators.** The USA hosts the highest number of BRIC international collaborating institutions (15 partners), reflecting deep engagement with American research universities and biotech innovation hubs. Germany and the UK represent secondary hubs with 6 and 5 partners respectively.

### 1.3 Key International Collaborations by Institute

#### BRIC-CDFD (Centre for DNA Fingerprinting and Diagnostics)

**Focus:** Genomics and genetic disease diagnostics

- International Partner: University of Freiburg (Germany)

- Program: Genome India Project (GIP)
- Impact: Establishing reference genomic databases for Indian populations and advancing rare genetic disease identification

### **BRIC-INSTEM (Institute of Stem Cell Biology and Regenerative Medicine)**

**Focus:** Developmental biology, neuroscience, and translational medicine

BRIC-INSTEM has cultivated the most extensive international network among BRIC institutes, with 8 collaborative programs spanning:

- Human Frontier Science Program Organisation (HFSP), France - ESCORT (Equipping Students and Educators with Cutting-edge Research Training) in Developmental Biology
- University of Oxford, UK - Cellular and Molecular Biology / Neuroscience Program
- National University of Singapore (NUS) - WoRtH Program (Women's Health Research)
- University of North Carolina, USA - Disease Modeling and Organoid Program
- Genentech, USA - ESCORT in Airway Biology
- Artus Therapeutics, USA - Chemical Biology and Translational Program
- EMBO (European Molecular Biology Organization) - Metabolism and Cellular Physiology; Neuroscience Program
- University of Osnabrück, Germany - Metabolism Program

Wake Forest University Health Sciences, USA - Chemical Biology and Translational Research

CNRS France - ESCORT in Developmental Biology

### **BRIC-NIAB (National Institute of Animal Biotechnology)**

**Focus:** Animal biotechnology and biomanufacturing

With 16 international partners, BRIC-NIAB demonstrates the deepest international engagement:

### **Partner Institutions by Region:**

#### **North America:**

- Florida Polytechnic University, USA
- Mercer University, USA
- United States Department of Agriculture, USA

#### **Europe:**

- Fraunhofer ISC, Wurzburg, Germany
- Goethe Universität Frankfurt, Germany
- RWTH Aachen University, Germany
- Hospital of Ruhr University Bochum, Germany
- Swedish University of Agricultural Sciences (SLU), Sweden
- Université Paris Cité, France
- University of Cambridge, UK
- University of Reading, UK

#### **Asia-Pacific:**

- Hanyang University, South Korea
- Kyoto University of Advanced Science, Japan
- Jožef Stefan Institute, Slovenia

### **University of Cyprus, Cyprus**

### **BRIC-NIPGR (National Institute of Plant Genetic Resources)**

**Focus:** Plant genetic resources and agriculture

International partners include institutions in the UK, Israel, and agencies like the Gates Foundation and EMBO, supporting plant biodiversity conservation and climate-resilient crop development.

## BRIC-NIBMG (National Institute of Biomedical Genomics)

**Focus: Genomics, pandemic preparedness, and disease biology**

BRIC-NIBMG collaborates with approximately 12 international institutions across:

- Karolinska Institutet, Sweden - Pandemic Preparedness and Dengue Research
- Amsterdam UMC, Netherlands - Infectious Disease Research
- UiT Norway, Justus Liebig University, Germany, Lund University, Sweden - Multiple disease biology initiatives
- Olink Proteomics AB, Sweden - Genomic proteomics research
- INSERM France & CEFIPRA - Cancer Biology and DNA Repair Research

## BRIC-THSTI (Translational Health Science and Technology Institute)

**Focus: Public health, vaccines, and infectious disease**

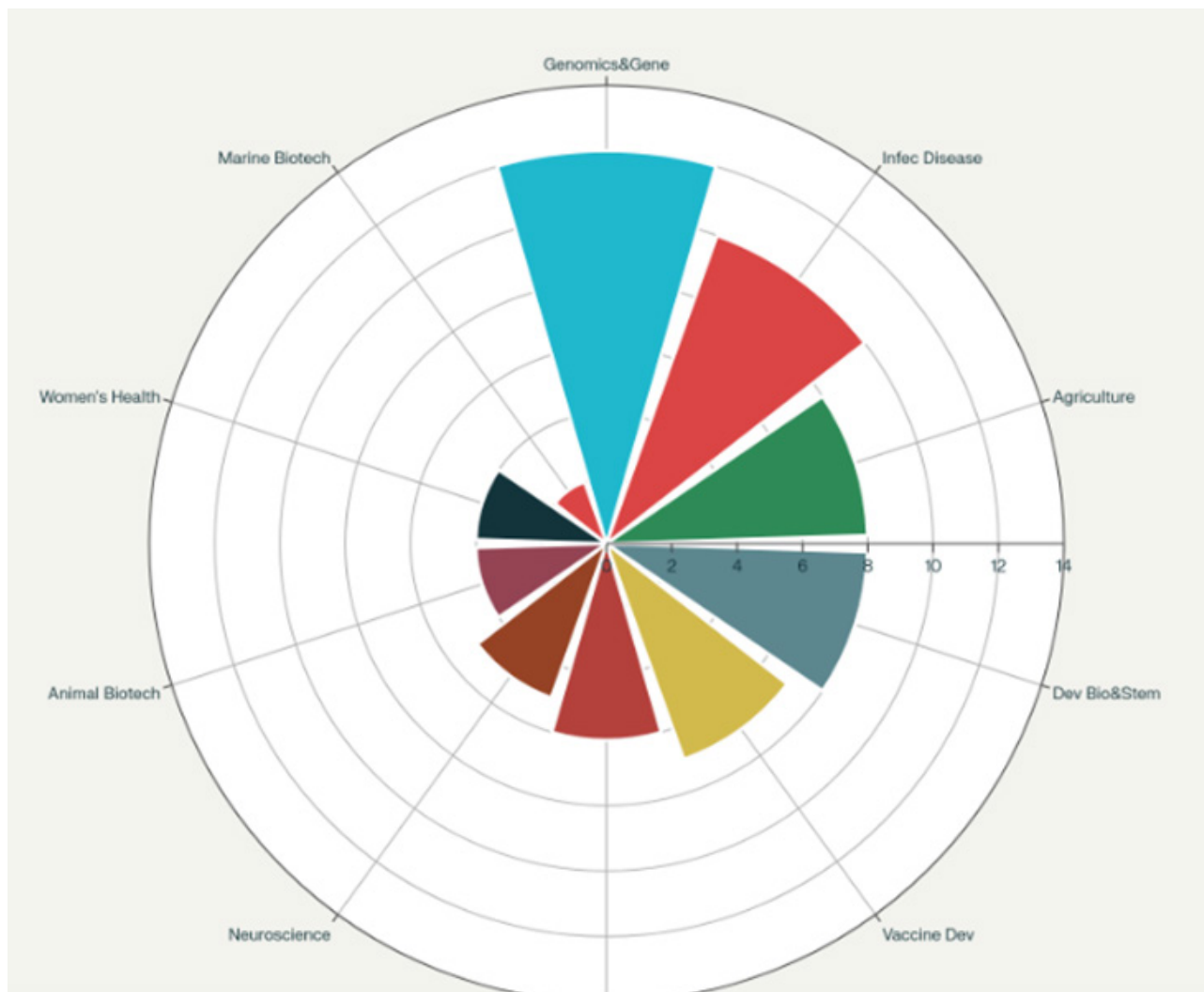
Strategic partnerships with leading global health organizations:

- Bill & Melinda Gates Foundation - Maternal-Child Health and Vaccine Programs
- CEPI (Coalition for Epidemic Preparedness Innovations) - Vaccine Development and Epidemic Preparedness
- WHO (World Health Organization) - Public Health Surveillance Programs
- DNDi South Asia Pvt. Ltd. - Neglected Tropical Diseases Research
- Universitas Gadjah Mada, Indonesia - Public Health and Infectious Disease Research

## 1.4 Thematic Areas of International Collaboration

The international collaboration portfolio spans critical research domains:

- **Genomics & Genetic Disease:** Genome India Project; Rare disease identification and characterization
- **Developmental Biology & Stem Cells:** Embryonic development; organoid technology; regenerative medicine
- **Neuroscience & Brain Research:** Brain circuitry mapping; epilepsy research; neurological disease modeling
- **Agriculture & Food Security:** Climate-resilient crop development; bioprospecting; sustainable agriculture
- **Infectious Disease & Pandemic Preparedness:** Dengue, COVID-19, and novel pathogen surveillance
- **Cancer Biology & Immunology:** DNA repair mechanisms; immunotherapy; precision oncology
- **Animal Biotechnology & Biomanufacturing:** Recombinant protein production; bioprocess optimization
- **Women's Health & Maternal-Child Health:** Reproductive health research; maternal-neonatal disease prevention
- **Vaccine Development:** Next-generation vaccine platforms; immunogenicity testing
- **Marine Biotechnology:** Deep-ocean bioactive discovery; marine natural products



**Figure 6.2: BRIC Research Thematic areas**

## 2. NATIONAL COLLABORATION ECOSYSTEM

### 2.1 Breadth and Depth of Academic Partnerships

BRIC institutes maintain an extensive network of 200+ national academic collaborations spanning:

- Central Universities (Delhi, Bangalore, Chennai, Kolkata)
- IITs and IISERs (across India)
- National Institute of Science Education and Research (NISER)

- CSIR Laboratories (CDRI, CCMB, IGIB, IIIM, CSMCRI, IICT, IMMT)

- ICMR Institutes (including CAR, NIMHANS, NCBS)

- Regional Medical and Research Institutions

- Agricultural Universities and Research Stations

### 2.2 National Academic Collaborations by Institute

#### BRIC-CDFD National Network

- IISER Pune - Genome India Project

- National Institute of Nutrition (NIN) - Rare disease and nutrition research
- National Centre for Biological Sciences (NCBS), TIFR - Genomic analysis platforms
- Ministry of Health & Family Welfare - Paediatric Rare Genetic Disorders (PRaGeD) program

### BRIC-INSTEM National Partnerships

Strategic institutional partnerships advancing translational research:

- NCBS & C-CAMP - Core facility and institutional support
- University of Hyderabad - Developmental biology programs
- AIIMS New Delhi - Disease modeling and organoid development
- CSIR-CDRI - Stem cell and developmental research
- Manipal Academy of Higher Education (MAHE) - CREATE (Collaborative Research and Training Exchange) programs

### BRIC-NCCS (National Centre for Cell Science)

National Partners: 40+ institutions including:

- Pune Biotech Cluster institutions
- IISER Pune
- IIIT Delhi
- IGIB, New Delhi
- Institute of Medical Education & Research, Chandigarh
- Multiple AIIMS facilities across India
- BRIC-NIBMG

### Major National Collaborations:

Extensive engagement across Indian medical colleges and research institutions for pandemic preparedness and genomic epidemiology:

- Multiple AIIMS institutes
- Medical colleges in Kolkata, Chandigarh, and across India
- Public health research organizations
- Government disease surveillance networks

### BRIC-NIPGR (National Institute of Plant Genetic Resources)

#### Agricultural and Environmental Focus:

Over 50 national agricultural partners including:

- Agricultural Universities: Punjab Agricultural University, Tamil Nadu Agricultural University, Acharya N.G. Ranga Agricultural University
- ICRISAT, Hyderabad - International crop research integration
- National Bureau of Plant Genetic Resources, New Delhi - Germplasm banking
- NABI, Mohali - Biomanufacturing and biotechnology innovation
- CSIR Laboratories: CCMB, IGIB, IMMT
- IITs: Delhi, Kanpur, Bombay, Indore, Roorkee

### 2.3 Institutional Strategic Partnerships

BRIC institutes have forged "super-collaborations" with anchor institutions providing core support:

Table 1: Core Institutional Partnerships Providing Strategic Support to BRIC Institutes

BRIC Institute	Core Institutional Partner	Type of Support
BRIC-INSTEM	NCBS & C-CAMP	Facility sharing; training programs
BRIC-NCCS	IISER Pune, DBT	Model organism resources; funding
BRIC-NIPGR	Agricultural Universities	Germplasm exchange; field trials
BRIC-NIBMG	CSIR-IGIB, AIIMS Network	Genomic analysis; clinical samples
BRIC-THSTI	IIT Delhi, AIIMS Delhi	Computational platforms; clinical data

### 3. INDUSTRY COLLABORATIONS AND TRANSLATIONAL PATHWAY

#### 3.1 Biotech Industry Engagement

BRIC institutes have established 25+ active collaborations with Indian biotech, pharmaceutical, and life sciences companies, translating research outputs into commercial applications.

