



DEPARTMENT OF BIOTECHNOLOGY
Ministry of Science & Technology

Celebrating Biotechnology: Building India as an Innovation Nation

Contributing to India's National Missions



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विज्ञान से विकास

“Any society that does not innovate, stagnates.
Make India the most attractive destination for innovation.
Innovate in India and innovate for humanity.”

— Prime Minister Narendra Modi



Dr. Harsh Vardhan

*Hon'ble Minister for Science and Technology,
Earth Sciences and Environment, Forest and
Climate Change, Government of India*

I congratulate the Department of Biotechnology on the occasion of its 33rd Foundation Day on 26th February 2019. DBT, since its inception, has played a major role in promoting biotechnology across the country. Through its fifteen Autonomous Institutes, one International Centre for Genetic Engineering and Biotechnology and the two Public Sector Undertakings, DBT has created a strong ecosystem for facilitating basic, early and late translational research and entrepreneurship. Biotechnology today offers innovative solutions for addressing complex societal challenges of food, nutrition and agriculture, affordable healthcare, a clean and green environment and a prosperous bio-based economic growth.

With a major emphasis on building capacities, both human resource and infrastructure and national and international partnerships, biotechnology in India is poised to achieve global leadership.

I once again convey my good wishes on this occasion and wish the Department and all its institutes, organizations, officials, scientists, researchers, students and start-ups all the very best for achieving their targets in the years to come.

जय जवान, जय किसान, जय विज्ञान, जय अनुसंधान

— Dr. Harsh Vardhan

DBT Institutes



● Autonomous ● Public Sector Undertaking

Preface



Dr. Renu Swarup
*Secretary, Department of Biotechnology
Ministry of Science & Technology,
Government of India*

The Department of Biotechnology has over the last 3 decades made tremendous effort in promoting Bioscience research, translational education and entrepreneurship. The National Biotechnology Development Strategy announced in 2015 lays major emphasis on the generation of biotech products, processes and technologies for enhanced efficiency, productivity and cost-effectiveness in the areas of agriculture, food and nutritional security; affordable health care and wellness; environmental safety; clean energy and biofuel: and bio-manufacturing. Skill development programmes have been developed in close coordination with State Governments. The policies announced by the Government have strengthened the Institutional Mechanisms for empowering innovation and ensuring scale up and sustainability. The emphasis has been on technology-oriented research aimed at improving lives and living of millions by providing affordable solutions to public health problems impacting the society.

There has been a paradigm shift in the relationship between Government, Academia, Industry, Startups and Civil Society. The Department has made special efforts to contribute through its various programmes to the National Missions launched by the Hon’ble Prime Minister-Swasth Bharat, Swachh Bharat, Stratup India, Make in India and Digital India. The Department through its Public Sector Undertaking BIRAC has created a vibrant ecosystem for innovation to thrive in our country.

This report summarizes some of our success stories over the last five years and how the Department through its efforts is contributing to the Missions of the Government of India. The Department of Biotechnology remains committed to provide a special impetus to new knowledge generation and discovery, launch major strategically driven and directed Missions, empower the country’s human resource scientifically and create a strong ecosystem for research, development, translation and commercialization in order to create a robust bioeconomy.

We are confident that India can become a Global Biomanufacturing Hub and we will achieve our target of a USD 100 billion Bioeconomy.

कौशल भारत आयुष्मान स्वच्छ भारत कृषि पूर्वोत्तर विकास राज्य

“Attaining new heights in biotechnology research, shaping biotechnology into a premier precision tool of the future for creation of wealth and ensuring social justice - specially for the welfare of the poor.”

Highlights
National &
International
Partnerships

Page 13

Towards a
Clean and
Green India

Page 41

Improving
Farmer
Livelihoods

Page 67

Healthcare
for all

Page 99

Skill
Development
& Capacity
Building

Page 141

Northeast
Region
Initiatives

Page 199

Highlights

2014 - 2019

1,474
Agencies
Supported

4,474
Scientists
Supported

108
Technologies
Commercialized

350
Technologies
Developed

3,033
Projects
Awarded

399
Patents
Applied

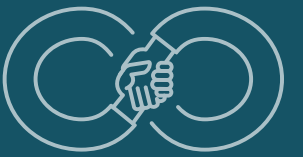
168
Patents
Granted

15,738
Fellows
Supported
(RA, SRF, JRF)

500+
Startups
Supported

3,581
Students
Supported (BITP,
Finishing School)





National & International Partnerships

Australia | Belgium | Brazil | Canada | Cuba
Denmark | Finland | Germany | France | Japan | Korea
Netherlands | Russia | Spain | Switzerland | Sweden
South Africa | UK | USA | EU

Signing of MoU between Ministry of AYUSH & Department of Biotechnology

MoU was signed between Ministry of AYUSH and DBT on 31st December 2018 for mutual collaboration to explore the possibility of cooperation, convergence and synergy to have a biotechnological intervention in AYUSH sector and to have a platform for exchange of information between both the Ministries.

DBT will be responsible for undertaking the research on domestication, identification of elite and quality planting material of selected medicinal and aromatic plants and their mass multiplication etc.



Ministry of AYUSH will help and guide DBT in taking already available research leads forward towards developing drugs in AYUSH mode

MoU between CSIR, DBT & ICMR

The MoU was signed amongst CSIR, DBT and ICMR on 31st December 2018 for mutual collaboration to develop phytopharmaceutical products for therapeutic use following international standards and norms for establishing safety, quality, standardization and efficacy.

The effort would be to take forward the leads already existing with CSIR, DBT and ICMR and develop specific collaborative projects in the domain aiming at rigorous modern scientific testing and development of standard products to maintain global competitiveness.



DBT & ICAR MoU

Signing of **Memorandum of Understanding (MoU)** between Indian Council of Agricultural Research & Department of Biotechnology, Govt. of India.