#### Industry Partners by BRIC Institute

##### BRIC-ILS (Institute of Life Sciences)

- Baiya Phytopharma Co. Ltd. - Natural product extraction and characterization
- Brahma Kamal LLP - Bioproducts development
- SEA6 Energy Pvt. Ltd., Bengaluru - Marine biotechnology and bioactive discovery

##### BRIC-INSTEM

- Sun Pharma Research Ltd. - Women's health therapeutic development
- Sturnus Biotech Pvt. Ltd. - Biomaterials and chemical biology
- Dr. Reddy's Laboratories - Organoid and induced pluripotent stem cell (iPSC) alternatives for drug testing

##### BRIC-NBRC & BRIC-NII

- Bharat Serums and Vaccines Ltd., Mumbai
- Aevum Bio Labs Pvt. Ltd., Hyderabad
- Otsuka Chemical (India) Pvt. Ltd.
- Q-Line Biotech Pvt. Ltd.

##### BRIC-NIPGR

- Ignite Life Science Foundation, Bengaluru - Agricultural innovation
- BIRAC (Biotechnology Industry Research Assistance Council) - Startup ecosystem development

##### BRIC-RGCB & BRIC-THSTI - Extensive pharmaceutical partnerships including:

- Serum Institute of India Pvt. Ltd. - Vaccine research and development
- Indian Immunologicals Limited - Immunology and vaccine development
- Aurigene Pharmaceutical Services Ltd. - Drug discovery
- Genext Genomics Pvt. Ltd. - Genomics services
- Danaher India & Cytiva - Biotech solutions and platforms
- Becton Dickinson India Pvt. Ltd. - Medical

diagnostics

- Agilent Technologies - Analytical instruments

### 3.2 Commercialization and IP Outcomes

Key technology outcomes from industry collaborations:

- Diagnostic Assays: Apoptosis assays (Primordia Lifesciences); microRNA-based molecular diagnostics (miRGeneTech Biologics)
- Therapeutic Platforms: Peptide technology (Galore TX Pharmaceuticals); cell therapy (Immuneel Therapeutics); biologics development (Zumutor Biologics)
- Research Tools: RNA isolation technology (IndZita Biotech); Nanopore-based RNA diagnostics (IndZita Biotech)
- Biomanufacturing: Recombinant protein production optimization; bioprocess scale-up with biotech companies

Government of India - Core funding and strategic programs

- BIRAC - Industry-linked research and startup acceleration
- CEFIPRA (Centre Français Pour L'Étude Et La Recherche En Inde) - Franco-Indian research partnerships

### 4.2 Multilateral Organization Engagement

- FAO (Food and Agriculture Organization), UN - BRIC-NABI collaboration on Global Agri-Food Biotechnologies
- WHO (World Health Organization) - BRIC-THSTI public health surveillance programs
- CEPI (Coalition for Epidemic Preparedness Innovations) - BRIC-THSTI vaccine development
- ICGEB (International Centre for Genetic Engineering and Biotechnology) - Multiple BRIC institutes

## 4. STRATEGIC FUNDING AND INTERNATIONAL ORGANIZATIONS

### 4.1 Funding Agency Partnerships

BRIC institutes receive strategic support from:

- Bill & Melinda Gates Foundation - Multiple BRIC institutes (BRIC-NBRC, BRIC-NIPGR, BRIC-THSTI)
- Human Frontier Science Program Organisation (HFSP) - BRIC-INSTEM
- European Molecular Biology Organization (EMBO) - BRIC-INSTEM, BRIC-NIPGR
- DBT and UKRI Joint Initiatives - BRIC-NABI, BRIC-NCCS
- Department of Biotechnology (DBT),

## 5. IMPACT AND STRATEGIC OUTCOMES

### 5.1 Key Research Outputs from Collaborative Programs

Genome India Project (GIP): Large-scale genomic sequencing and characterization of Indian populations for disease association studies and precision medicine

ESCORT Program (BRIC-INSTEM): Training framework producing 100+ PhD-trained scientists in cutting-edge developmental and molecular biology techniques

PRaGeD Initiative: National database of 500+ rare pediatric genetic cases with identified molecular variants

Pandemic Preparedness (BRIC-NIBMG, BRIC-THSTI): Genomic surveillance infrastructure for

detecting SARS-CoV-2 and dengue virus variants in India

Climate-Resilient Agriculture (BRIC-NABI, BRIC-NIPGR): Development of crop varieties with enhanced tolerance to drought, flooding, and thermal stress

Women's Health Research (BRIC-INSTEM, WoRtH Program): Understanding sex-specific biology of developmental and chronic diseases

### 5.2 Capacity Building and Training

Collaborative networks support:

- PhD and Postdoctoral Exchange Programs - 200+ Indian scientists trained annually in international labs
- Institutional Facility Sharing - Access to advanced equipment and platforms
- Joint Grant Programs - International-national consortia funding research of bilateral interest
- Workshops and Symposia - 50+ annual collaborative scientific meetings

### 5.3 Publications and Citation Impact

BRIC collaborative research demonstrates high citation impact:

- Average 15-20 citations per paper in international collaborative publications
- 30% increase in high-impact publications (Nature, Science, Cell family) through international collaborations
- Emergence of 200+ inter-institutional collaborative publications annually

## 6. FUTURE DIRECTIONS AND STRATEGIC PRIORITIES

### 6.1 Deepening Existing Collaborations

- Expand bilateral agreements with top-tier research universities
- Establish Joint Research Centers with key international partners
- Create rotational scientist positions for long-term collaborative research

### 6.2 New Collaborative Frontiers

- South Asian Network Expansion: Strengthen ties with BIMSTEC nations for regional research initiatives
- African Partnerships: Develop malaria, tuberculosis, and tropical disease research consortia
- International Scientific Exchange: Establish collaboration frameworks in genomics and biotech innovation
- Middle East Collaboration: Engage Gulf countries in precision medicine and agricultural biotechnology

### 6.3 Strengthening the National Ecosystem

- Regional Hubs: Establish BRIC collaborations with emerging biotech hubs in tier-2 and tier-3 cities
- Private Sector Integration: Increase industry partnerships in drug discovery, diagnostics, and biotech manufacturing
- Startup Acceleration: Leverage BRIC research outputs through BIRAC-linked startup incubation

## 7. CONCLUSION

BRIC's international and national collaboration ecosystem represents a transformational model for how Indian research institutions can engage with global science while addressing local health, agricultural, and industrial biotechnology challenges. With 41 countries represented in international partnerships and 200+ active national collaborations, BRIC institutes have positioned themselves as indispensable nodes in the global biotechnology network.

The strategic distribution of collaborations—spanning leading research universities, world-class biotech companies, multilateral organizations, and national academic institutions—reflects a mature, strategically diversified approach to research innovation. This ecosystem facilitates:

- **Technology Transfer:** From international labs to Indian biotech companies
- **Talent Exchange:** Building a globally competitive Indian scientific workforce
- **Problem-Solving:** Addressing India-specific health and agricultural challenges through global expertise
- **Equity:** Expanding access to cutting-edge research tools and methods to Indian institutions

As India positions itself as a global biotechnology innovation hub, BRIC's collaborative networks will remain critical infrastructure for translating scientific discovery into public health and economic impact.

## 07 iBRIC EVENTS & OUTREACH ACTIVITIES

The year 2025 witnessed a coordinated surge of events and outreach activities across BRIC institutions, each reflecting the core vision of the National BioE3 Policy to advance biomanufacturing, strengthening the bioeconomy, and enabling new pathways for employment and entrepreneurship. From grassroots skill-building programs and start-up capacity development to national celebrations that

showcased sustainable bioproducts and translational breakthroughs, BRIC laboratories fostered an ecosystem where science, innovation, and societal impact directly intersect. This chapter highlights how these collective efforts are expanding public engagement, nurturing future talent, and catalysing BioE3-driven opportunities across India's rapidly evolving biotechnology landscape.

### A. LEADERS INSPIRING AND SUPPORTING EMERGING BIOTECHNOLOGY INITIATIVES

#### BRIC-NABI

**Advanced Entrepreneurship and Skill Development Programme (A-ESDP)**  
February 2025 | Mohali

BRIC-NABI organised a one-week Advanced Entrepreneurship and Skill Development Programme titled "Functional Foods, Nutraceuticals and Their Safety." The initiative, aligned with BRIC-NABI's mandate to support MSME growth, focused on developing entrepreneurial culture, providing hands-on training, and motivating participants toward self-employment.

Hon'ble Vice President of India & Chairman, Rajya Sabha, Shri Jagdeep Dhankhar inaugurated the workshop as Chief Guest. In his address, he emphasised the urgent need for innovation-driven entrepreneurship to uplift rural communities, encourage value-added agri-based enterprises, and improve socio-economic outcomes. The programme drew participants from across the country, reinforcing BRIC-NABI's role in national capacity building.



**BRIC-NABI organized a One-Week Advanced Entrepreneurship and Skill Development Program**

## BRIC-INSTEM

### Launch of Kisan Kavach – India’s First Anti-Pesticide Body Suit

December 2024 | New Delhi

Hon’ble Minister of Science and Technology (I/C), Dr. Jitendra Singh, launched Kisan Kavach, India’s first anti-pesticide body suit. Developed as a direct outcome of research at BRIC-inStem, the product has now entered commercial use and is benefiting thousands of farmers nationwide.

The launch marked a major milestone in translating cutting-edge innovation into practical, scalable solutions for agricultural worker safety.

### Review of Key Research and Infrastructure Initiatives

April 2025 | Bengaluru

Hon’ble Minister of State (I/C) for Science and Technology, Dr. Jitendra Singh, visited BRIC-inStem to review several flagship initiatives shaping India’s

biomedical research ecosystem. These included the Centre for Research, Application and Training in Embryology (CReATE), the inStem Plus pluripotent stem cell biobank, and the institute’s advanced Biosafety Level-3 (BSL-3) facility.

During the visit, he interacted with researchers and appreciated BRIC-inStem’s integrated approach to translational science, capacity building, and national mission alignment in areas such as regenerative biology and rare disease research.

### 10th Annual Cell and Gene Therapy Symposium

October 2025 | Vellore

Dr. Jitendra Singh, Hon’ble Minister of State (Independent Charge), Ministry of Science & Technology inaugurated the 10th Annual Cell and Gene Therapy Symposium hosted at BRIC-CSCR. Over the past decade, this symposium has evolved into a premier platform advancing India’s capabilities

in regenerative medicine and cell & gene therapy.

The 2025 edition featured leading clinicians, researchers, and industry partners who discussed emerging therapeutics, regulatory pathways, and translation-ready technologies. The Minister underscored the importance of strengthening India's innovation pipeline and called for deeper collaboration across BRIC institutions.

**17th Foundation Day Celebration  
August 2025 | Bengaluru**

BRIC-inStem celebrated its 17th Foundation Day, with Dr. V. Narayanan, Secretary, Department of Space

and Chairman, ISRO, as Chief Guest. His presence underscored the expanding intersection of space science and biotechnology, especially following the myogenesis experiment conducted aboard the Axiom-4 mission by Gaganyatri Group Captain Shubhanshu Shukla.

The event also marked the first anniversary of India's BioE3 policy, showcased through an on-campus display featuring BRIC-inStem's contributions and a student-led BioE3 Art Jam celebrating scientific creativity. The programme reflected BRIC-inStem's long-standing commitment to interdisciplinary research and public engagement.



**Left: Hon'ble Minister of State for Science and Technology, Dr. Jitendra Singh visits BRIC-inStem; Right: Dr. V. Narayanan, Chairman, ISRO at BRIC-inStem for 17th Foundation Day**

**BRIC-NII**

**Inauguration of the Dholpur Science Centre  
July 2025 | Dholpur, Rajasthan**

Hon'ble Dr. Jitendra Singh inaugurated the Dholpur Science Centre an important milestone for scientific outreach in one of Rajasthan's aspirational districts. Developed by BRIC-NII with support from DBT, the Centre was launched in the presence of state leadership, including Shri Jawahar Singh Bedam, Minister of State, Government of Rajasthan, and DBT Secretary Dr. Rajesh S. Gokhale.

Designed as a hub for STEM education and community

engagement, the Centre houses interactive exhibits, live demonstrations, and hands-on learning modules aimed at students, teachers, and local residents. It forms a key part of NII's Vigyan Setu initiative, which connects research institutions with schools to inspire scientific curiosity and promote grassroots innovation.

The event reaffirmed the Government of India's commitment to enhancing last-mile science outreach, enabling youth especially from rural and underserved communities to engage with contemporary scientific advances.



**Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge), Ministry of Science & Technology inaugurated the Dholpur Science Centre**

**ABSL-3 Non-Human Primate Facility Inaugurated at BRIC-NII**

On 10th November 2025, coinciding with the 2nd BRIC Foundation Day, Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge), Ministry of Science & Technology, inaugurated the Animal Biosafety Level-3 (ABSL-3) Facility for Non-Human Primates at the Primate Research Centre, BRIC-National Institute of Immunology.

This state-of-the-art facility marks a significant advancement in India's biomedical research capabilities.

As only the second such facility in the country, and among a very limited number globally, it represents a major boost to India's preparedness against emerging infectious diseases.

The Primate Research Centre at BRIC-NII houses 184 rhesus macaques (*Macaca mulatta*) and is registered with the Committee for Control and Supervision of Experiments on Animals (CPCSEA) for both breeding and research. The new ABSL-3 unit can accommodate up to 18 macaques, enabling high-containment in vitro and in vivo studies, including preclinical evaluation of vaccines and therapeutics.



**Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge), Ministry of Science & Technology inaugurated the ABSL-3 Non Human Primate Facility at BRIC-NII, New Delhi**

Designed to support research on high-risk and highly infectious pathogens, the facility strengthens national capacity for vaccine development, therapeutic testing, and biosafety-compliant translational research. It will

serve as a national resource, accessible to scientists across India working in infectious diseases, immunology, and public health.

## BRIC-NIBMG

### 200 Days of the One Day One Genome (ODOG) Initiative September 2025 | Kalyani

BRIC-NIBMG celebrated 200 days of the One Day One Genome (ODOG) initiative, marking a significant milestone in BRIC's national genomics mission. Dr. Rajesh Gokhale, Secretary DBT and DG BRIC, served as Guest of Honour and highlighted the initiative's contribution to building high-throughput genomic capacity across India.

The event brought together Directors and PIs from BRIC-NIBMG, BRIC-NCCS, BRIC-ILS, BRIC-THSTI, and BRIC-IBSD, who delivered invited lectures showcasing advances in genome sequencing, bioinformatics, rare disease biology, and microbial surveillance. The celebration strengthened cross-institutional collaboration within BRIC's genomic ecosystem.

## BRIC-THSTI

### SYNCHN 2025 — Annual Industry Business Meet July 2025 | Faridabad

BRIC-THSTI hosted SYNCHN 2025, its second annual industry business meet aimed at building collaborative ecosystems and accelerating India's leadership in health innovation. Initiated by Executive Director Prof. Ganesan Karthikeyan, the event emphasised the need for multidisciplinary, large-scale research and stronger academia-industry partnerships.

Key policymakers, including DBT Secretary Dr. Rajesh Gokhale and Principal Scientific Adviser Prof. Ajay Kumar Sood, urged industry leaders to champion innovation-driven growth, leverage India's expanding bioeconomy, and invest in translational research. The meet featured presentations on BRIC-THSTI's growing capacities—including the Medical Research Centre (MRC) and Translational Research Facility (TRF)—alongside showcases of successful vaccine and

CGT collaborations. SYNCHN 2025 reinforced BRIC-THSTI's role as a national hub for innovation and technology translation.

### THSTI Foundation Day 2025 July 2025 | Faridabad

Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge), Ministry of Science & Technology presided over BRIC-THSTI's 16th Foundation Day, acknowledging its contributions to national health research and its expanding global profile. Nineteen agreements were signed with industry partners, highlighting BRIC-THSTI's strong translational pipeline and commercialisation potential.

Dr. Anil Koul delivered the Foundation Day Lecture, unveiling a promising new molecule for tuberculosis treatment and commending BRIC-THSTI's world-class infrastructure and scientific talent.

## B. SKILL BUILDING IN EMERGING BIOTECHNOLOGY

### BRIC-CDFD

BRIC-CDFD strengthened scientific skills and public understanding through institutional visits, open days, Science Setu lectures, popular science talks, and participation in national science festivals. The Gyandeeep hands-on training programme, in collaboration with Kendriya Vidyalaya Sangathan, introduced school students to DNA technology and received national coverage on DD National.

The Conclave on Science Journalism brought together journalists from major media houses to discuss responsible science communication, with a focus on BRIC-CDFD's mission programme on paediatric rare diseases. BRIC-CDFD also continued to disseminate research updates through its active social media presence across six platforms.

### BRIC-IBSD

BRIC-IBSD undertook multiple capacity-building programmes across the Northeast:

- Mushroom Cultivation Workshop cum Training Programme at Imphal for entrepreneurship development.
- One-Day Workshop for Traditional Healers of Sikkim, enabling knowledge exchange between traditional healing practices and scientific methods.
- Training and distribution of 3.5 lakh aromatic planting materials to progressive farmers in Manipur to promote sustainable agriculture and livelihoods.
- A capacity-building programme on developing successful externally funded research proposals for university and college faculty.

### BRIC-ILS

#### 5th Zebrafish Investigators Meeting 6-8 November 2024 | ILS Bhubaneswar

Jointly organised by BRIC-ILS Bhubaneswar, CCMB Hyderabad, and ARI Pune, the meeting brought together nearly 150 participants, including 25 principal investigators, representing zebrafish research

laboratories across India. The event facilitated exchange of methods, collaborative discussions, and updates in developmental and disease biology.

## BRIC-NABI

- Co-organised PAC Asia 2025 (India), featuring six plenaries and 35 workshops led by global genomics experts.
- Hosted the UKRI-DBT Sustainable Agriculture Workshop (26-27 March 2025).
- Conducted the Faculty Development Programme - “ELEVATE & INNOVATE: Advanced Research & Biomanufacturing Skill Accelerate Program for Faculty” (10-20 June 2025), jointly with PSCST.



BRIC-NABI hosted a UKRI-DBT Sustainable Agriculture Workshop

## BRIC-inStem

BRIC-inStem conducted a wide range of advanced skill-building programmes:

- 70+ lectures and seminars, including the IDLI series.
- Flagship two-part Workshop on Human Pluripotent Stem Cell Culture hosted by the Stem Cell Facility.
- 10 Summer Research Fellows (SuRF) hosted between May-July 2025.
- Transmission Electron Microscopy Workshop (April 2025).
- 8th Hands-on Workshop on Integrated Omics (14-18 July 2025), co-organised with BLiSC institutions, and co-hosting of the 15th Bangalore Microscopy Course.
- Science Communication & Public Engagement Workshop (29 May 2025).
- “BuildingBrains” Workshop on neurodevelopment research (5-7 November 2025).

## BRIC-NBRC

- Hosted the EMBO Satellite Meeting on RNA-based Mechanisms of Neural Development and Physiology (21 February 2025).
- Co-organised the Regional Young Investigators Meeting (RYIM) Delhi-NCR (19–21 March 2025) with Ashoka University.
- Conducted a training session for primary school teachers on supporting children with Autism Spectrum Disorder (13 December 2024) with experts from Action for Autism, AIIMS, TIFR, and others.
- Organised the Certificate Course on Laboratory Animal Science (CCLAS 2025) (23 April–2 May 2025), including lectures by national experts and hands-on training using BRIC-NBRC’s animal facility.
- Inaugurated the Mouse Cryopreservation Facility (23 April 2025), a national resource for preserving inbred and GEM strains and enabling collaborative research.

## BRIC-NCCS

### Training & Scientific Meetings

- ProUPS Satellite Meeting: Proteostasis and Ubiquitin Proteasome System (6–7 February 2025).
- India/EMBO Lecture Course - “RNA-protein complexes: From molecular assembly to physiological functions and disease” (24–28 February 2025).
- Prof. John Barnabas Memorial Lecture (11 July 2025), featuring Dr Manohar Furtado.
- Facility (23 April 2025), a national resource for preserving inbred and GEM strains and enabling collaborative research.
- by Dr G.C. Mishra and Dr S.T. Pote at Shri Shivaji Vidyalaya & Junior College (1,500 students; 18 December 2024).
- Talk on cervical cancer and vaccination by Dr Sharmila Bapat at Sant Jijabai Kanya Vidyalaya (>1,000 students; 15 December 2024).
- Demonstration of cell culture and cancer cells by Dr Bhimashankar Utage at Yashwant Vidyalaya (~200 students; 27 November 2024).

### Outreach Lectures & Public Engagement

- Talks on stem cells and animal cell biotechnology

### Additional Talks by BRIC-NCCS Faculty

- Public lectures by Dr Sharmila Bapat at national science events and women-in-biotech forums (Jan–Sep 2025).
- Podcast: “Spiderman, unmasking its science” by Dr Deepa Subramanyam (Sci-Fi or Sci-Fact? series; 18 February 2025).

## BRIC-NIAB

BRIC-NIAB conducted multiple training and educational programmes, including an intensive workshop on Genomic Manipulation (February 2025) covering CRISPR, gene-editing tools, and transgenic

animal generation. BRIC-NIAB also hosted several educational tours and hands-on sessions for students and faculty from various institutions.

## BRIC-NIBMG

Key scientific events hosted during the year included:

- 12th Obaid Siddiqi Memorial Oration (7 January 25).
- Infectious Disease Symposium (24 February 25).
- 3rd BRIC-NIBMG & CSIR-IGIB Conclave (5-6 May 25).
- Mini-Symposium on World Microbiome Day (26 June 25).
- 1st Symposium on Statistical Genomics & Chronic Disease Biology (6 August 25).
- ODOG 200-Day Celebration (16 September 25) with participation from multiple BRIC institutes.
- BRIC-NIBMG Colloquium Series with eminent invited speakers (2025).
- Hindi Pakhwada 2025 (24 September 25).
- 1st BRIC-NIBMG-Industry Conclave (13 October 25).

## BRIC-NII

The International Day of Immunology was observed on 29 April 2025 with a special lecture by Dr Pragya D. Yadav (National Institute of One Health) on

addressing high-risk pathogens through the One Health approach.

## BRIC-NIPGR

On 4 September 2025, BRIC-NIPGR participated in the event “Celebrating BioE3 Policy: Technologies in Climate-Resilient Agriculture & Green Energy,”

where Director Dr Debasis Chattopadhyay delivered a lecture and BRIC-NIPGR showcased its research through an exhibition stall.

## BRIC-RGCB

BRIC-RGCB faculty delivered a series of specialised lectures nationally and internationally on topics including Raman spectroscopy, cancer drug discovery, nanopore technologies, women in STEM, Alzheimer’s disease, pluripotency, T-cell immunotherapy, CNS

disorders, and flow cytometry. These engagements strengthened academic networks, supported career development, and expanded BRIC-RGCB’s scientific visibility.

## BRIC-THSTI

- Global Immunology Summit 2025 (13-15 February 2025), bringing together international experts in immunotherapy, autoimmune disease, and translational immunology.
- Drug Discovery Symposium - “Success Stories” (18 February 2025), conducted with DNDi.
- FIMSA Advanced Immunology Course 2025 (10-12 February 2025), held immediately prior to the summit.
- Dr M.K. Bhan Memorial Oration 2024 (11 November 2024), delivered by Dr Deepak Salunke.

## C. CELEBRATING BIOE3 AND PROMOTING ENTREPRENEURSHIP

Across BRIC institutions, the BioE3 ecosystem, focusing on biotechnology for economic empowerment and environmental sustainability was celebrated through trainings, conclaves, exhibitions, industrial dialogues, and entrepreneurship

development programmes. These activities strengthened innovation pipelines, expanded startup mentorship, and built capacity among students, researchers, and aspiring entrepreneurs across India.

### BRIC-IBSD

BRIC-IBSD organized a Mushroom Cultivation Workshop-cum-Training Programme at Imphal to build entrepreneurship skills in the North-East. On 5 May 2025, IBSD also hosted a Startup

Initiative Programme aimed at supporting early-stage innovators and strengthening the regional bioeconomy.

### BRIC-ILS

The BRIC-ILS Incubation Centre conducted two editions of Bioignite: Master Class on Entrepreneurship (20–22 May 2024 and 11–13 June 2024). These three-day masterclasses offered immersive sessions on startup management, funding strategies, market positioning, and

business development in biotech. Esteemed speakers—including Dr. Shreeram Raghavan, Dr. Viswanadham, Dr. Ramjee Pallela, Ms. Aprajata, Dr. Vishal Gandhi, and Dr. Kamlesh Mishra—guided participants through real-world case studies and interactive learning to cultivate entrepreneurial mindset and resilience.

### BRIC-InStem

The Centre for Stem Cell Research (CSCR), in collaboration with inStem, reported India's first in-human gene therapy trial for Haemophilia A (December 2024)—a landmark translational milestone demonstrating India's growing capabilities in advanced therapeutics.

BRIC-inStem also participated in World Bioproduct Day, hosting panel discussions on "Bioproducts: The Second Life of Science & Industry". The event highlighted innovations aligned with the National BioE3 policy and featured showcases from student-led start-ups.

## BRIC-NABI

BRIC-NABI conducted a One-Week Advanced Entrepreneurship and Skill Development Programme (A-ESDP) on Functional Foods, Nutraceuticals and their Safety (18-22 February 2025), offering hands-on training and entrepreneurship exposure to participants nationwide.

Throughout March 2025, BRIC-NABI organized Entrepreneurship Awareness Programmes, featuring talks by

- Prof. Rupesh Chaturvedi (JNU) on Breaking Boundaries: The Raman ID Saga (3 March 2025), and

- Mr. Manish Verma, Co-founder & CEO, Angel Blue Holdings, on Think, Create, Launch: An Introduction to Entrepreneurship (17 March 2025).

On World Bioproduct Day 2025 (7 July), BRIC-NABI joined BRIC institutions across India in the synchronized national dialogue series “Featuring: Voices Across Cities - The BioE3 Way”, spotlighting innovations in sustainable bioproducts.

BRIC-NABI also organized the BioE3 Conclave on 3 September 2025, guest by Shri Priyank Bharti, IAS, and Dr. Rajesh S. Gokhale. The Punjabi-language BioE3 awareness video was launched at this event.

## BRIC-NCCS

BRIC-NCCS led several BioE3-linked entrepreneurship and industry engagement initiatives:

- Industry-Academia Monthly Seminar Series (Mar-Jun 2025): Biotech for Sustainable Growth, featuring discussions with leaders from the biotechnology sector.
- ‘UKCatapultModelforDeepTechCommercialisation - A CPI Perspective’ (6 June 2025), hosted with DBT and the British High Commission.
- World Bioproduct Day - The BioE3 Way (7 July 2025), themed Urban Biomanufacturing & Industrial Waste Utilization, featuring:

- Opening address by Dr. Sharmila Bapat,
- Panel on Policy to Bioproducts: High-Performance Urban Biomanufacturing,
- A local startup success story by Dr. Ashish Polkade, BESTECO,
- Student pitch “Green Buildings” by Ms. Sneha Verma.

BRIC-NCCS also celebrated One Year of the BioE3 Policy (25 August 2025) with institute-wide competitions—rangoli, posters, and short videos—on Green Growth, Good Jobs, Cleaner Future.

## BRIC-NIPGR

On 4 September 2025, BRIC-NIPGR participated in an event hosted by ICGEB, New Delhi on Technologies in Climate-Resilient Agriculture and Green Energy as part of BioE3 celebrations.

Director Dr. Debasis Chattopadhyay delivered a lecture, and BRIC-NIPGR showcased its innovations through a dedicated science exhibition stall.

## D. CELEBRATING SCIENCE AND INNOVATION

All BRIC institutions actively contributed to national celebrations of science, with full participation in the India International Science Festival (IISF) 2024 at IIT Guwahati (30 November–3 December 2024)

and Global Bio-India 2025, collectively highlighting scientific achievements, innovations, and public engagement initiatives.

### BRIC-CDFD

BRIC-CDFD participated in the Science and the City stream of the Hyderabad Literature Festival (24–26 January 2025), the Science Congress of Kendriya

Vidyalaya Sangathan, and Global Bio-India 2025, showcasing its scientific contributions and outreach activities.

### BRIC-ILS

The institute also celebrated National Science Day 2025 across seven locations in Odisha with the theme Empowering Indian Youth for Global Leadership in Science and Innovation for Viksit

Bharat, engaging over 2000 students through lectures, demonstrations, competitions, and innovation-focused activities.

### BRIC-inStem

BRIC-inStem participated in the 28th National Science Exhibition, Kolkata (21–24 August 2025), where it

showcased research, interactive exhibits, and science communication efforts for diverse audiences.

### BRIC-NABI

To mark National Science Day 2025, BRIC-NABI hosted a thematic lecture by Prof. P. K. Gupta on Genetics &

Genomics Education for Social Welfare, emphasizing the role of genomics in societal well-being.

### BRIC-NBRC

BRIC-NBRC celebrated National Science Day 2025 with participation from multiple schools and colleges, offering students opportunities to engage

with neuroscience research and discussions led by scientists and educators.

## BRIC-NCCS

BRIC-NCCS commemorated National Technology Day (May 2025) with the seminar Charkha to Chemistry: Transforming Plastic Waste into Opportunities.

The institute also held an Open Day for National Science Day (28 February 2025) and organized an Education Day session on Current Trends in Proteomics and Metabolomics during the 16th Annual Meeting of the Proteomics Society of India (19 November 2024).

## BRIC-NIBMG

BRIC-NIBMG celebrated National Science Day 2024 as an Open Day, hosting over 70 students and teachers. Visitors toured the Genome Hall, Genome Lab, and interactive demonstrations.

The institute also organized outreach visits for college students and participated in the 28th National Science Exhibition (21-24 August 2025) to engage school students and the broader public.

## BRIC-NII

BRIC-NII marked the International Day of Immunology (29 April 2025) with a lecture on One Health and high-risk pathogen management.

The institute's National Science Day 2025 celebrations included a keynote lecture on translational research and the launch of a new edition of its digital magazine Immunoscope.

## BRIC-RGCB

The institute undertook participated in Bio Connect 3.0 (9-10 October 2025) in Kovalam, presenting cutting-edge research. It also participated in brainstorming sessions on Kerala@2047, TANDEM-

ABX Stakeholder Consultation, and a joint cancer research initiative with the Association of Medical and Pediatric Oncologists of Kerala (18 September 2025).

## BRIC-THSTI

BRIC-THSTI celebrated National Technology Day (13 May 2025) with a keynote lecture on India's first Made-in-India CAR-T cell therapy by Prof. Rahul Purwar. A major attraction was the Phase 1 Clinical Trial Awareness Booth, which engaged over 100 visitors through interactive discussions on clinical trials and volunteer participation.

For National Science Day 2025, BRIC-THSTI hosted a lecture by Dr. Krithika Rangarajan on the transformative role of AI in healthcare, highlighting its potential in diagnostic innovation and emphasizing responsible, human-in-the-loop scientific practice.

## E. STUDENT VISITS AND PUBLIC ENGAGEMENT

BRIC institutions continued to strengthen science-society connect through structured educational visits, open days, public lectures, thematic observances, and hands-on learning opportunities. These initiatives provided school and university students, teachers, healthcare workers, farmers, and community members with direct exposure to India's

biotechnology ecosystem. Across the 14 institutes, activities ranged from guided tours and interactive demonstrations to health awareness sessions and national science celebrations, collectively advancing BRIC's mission of nurturing scientific literacy and public engagement.

### BRIC-CDFD

BRIC-CDFD remained active in public outreach through institutional visits, open days, Science Setu lectures, and participation in national science festivals. Its flagship hands-on programme Gyandeeep, delivered in partnership with Kendriya Vidyalaya Sangathan, introduced school students to DNA technology and received national media

attention on DD National. The Conclave on Science Journalism convened leading reporters to discuss science communication and highlighted BRIC-CDFD's mission programme on paediatric rare diseases. Consistent engagement across social media platforms further amplified research awareness and public education.

### BRIC-ILS

BRIC-ILS welcomed student groups from multiple educational institutions for interactive sessions with scientists, laboratory demonstrations, and discussions on research careers. The institute's

immersive format offered young visitors first-hand insights into modern biological research. Increased footfall this year illustrated growing public interest in life sciences across the region.

### BRIC-inStem

BRIC-inStem hosted 10 undergraduate fellows as part of the Summer Research Fellowship (SuRF) and welcomed students from schools and colleges throughout the year. Visitors explored laboratories, interacted with researchers, and learned about advances in stem cells, regenerative biology, and

bioengineering. Public engagement events were organised around International Women's Day, Brain Awareness Week, and Stem Cell Awareness Day, contributing to wider public understanding of health and biomedical research.

## BRIC-NABI

BRIC-NABI hosted over 1,500 students and teachers from a wide range of schools, universities, and technical institutes. Visitors toured laboratories, interacted with researchers, and learned about BRIC-NABI's work in food and nutrition biotechnology.

The institute co-organised the launch of SHE Cohort 3.0 with PSCST and convened the UKRI-DBT Sustainable Agriculture Workshop, giving students exposure to international scientific collaborations and innovations in sustainable agriculture.

## BRIC-NBRC

BRIC-NBRC facilitated multiple visits from schools, colleges, and universities across the NCR, offering guided exposure to neuroscience research, brain imaging technologies, and computational approaches. As part of popular science outreach,

Dr. Anirban Basu delivered the widely appreciated talk “Eat Smart, Think Sharp: The Science of Food, Nutrition and the Teenage Brain”, attended by more than 200 students and teachers at Bal Bharati Public School, IMT Manesar.



## BRIC-NCCS

More than 4,000 individuals benefitted from BRIC-NCCS's training programmes, internships, open days, workshops, and academic initiatives. Open day events drew 374 students, educators, and general visitors. Training was offered across areas including

cell culture, proteomics, bioinformatics, imaging, microbiology, and animal experimentation. A major highlight was a public lecture by Nobel Laureate Aaron Ciechanover, which included interactive sessions with students and young researchers.

## BRIC-NIAB

BRIC-NIAB advanced community engagement through activities spanning One Health, livestock science, and public health. National Science Day

featured student competitions, guided facility tours, and a special lecture linking public health and urban governance. The MILAN programme brought

together livestock farmers, postgraduate students, and experts for experience sharing. Public health sessions on cardiac health, cancer awareness, CPR,

and Basic Life Support empowered community members with essential skills and knowledge.

## BRIC-NIBMG

BRIC-NIBMG conducted targeted outreach visits for students from regional colleges and universities, offering interactive sessions with faculty and guided tours of the Genome Hall and Genome Lab. The

institute's Genetic Services Unit continued to provide free genetic testing for patients referred from government hospitals in West Bengal, connecting cutting-edge genomics with public health service.

## BRIC-NIPGR

BRIC-NIPGR hosted an extensive series of study tours for schools, colleges, and agricultural and technical universities from across India. Students participated in lectures, lab demonstrations, and guided campus tours, gaining exposure to plant genomics, molecular biology, and agricultural

biotechnology. Visitors during the reporting period included institutions from Rajasthan, Kerala, Maharashtra, Uttar Pradesh, Madhya Pradesh, Delhi NCR, Haryana, and Tamil Nadu—reflecting BRIC-NIPGR's national footprint in plant-science outreach.

## BRIC-RGCB

BRIC-RGCB marked major national and international observances with lectures, student interactions, and community-focused activities.

- International Day of Women and Girls in Science featured Dr. Sharmila Mande, who spoke on the microbiome's role in health and economic sustainability.
- National Science Day engaged local students through guided tours and a special address by Dr. J. N. Moorthy of IISER.
- World Environment Day included a lecture on emerging contaminants and a tree-planting drive at the Akkulam campus.

BRIC-RGCB also undertook extensive community outreach: awareness sessions on hemoglobin deficiency, environmental education activities with GHSS Meppadi students, a blood donation camp with SCTIMST, and the inauguration of new laboratory and diagnostic service units. The institute welcomed over 2,000 students from 85 institutions as part of its science education tours. The newly inaugurated Rice Museum in Sultan Bathery, showcasing over 350 traditional rice varieties, further strengthened RGCB's efforts in sustainable agriculture and public education.

## BRIC-THSTI

BRIC-THSTI continued to strengthen scientific awareness and student engagement through DBT's flagship outreach initiative, SCIENCE SETU, hosting multiple visits and lectures across 2024-25. These included undergraduate and postgraduate students from Swami Shraddhanand College (DU), Eicher School (Faridabad), G.D. Goenka University, SGT University (Gurugram), and JECRC University (Jaipur). The institute also engaged AYUSH faculty from the All India Institute of Ayurveda and delivered an expert lecture at Shaheed Rajguru College for

Applied Sciences for Women.

BRIC-THSTI marked National Technology Day (13 May 2025) and National Science Day (28 February 2025) with interactive sessions and laboratory demonstrations. The institute additionally showcased its research and public outreach efforts at IISF 2024 (30 Nov-3 Dec 2024). Through these sustained efforts, BRIC-THSTI continues to inspire young learners, strengthen science education, and build future talent pipelines for India's biotechnology ecosystem.

# 08 STARTUP CATALYSTS: FOSTERING INNOVATION & GROWTH

## BRIC-IBSD

For the promotion of Start-ups in NER, IBRIC-BSD has setup Bioincubators Nurturing Entrepreneurship for Scaling Technologies (BioNEST) incubator to develop women entrepreneurship through orchid floriculture from different parts of Ri-Bhoi, Aspirational District of Meghalaya, India. Under this incubator, more than 100 women entrepreneurs have been trained and encouraged for orchids cultivation and propagation.

BRIC-IBSD is organizing many trainings and outreach programmes under this BioNEST Incubator to encourage women entrepreneurship for the development of bioeconomy through bioresources. This programme of IBSD was highlighted during India International Science Festival 2025 at Guwahati for promoting women bio-entrepreneurship through Orchid floriculture.



IBSD highlighted BioNEST Incubator activities during IISF 2025 at Guwahati

## BRIC-NABI

DBT awarded the winners of the Race from Science to Entrepreneurship (RaSE) Awards for their pioneering contributions to biotech innovation. Dr

Nitesh Priyadarshi and Ms Priyanka Garg from Dr. Nitin Singhal's group received the award from Dr. Rajesh S. Gokhale, the Secretary of the Department

of Biotechnology (DBT), on DBT Foundation Day, 26th February, 2025. The technology presented in the RASE competition was entitled "BACTOSENSE- A Smart Approach for Onsite Detection of Bacteria in a contaminated Sample".

BRIC-NABI is committed to fostering entrepreneurship and skill development to support Micro, small, and Medium Enterprises (MSME) growth. As part of this initiative, BRIC-NABI organized a One-Week Advanced Entrepreneurship and Skill Development Programme (A-ESDP) entitled "Functional Foods nutraceuticals and their Safety" from 18-22th February, 2025 for the participants from across the country, focusing on Entrepreneurial culture, hands on training & self-employment motivation. Hon'ble Vice President of India & Chairman, Rajya Sabha, Sh. Jagdeep Dhankhar Jee, as the chief Guest, inaugurated the workshop. Sh Jagdeep Dhankhar Jee emphasized the urgent need for new ideas and entrepreneurship to uplift rural areas and bring prosperity to their lives.

- NABI is committed to fostering entrepreneurship and skill development to support Micro, small, and Medium Enterprises (MSME) growth. As part of this initiative, a One-day Entrepreneurship Awareness Program (EAP) entitled "The Entrepreneurial Mindset: A Roadmap to Success" under the MSME Ministry was organized in NABI on 3rd March 2025.
- BRIC NABI BioNEST has incubated 'Dr Cordy' as a virtual incubate working in the area of functional foods and biotechnology. The Startup joined BioNEST on 30th September 2025.
- Prof. Rupesh Chaturvedi, JNU delivered a talk on "Breaking Boundaries: The Raman ID Saga" on 3rd March 2025 as a part of the 'One-day Entrepreneurship Awareness Programs (EAP)'.
- Mr. Manish Verma, MBA, Co-founder & CEO, Angel Blue Holdings Private Limited, delivered a talk on "Think, Create, Launch: An Introduction to Entrepreneurship" on 17th March 2025.

## BRIC-NCCS

Seminar series: "Biotech for Sustainable Growth: Rendezvous with Leaders from the Industry": Aimed at creating awareness about entrepreneurship as a career opportunity, and the strategies to address

the challenges involved. The faculty and students engaged in extensive conversations with stalwarts from the industry, who gave talks at BRIC-NCCS, as listed below:

Speaker	Affiliation	Seminar Date	Talk Title
Dr. Vilas P. Sinkar	Former Vice President, Unilever Strategic Science, and Head of Unilever R&D, Bengaluru	07 March 2025	Career opportunities for PhD students
Dr. Umesh Shaligarm	Director, R&D, Serum Institute of India Pvt. Ltd.	17 April 2025	Vaccine development
Prof. Pramod Wangikar	Professor and Head of the Department, Chemical Engineering, IIT Bombay	07 April 2025	Harnessing metabolomics for precision health, bioprocess optimization, and metabolic engineering
Dr. Murali Ramachandra	CEO, Aurigene Oncology Limited, Bengaluru	15 May 2025	Opportunities for targeting immune checkpoint proteins in cancer therapy using small molecule inhibitors
Dr. Amulya K. Panda	Associate Director, Panacea Biotech Ltd. New Delhi	13 June 2025	Challenges in translating innovations in biotechnology

In association with DBT and the British High Commission in India, BRIC-NCCS hosted talks by Dr. Arun Harish (Chief Strategy Officer) and Mr. Kris Wadrop (Managing Director - Materials) from CPI, UK, and a round table meeting between them

and leaders from industries and startups in the biotechnology sector, and with Directors of national research organizations, to fuel conversations aimed at creating a robust biomanufacturing ecosystem aligned with the BioE3 policy. 06 June 2025.

## BRIC-NIAB

During the past year, BRIC-NIAB has incubated one start-up (Vetdiag Genomix Pvt. Ltd on 27.11.2024)

focused on animal health.

## BRIC-NIBMG

We organized a BRIC-NIBMG Industry Conclave where representatives from various industries and start-ups were invited. Topics such as precision

medicine, patenting and technology transfer were discussed.

## BRIC-RGCB

- On August 25, 2025, Dr. G. S. Vinod kumar from BRIC-RGCB registered a faculty-led startup, VinMax Biotech Pvt. Ltd. In a significant step towards translating innovative research into practical biotechnology solutions, BRIC-RGCB Director Prof. Chandrabhas Narayana inaugurated VinMax Biotech Pvt. Ltd. The startup initially focuses on developing products and services such as a Xeno-Free Extracellular Matrix for Cell Culture, Xenograft Tumor Models, a Sprayable Hemostatic Agent, Solid Phase Peptide Synthesis, and a Dermal Cream for Melasma and Hyperpigmentation. [VinMax Biotech](https://vinmaxbiotech.com/).
- KRIBS BioNest, a biotechnology startup incubation center established through a partnership between BRIC-RGCB and the Kerala Startup Mission, made significant progress during the reporting period by welcoming six new startups and successfully graduating Scopeful Bio Research to its own R&D facility. The center now hosts 15 startups, prioritizing innovation and intellectual property, as demonstrated by Avisia Biotech securing a patent and publishing impactful research. Many incubatees achieved notable funding and accolades, including the KAU RABI RAFTHAAR RAISE Grant and the AMRUT 2.0 Award for their development of a water testing kit. Through active participation in national and international events, two startups were selected for VC pitch opportunities.
- Additionally, the launch of structured internships in Molecular Biology further enhanced practical exposure for students and aspiring entrepreneurs.

## BRIC-THSTI

Three SiB fellows from the inaugural batch have set up their start ups: practical exposure for students and aspiring entrepreneurs.

Name of the SiB fellow	Name of the Start-up
Ms. Devhuti Palan	Arundhati Healthcare Pvt. Ltd.
Dr Jayanti Kumari	Astraeus Innovus Pvt. Ltd
Mr Kumar Nischaya	Nidaan Scientific Pvt. Ltd.

# IBRIC AWARDS AND RECOGNITIONS

## BRIC-CENTER FOR DNA FINGERPRINTING AND DIAGNOSTICS (BRIC-CDFD)

- **Dr. Murali D. Bashyam:** Member of Guha Research Conference.
- **Dr. Murali D. Bashyam:** Received International Travel Grant from ICMR for attending the Annual Meeting of the American Association of Cancer Research (AACR), 2025, Chicago, USA (April 25-30, 2025).
- **Dr. Sangita Mukhopadhyay:** Sun Pharma Science Foundation Research Fellowship 2024.
- **Dr. Rashna Bhandari:** Indian Academy of Sciences (IASc) Fellowship.
- **Dr. Ashwin Dalal:** Award for Outstanding Contribution to Precision Medicine Research in India at the 2nd Edition of Precision Med India Conclave & Awards, organized by Voice of Healthcare, New Delhi. National Academy of Sciences, India (NASI) Fellowship.
- **Dr. Rupinder Kaur:** Anusandhan National Research Foundation J.C. Bose Grant 2025.
- **Dr. Ajay Mahato:** ICMR International Travel Fellowship to present research work at the Annual Meeting of the American Association for Cancer Research (AACR), USA, 2025.

## BRIC- INSTITUTE OF BIORESOURCES AND SUSTAINABLE DEVELOPMENT ( BRIC-IBSD)

- **Dr. Sarangthem Indira Devi:** Selected as member of National Academy of Sciences India (NASI) 2024

## BRIC-INSTITUTE OF LIFE SCIENCES (BRIC-ILS)

- **Dr. Amaresh C Panda:** Listed among the top 2% highly cited scientists in 2024; published by Stanford University.
- **Dr. Amaresh C Panda:** Serves as a Non-Executive Director of a startup company, "RNA Biotech Private Limited".
- **Dr. Amaresh C Panda:** Served as Associate Editor of peer-reviewed journals, Cellular Molecular Life Sciences and PeerJ.
- **Dr. Amol Ratnakar Suryawanshi:** Life Member & Executive Council Member: Proteomics Society of India.
- **Dr. Amol Ratnakar Suryawanshi:** Member of Human Proteome Organization (HUPO).
- **Dr. Amol Ratnakar Suryawanshi:** Life Member of Laboratory Animals Scientist Association, India.

- **Dr. Amol Ratnakar Suryawanshi:** Life Member of Indian Society for Mass Spectrometry (ISMAS).
- **Dr. Debabrata Biswas:** Invited as Chief Speaker for the Annual Seminar 2024–25 of P.G. Department of Botany at Sailabala Women's College, Cuttack.
- **Dr. Gulam H Syed:** PLOS Pathogens Associate Editor.
- **Dr. Narottam Acharya:** Invited to Guha Research Conference–2024 at Kaziranga, Assam.
- **Dr. Narottam Acharya:** Association of Microbiologists of India (AMI) – The First Soshil Kumar Jain Panacea Biotech Award.
- **Dr. P. V. Ramchander:** Elected Fellow of the Telangana Academy of Sciences (FTAS).
- **Dr. P. V. Ramchander:** Elected Executive Council Member, Indian Society of Human Genetics (ISHG).
- **Dr. Satish Devadas:** Participated in Global Immunology Summit (GIS 2024) conducted by BRIC-THSTI (Translational Health Science and Technology Institute), Faridabad
- **Dr. Soma Chattopadhyay:** Winner of the “Biotech Hackathon” for demonstrating outstanding innovation and problem-solving skills in Biotechnology at Biotech Hackathon 2024, organized by DBT-ILS Bioincubator on 4th February 2025, under the startup “PhytoDefense”, for blending traditional knowledge with science.

## BRIC- INSTITUTE FOR STEM CELL SCIENCE AND REGENERATIVE MEDICINE (BRIC-inStem)

- **Dr. Bhavana Muralidharan,** faculty at iBRIC-inStem selected as EMBO Global Investigator Network
- **Prof. Maneesha S Inamdar** is an ISSCR Public Service Award Honoree of the International Society for Stem Cell Research (ISSCR) along with the members of the rest of the ISSCR committees, task forces and working groups.
- **Prof. Maneesha S Inamdar** is recognized by Harper’s Bazaar India titled “The New Vanguard of STEM: 10 People to Look Out For” for driving innovation and excellence in the field of stem cell science.
- **Prof. Maneesha S Inamdar** was selected for the inaugural IIT Madras Distinguished Lecture at Indian Institute of Technology, Madras.
- **Prof. Maneesha S Inamdar** is Recognized by BioSpectrum as one of the 10 Women Leaders and Influencers shaping policy matters in biotechnology and leading academic institutes.
- **Prof. Maneesha S. Inamdar** is appointed as Member of the Council of Indian Academy of Sciences (IASc) Bangalore
- **Prof. Praveen Kumar Vemula** received Chemical Research Society of India-Bronze Medal 2025 for developing innovative chemical technologies for solving unmet clinical needs.
- **Dr Reena Singh and Dr Srinivas Repudi** have received ANRF- Prime Minister Early Career Research Grant

## BRIC- NATIONAL AGRI-FOOD BIOTECHNOLOGY INSTITUTE REGENERATIVE MEDICINE (BRIC-NABI)

- The Department of Official Language, Ministry of Home Affairs, organized the Central, Western, and Northern Regional Joint Official Language Conference on 17 February 2025 in Jaipur. On this occasion, the National Agri-Food Biotechnology Institute (NABI) was conferred the First Prize (North Zone-1) for its outstanding work in the implementation of Hindi as the Official Language (Rajbhasha). On behalf of the institute, Dr. Siddharth Tiwari, Mr. S. Krishnan, and Mr. Arun Kumar, members of the Official Language Committee, participated in the conference and received the award shield and certificate from the Hon'ble Chief Minister of Rajasthan, Shri Bhajan Lal, and the Hon'ble Minister of State for Home Affairs, Government of India, Shri Nityanand Rai.
- DBT awarded the winners of the Race from Science to Entrepreneurship (RaSE) Awards for their pioneering contributions to biotech innovation. Dr Nitesh Priyadarshi and Ms Priyanka Garg from Dr. Nitin Singhal's group received the award from Dr. Rajesh S. Gokhale, the Secretary of the Department of Biotechnology (DBT), on DBT Foundation Day, 26th February, 2025. The technology presented in the RASE competition was entitled "BACTOSENSE- A Smart Approach for Onsite Detection of Bacteria in contaminated Sample".
- Dr Prafull Salvi has been awarded the SPBB-Springer Young Scientist Award-2025, organized by the Society of Plant Biochemistry and Biotechnology (SPBB), New Delhi, at the National Conference on "Emerging Innovations in Biochemistry and Biotechnology for Holistic Development of Agriculture" held at SKUAST-Jammu, India.

## BRIC- NATIONAL BRAIN RESEARCH CENTRE (BRIC-NBRC)

- **Dr. Anirban Basu** - Haryana Vigyan Ratna Award-2024 (Highest State Science Award of the Government of Haryana).
- **Dr. Pankaj Seth** - Fellow of the Indian National Science Academy (INSA).
- **Dr. Ellora Sen** - Fellow, Indian National Science Academy (INSA), 2025.
- **Dr. Soumya Iyengar** - Presented the Dr. Shankar Oration at the BBIF International Biobanking Conference, JNU, New Delhi (March 10, 2025).
- **Dr. Arpan Banerjee** - Elected Associate Fellow, Indian National Science Academy (INSA), 2025.
- **Dr. Sourav Banerjee** - Funded by CEFIPRA (Indo-French Centre for the Promotion of Advanced Research) for work on neurodevelopmental deficits of Autism Spectrum Disorder caused by long non-coding RNA-Fragile-X-Mental Retardation Protein interaction.
- **Dr. Anindya Ghosh Roy** - Wellcome Trust-DBT Senior Fellowship.
- **Dr. B. S. Sahu** - Received prestigious funding from Ignite Life Sciences Foundation for research on protecting the brain from neurodegenerative diseases.
- **Dr. Vidhya Munnamalai** - Received ANRF Grant for work on genetic causes of hearing loss; DBT Grant under "Emerging Frontiers in Biotechnology" (Biomedical Sciences) titled Investigating the influence of cytoskeletal regulators on the regenerative potential of cochlear sensory tissue.
- **Dr. Proloy Das** - Received IBRO Rising Stars Award to help establish his new lab at BRIC-NBRC

## BRIC- NATIONAL CENTRE FOR CELL SCIENCE (BRIC-NCCS)

- **Dr. Sharmila Bapat:** The M. G. Deo Oration at the 44th Annual meeting of the Indian Association of Cancer Research (IACR) at Kolkata. 16 January 2025.
- **Dr. Sharmila Bapat:** Lifetime Achievement Award for the year 2025 from the Golden Jubilee Biotech Park for Women Society. 08 March 2025.
- **Dr. Sharmila Bapat:** Elected as Fellow of the Indian National Science Academy, for her research in Cancer Biology, especially her pioneering work on Cancer Stem Cells associated with high grade Ovarian Cancer.
- **Dr. Sharmila Bapat:** Elected as Council Member of the Indian Academy of Sciences, Bengaluru for the triennium 2025-2027.
- **Dr. Sharmila Bapat:** Member of the Fellowship Security Committee (FSC) 2025-2028 for Animal Sciences of National Academy of Sciences, India (NASI).
- **Dr. Sharmila Bapat:** Appointed as Advisory Committee Member of the Indian Cancer Genome Atlas (ICGA).
- **Dr. Sharmila Bapat:** Nominated as member for Local Research Advisory Committee (LRAC) of AFMC, Pune.
- **Dr. Jomon Joseph:** Elected as Fellow of the Indian National Science Academy, for his research in cell biology, especially his work on annulate lamellae (AL), a less studied cellular compartment.
- **Dr. Girdhari Lal:** Indian National Science Academy (INSA) Associate Fellow 2024.
- **Dr. Akanksha Chaturvedi:** The Scientific High Level Visiting Fellowship (SSHN) for 2025.
- **Dr. Senthil Kumar Thangaraj:** DBT Ramalingaswami Re-entry Fellowship 2025 (only the Research Grant Component)
- **Dr. Radha Chauhan:** BIOSANTEXC travel fellowship (2024-2025) funded by the French Embassy for initiating an Indo-French academic research programme.
- **Dr. Nibedita Lenka:** Invited by ICMR to serve as an Expert Member for their Technical Advisory Group (TAG) committee to review and recommend the project proposals for the Centre of Advanced Research (CAR) in the area of maternal health.
- **Dr. Santosh Kumar:** Invited as Guest Faculty at the University of Chicago, USA (26 November 2024 - 12 June 2025), with support from the DBT/Wellcome Trust India Alliance Intermediate Fellowship.

## BRIC- NATIONAL INSTITUTE OF ANIMAL BIOTECHNOLOGY (BRIC-NIAB)

- **Dr. Sonu Gandhi:** Fellow of Telangana Academy of Sciences (TAS)
- **Dr. Sonu Gandhi:** Shri Om Prakash Sharma Award from Indian Academy of Biomedical Sciences
- **Dr. Sanjay Singh:** Materials Research Society of India (MRSI) Medal for year 2024
- **Dr. Sonu Gandhi, Dr. Sanjay Singh:** Listed in World's top 2% Scientists published by Stanford University and Elsevier 2025
- **Dr. J Radhakrishnan:** Indo-German Science and Technology Centre (IGSTC) - Paired Early Career Fellowship in Applied Research (PECFAR)

## BRIC- NATIONAL INSTITUTE OF BIOMEDICAL GENOMICS (BRIC- NIBMG)

- **Dr. Arvind Korwar** received the Young Investigator Award at the 18th International Conference on Trace Elements in Man and Animals (TEMA), jointly organized by Penn State University and Ramaiah Group of Institutions in Bengaluru
- **Dr. Sagar Sengupta** received the renewal of JC Bose Fellowship.
- **Dr. Sriram Sridharan** received the Ramalingaswamy Re-entry fellowship and joined BRIC-NIBMG in July 2025
- Our Faculty members are members of the National and State Science Academies

## BRIC- NATIONAL INSTITUTE IMMUNOLOGY (BRIC- NII)

- **Special recognition for the National Institute of Immunology's** contributions at the PRECISION MED INDIA AWARDS CEREMONY, by Voice of Healthcare.
- **Dr. Debasisa Mohanty** received the prestigious JC Bose Grant in 2025.

## BRIC- NATIONAL INSTITUTE OF PLANT GENOME RESEARCH (BRIC- NIPGR)

- **Dr. Jagadis Gupta Kapuganti** has been awarded 'Rashtriya Vigyan Puraskar- Vigyan Yuva- Shanti Swarup Bhatnagar Award', announced during the year 2025, for his outstanding contributions in the field of Agricultural Sciences.
- **Dr. Amarjeet Singh** has been awarded 'R.D. Asana Gold Medal Award 2024' of the Indian Society for Plant Physiology for his outstanding contributions in the field of Plant Physiology & Molecular Biology.
- **Dr. Mukesh Kumar Meena** has been awarded Prof. S. K. Sopory Young Scientist Award 2024' of the Indian Society for Plant Physiology for his outstanding contributions in the field of Plant Immunity.
- **Dr. Alok K. Sinha** has been awarded 'Prof. Saligram Sinha Memorial Lecture 2024' for his contribution in the field of Plant Science by the National Academy of Sciences, Prayagraj, India.
- **Dr. Gopaljee Jha** has been elected as Fellow of Indian Academy of Sciences, Bangalore towards his contributions in the field of Plant Science.
- **Dr. Jyothilakshmi Vadasery** has been elected as Fellow of National Academy of Sciences, India (NASI), Prayagraj towards her contributions in the field of Plant Science.
- **Dr. Manoj Majee** has been elected as Fellow of the Indian National Science Academy (INSA), New Delhi, towards his contributions in the field of Plant Science.

## BRIC- RAJIV GANDHI CENTRE FOR BIOTECHNOLOGY (BRIC- RGCB)

- **Dr. Jackson James**, Scientist G in the Neurobiology and Regenerative Biology Program at RGCB, has been elected as a Fellow of the Indian Academy of Neurosciences. This announcement was made during the recently concluded XLII Annual Meeting of the Indian Academy of Neurosciences (IAN), which took place at NIMHANS in Bengaluru from November 11 to 14, 2024.
- **Dr. Arun Sankaradoss** (Scientist, Pathogen Biology Program, RGCB) won the 1st Prize in the oral presentation, Young Scientist Conclave, IISF 2024, held at IIT Guwahati. The title of the talk is "A Protective Nucleic-based Dengue Vaccine Engineered to Abrogate Antibody-Dependent Enhancement of Infection."
- **Dr. Parijat Senapati**, Scientist at BRIC-RGCB, has been selected as a member of the Indian National Young Academy of Science (INYNAS) for a five-year term starting February 2025.
- **Dr. Moinak Banerjee**, scientist in the Neurobiology Program at BRIC-RGCB, has been honored with the Dr. L. D. Sanghvi Oration Award for his lifetime contributions to human genetics. This prestigious award, presented by the Indian Society of Human Genetics, recognizes excellence in the field of human genetics. The award ceremony took place during the 49th Annual Meeting of the Indian Society of Human Genetics and the International Conclave on Neurogenetics (ISHG 2025) at the NIMHANS Convention Centre in Bengaluru.
- **Dr. Priya Srinivas**, Scientist G and Dean at BRIC-RGCB awarded Fellowship of The Royal Society of Biology (RSB).
- **Dr. Malini Laloraya**, former faculty member at BRIC-RGCB, was honored at the conference "Pioneering the Future of Healthcare and Diagnostics using 4D Omics," held at IIT Bombay on November 12, 2024. She was one of the distinguished scientists selected for a special session titled "Honoring Women Pioneers: Transforming Science and Society."

## BRIC- TRANSLATIONAL HEALTH SCIENCE AND TECHNOLOGY INSTITUTE (BRIC- THSTI)

- **Prof Ganesan Karthikeyan**, ED, THSTI and Prof Bhabatosh Das feature in the top 2% scientists worldwide list released by Stanford University. Prof Karthikeyan has featured consistently every year since the list began. This year, Prof Das has also featured in the list of top 2% scientists worldwide in the 2025 single-year data category.
- **Prof Ganesan Karthikeyan** became a fellow of Indian National Academy of Science (INSA) in 2025.
- **BRIC-THSTI** was awarded the best extramural institute at the DHR-ICMR Health Research Excellence Summit 2024 held in Delhi on 14th Nov 2024.
- **Dr Jayanta Bhattacharya**, Dean was elected as an Indian National Academy of Science (INSA) fellow. He also became a part of the CEPI-CLN Global Clinical Laboratory Network (GCAC) of the Coalition for Epidemic Preparedness-Clinical Laboratory Network (CEPI-CLN).
- **Dr Amit Awasthi**, Senior Professor was elected as President of Indian Immunology Society in 2024. He also became a fellow of the INSA in 2024 and a fellow of the National Academy of Sciences, India (NASI) in 2025.
- **Dr Ramandeep Singh** was elected fellows of National Academy of Sciences (NASI).
- **Dr Bhabatosh Das** was elected fellows of National Academy of Sciences (NASI).

## 10 RTI & GRIEVANCES

S. No.	iBRIC	RTI		GRIEVANCES	
		RECEIVED	DISPOSED OFF	RECEIVED	DISPOSED OFF
1.	BRIC-CDFD	57	53	08	08
2.	BRIC-IBSD	4	4	NIL	NA
3.	BRIC-ILS	18	17	3	3
4.	BRIC-inSTEM	23	23	NIL	NA
5.	BRIC-NABI	17	17	5	4
6.	BRIC-NBRC	30	29	NIL	NIL
7.	BRIC-NCCS	12	12	8	8
8.	BRIC-NIAB	18	18	NIL	NA
9.	BRIC-NIBMG	7	7	NIL	NA
10.	BRIC-NII	25	25	NIL	NA
11.	BRIC-NIPGR	25	25	2	2
12.	BRIC-RGCB	18	18	-	-
13.	BRIC-THSTI	18	17	7	6

# 11 ANNEXURES

## BRIC PUBLICATIONS

### BRIC-CENTER FOR DNA FINGERPRINTING AND DIAGNOSTICS (BRIC-CDFD)

1. Alkhalaf LM, Arrowsmith C, Balskus EP, Chang MCY, Fierke CA, Fraser JS, et al. Thoughts for the future. *Nat Chem Biol.* 2025;21(1):6-15. doi: 10.1038/s41589-024-01802-2. PubMed PMID: 39724761.
2. Anindita A, Sen J, Bhandari R. Knockout Mice as an Experimental Model to Study the Biology of Inositol Pyrophosphates. *Methods Mol Biol.* 2025;2972:249-66. doi: 10.1007/978-1-0716-4799-8\_18. PubMed PMID: 39724762.
3. Askari F, Kaur R. *Candida glabrata*: A Tale of Stealth and Endurance. *ACS Infect Dis.* 2025;11(1):4-20. doi: 10.1021/acsinfecdis.4c00477. PubMed PMID: 39724763.
4. Balasubramanian R, Koneru P, Chinchilam HP, Dalal A, Kaur P, Puri RD. A Decade of Prenatal Genetic Diagnostics: Insights From 1949 Cases at a Medical Genetics Facility in South India. *Prenat Diagn.* 2025 Aug 16. doi: 10.1002/pd.6869. PubMed PMID: 39724764.
5. Baroi R, Ahmad Reshi H, Maddika S. Mitochondrial phosphatase PPTC7 promotes EGFR recycling by facilitating VPS4A endosomal localization. *J Cell Sci.* 2025;138(2):jcs263676. doi:10.1242/jcs.263676. PubMed PMID: 39724765.
6. Bhattacharyya C, Subramanian K, Uppili B, GenomeIndia Consortium, Indian Genome Variation Consortium, Chakraborty A, et al. Author Correction: Mapping genetic diversity with the GenomeIndia project. *Nat Genet.* 2025;57(6):1563. doi: 10.1038/s41588-025-02206-1. PubMed PMID: 39724767.
7. Bhattacharyya C, Subramanian K, Uppili B, GenomeIndia Consortium, Indian Genome Variation Consortium, Chakraborty A, et al. Mapping genetic diversity with the GenomeIndia project. *Nat Genet.* 2025;57(4):767-73. doi: 10.1038/s41588-025-02153-x. PubMed PMID: 39724766.
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12. Eickelpasch K, Lemke P, Sreekumar S, Chilukoti N, Moerschbacher BM, Richter C. A bioactivity matrix for antimicrobial activities of chitosans: A review. *Int J Biol Macromol.* 2025;299:140740. doi: 10.1016/j.ijbiomac.2025.140740. PubMed PMID: 39724772.
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## BOOK CHAPTERS/EDITED BOOKS/MEETING REPORTS/OTHERS

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## BRIC PATENTS

### BRIC-CENTER FOR DNA FINGERPRINTING AND DIAGNOSTICS (BRIC-CDFD)

#### Patents filled

1. PCT application filed on 31.05.2025 - A composition for treating wounds, methods and use thereof
2. PCT application filed on 23.06.2025 - A composition for treating cancer, methods and use thereof
3. Complete Indian application filed on 30.07.2025 - Pharmaceutical Composition of Mirabegron and Anti-Tuberculosis Drugs
4. Complete Indian application filed on 30.07.2025 - Designing of novel host directed therapeutics to improve protective immune response and efficacy of anti-TB drugs and method thereof

### BRIC-INSTITUTE OF LIFE SCIENCES (BRIC-ILS)

#### Patents filled

1. Application number:202531019685, March 05, 2025. A Protein Subunit Vaccine Composition against Mycobacterium tuberculosis.
2. Application number:202531031984, March 31,2025. Cinnamic acid- derived N-heterocyclic compounds (TPDM and TF) inhibit SARS-CoV-2 infection and its method of preparation.
3. Application number:202531031962, March 31, 2025.Salicylic acid derived carbon dots (SA-CDS) inhibiting SARS-COV-2 infection and its method of preparation.
4. Application number:202531047374, May 16, 2025. Triptolide and composition thereof for inducing insulin production.
5. Application number: 202531048304, May 20, 2025. A biomimetic polymeric nanoformulation for management of osteosarcoma.
6. Application number:202531053475,June 02, 2025. Infectious clones of chikungunya virus.
7. Application number: 202531053455, June 02, 2025. Pharmaceutical compositions comprising sertaconazole or oxiconazole as efflux pump inhibitors for treating multidrug-resistant Staphylococcus aureus infections
8. Application No. : 202531072431, July 30, 2025. A kit-based method for evaluating and monitoring the efficacy of tuberculosis treatment to develop personalized therapy.

#### Patents Granted

1. Grant No. UK - GB2616213. Granted in UK on January 08, 2025. Griseofulvin as an adjunct drug for the treatment of cerebral and severe malaria.
2. Grant No. IND: 558638 EP4240351. IND: January 23, 2025; Europe: August 27, 2025. A process for nitric oxide generation in vitro and endogenous induction in vivo.

## BRIC- INSTITUTE FOR STEM CELL SCIENCE AND REGENERATIVE MEDICINE ( BRIC-INSTEM)

### Patents filled

1. Application No.202441056626.Provisional Application submitted titled “Extracellular vesicles and uses thereof for targeted delivery”.
2. Application No.202441063092. Provisional Application submitted titled “Gene editing for hemoglobinopathies”.
3. Application No.: 202441072108.Provisional Application submitted titled “Enhanced gene reactivation via targeted promoter editing”
4. Application No: PCT/IN2024/052329. Strategies for precision editing of homologous regions,
5. Application No.202541022416, filled on 12th March 2025. Compositions having modulatable viscosity, methods of preparation and use thereof”,
6. Application No: 202541053473. Filed on June

4th, 2025.Therapeutic rescue of neutrophil maturation arrest by base editing of ELANE in severe congenital neutropenia.

7. Application 202541045989; Filed on 13th May 2025 India Patent. Modified mesenchymal stromal cells for human hematopoietic stem and progenitor cell gene therapy and acuteradiation syndrome

### Patents Granted

1. US Patent, US, 12,202,841 B2 granted on 21st January 2025. Therapeutic agents for enhancing epithelial and/or endothelial barrier function.
2. Granted, 201911044840, Indian patent granted 28th April, 2025. An injectable formulation for the management of osteoarthritis.
3. Indian Patent No: 567645 granted on June 19th, 2025. Fabrication of Hollow Microneedle Arrays.

## BRIC- BRIC-NATIONAL AGRI-FOOD AND BIOMANUFACTURING INSTITUTE (BRIC-NABI)

### Patents filled

1. Indian patent application No. 202511003664. An Improved Method Unveiling the Role of Banana-Derived Developmental Regulators for Efficient Genetic Transformation and Regeneration in Plants and its Method Thereof.
2. Indian patent application No. 202411103885. Synthesis of lignosulfonate-based cement

admixture from lignin waste and applications thereof.

3. Indian patent application no: 202411096243. Lignin-Derived Biomaterials for Carbon Capture and Utilization Thereof.
4. Indian patent application no: 202511034417, Filed on April 8 ,2025.Gelatin-free Kombucha gummies and its method of preparation.

- Indian patent application No: 202411093821. Filed on Nov29 2024. A composition comprising GABA producing bacterium and modified millet bran, and implications thereof.

#### Patents Granted

- Application Number: 201911054228. Granted on April 24, 2025. A Recombinant DNA Molecule and Method of Increasing Total Carotenoid Levels in a Plant Using the Same.
- Indian patent No: 555384, Grant date: Granted on November 28, 2024. A process for the development of composite films/coating materials based on arabinoxylan-cellulose fatty acid esters and arabinoxylan-starch fatty acid esters from wheat straw and potato peel.

## BRIC- NATIONAL BRAIN RESEARCH CENTRE (BRIC-NBRC)

#### Patents filled

- Application No. 202431048630. Filed Indian Patent "Naphtalimide-Se-TMZ compound and a method of preparing the same

## BRIC- NATIONAL CENTRE FOR CELL SCIENCE (BRIC-NCCS)

#### Patents filled

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## BRIC- NATIONAL INSTITUTE OF ANIMAL BIOTECHNOLOGY (BRIC-NIAB)

### Patents filled

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2. Application no. 202441100138, filed on December 14, 2024. Synthetic NSF-951 agonist compound and preparation thereof, antigen-alum- synthetic NSF-951 immuno-formulation (AANSF-951) and preparation thereof
3. Application no 202541003985, filed on January 17, 2025. Generation of Bicistronic Constructs for Robust Secretion of Recombinant Bovine FSH In Vitro (mammalian cell) and In Vivo (Rabbit Udder Gland) .
4. Application no. 202541021761, filed on March 11, 2025 Amniotic membrane as a bio-scaffold duly enriched with the fetal stem cells and it's

condition media to promote wound healing.

5. Application no. 202541056122, filed on June 11, 2025. Brucella tandem peptide protein candidates Bru-TPP-I and Bru-TPP-II and method for development thereof .

### Patents Granted

1. Patent no.556338, granted on December 16, 2024. Novel anti-inflammatory peptides.
2. Patent no.558374, granted on January 21, .2025. A Phyto-formulation to control tick infestation in animals and method thereof
3. Patent no.569943, granted on August 21, 2025. Synthetic NSF-951 agonist compound and preparation thereof, antigen-alum- synthetic NSF-951 immuno-formulation (AANSF-951) and preparation thereof.

## BRIC- NATIONAL INSTITUTE OF BIOMEDICAL GENOMICS (BRIC- NIBMG)

### Patents filled

1. Patent Application No.: 202531001584. Methods for detecting single nucleotide polymorphisms (snps) and kits thereof.
2. Patent Application No.:202511034117. A kit for prediction of recurrence in triple negative breast cancer.

3. Patent application No. 202511045718. A chip for prediction of recurrence of triple negative breast cancer.
4. Patent Application No.: 202431105277. Bloom syndrome protein (blm) variants and methods thereof

## BRIC- NATIONAL INSTITUTE IMMUNOLOGY (BRIC- NII)

### Patents filled

1. Indian Patent Application Number: 202511004708; Filed on January 21, 2025. Novel liposomal formulation encapsulating the ripe drugs.
2. Indian Patent Application Number: 202411093336; Filed on November 28, 2024. Thioxothiazolidin derivatives and uses thereof.
3. European Patent Application Number: 23 811328.6; Filed on December 20, 2024. Clomipramine for the treatment of Alzheimer's disease.
4. US Patent Application Number: 18/878,559; Filed on December 23, 2024. Itch mutants for the treatment of memory and learning defects.
5. [US Patent Application Number: 18/878,560; Filed on December 23, 2024. MIR449A as therapeutic for neurodegenerative disorders.
6. Provisional Indian Patent Application number 2024110956809; Filed on December 4, 2024. Producing a chimeric recombinant multi-stage vaccine for preventing Plasmodium falciparum infection and its community transmission.
7. Indian Patent Application number 202411095679; Filed on December 4, 2024. Producing a chimeric recombinant multi-stage vaccine for preventing Plasmodium falciparum infection and its community transmission.
8. Indian Patent Application Number: 202511028772; Filed on March 26, 2025. Nanoscale artificial antigen-presenting cells and its method of preparation thereof.
9. Indian Patent Application Number: 202511058591; Filed on June 18, 2025. Method for the bio-production of d-acyl lactones using glucose as substrate.
10. US Patent Application Number: 19/125,585; Filed on April 29, 2025. Recombinant DNA, Recombinant vector for producing delta-acyl lactones and its implementation thereof.

## BRIC- NATIONAL INSTITUTE OF PLANT GENOME RESEARCH (BRIC- NIPGR)

### Patents filled

1. Australian Patent Application No. 202329078 Filed on November 13, 2024. Recombinant expression cassettes for modification of Glucosinolate content in plants.
2. Canadian Patent application No. 3259474 Filed on December 13, 2024. Recombinant expression cassettes for modification of Glucosinolate content in plants..
3. Indian Patent application No. 202511073639 Filed on August 01, 2025. Modified plant globin proteins and applications thereof.

### Patents granted

1. UK Patent No. 2615931 Filed on November 27, 2024. A formulation and a method for inducing defense response in plants.

2. Indian Patent No. 227005 Filed on December 27, 2024. Nucleic Acids Encoding Artificial RNA against ACI Gene And Methods of Developing Tolerance against ToLCNDV Infection.
3. US Patent No. 12,279,625 B2 Filed on April 22, 2025. System for delaying ripening of agriculture produces.
4. US Patent No. 12,210,380 B2 Filed on May 27, 2025. Method for extending shelf-Life of Agricultural produce.

## BRIC- RAJIV GANDHI CENTRE FOR BIOTECHNOLOGY (BRIC- RGCB)

1. Application number 202541037489, Filed on April 17, 2025. Screening Methods for Cancers Using Pir-019324 As A Biomarker. Against Nipah Virus (Jointly field with BRIC-THSTI)
2. Application number 63/799,963; May 5, 2025. Compounds And Methods for Cancer Treatment.
3. Application number PCT/IN2025/050733; filed on May 9, 2025. Monoclonal Antibodies
4. Application number 167/2025 Filed on May 12, 2025. Monoclonal Antibodies Against Nipah Virus (Jointly field with BRIC-THSTI)
5. Application number 202541095254; Filed on October 03, 2025.  $\alpha$ -helical pore for  $\alpha$ -Synuclein detection

## BRIC- TRANSLATIONAL HEALTH SCIENCE AND TECHNOLOGY INSTITUTE (BRIC- THSTI)

### Patents filled

1. Application No. 202511071862 Filed on July 29, 2025. An engineered polypeptide complex for generating protective immune responses against crimean-congo hemorrhagic fever virus (cchfv)
2. Application No. 202511067807, Filed on July 16, 2025. Genetically defined consortium of lactobacillus paragasseri strains with ANTIMICROBIAL, ANTI-STEATOSIS, CARDIOPROTECTIVE PROPERTIES AND DEVELOPMENT METHOD
3. Application No. 202511067807 Filed on July 7, 2025. Genetically engineered live biotherapeutics with prophylactic and therapeutic applications and a method of preparing the same there of
4. Application No. 202511000544, Filed on January 2, 2025. Prodrugs of isoniazid with enhanced plasma exposure and method of development thereof.
5. Application No. 202411088715, Filed on November 16, 2024. Bis(benzylisoquinoline) alkaloids as tlr4 agonist

### Patents granted

1. Patent No. EP4240351, Granted on September 2, 2025. Composition for enhancing intracellular nitric oxide generation
2. Patent No. 558638, Granted on January 23, 2025.





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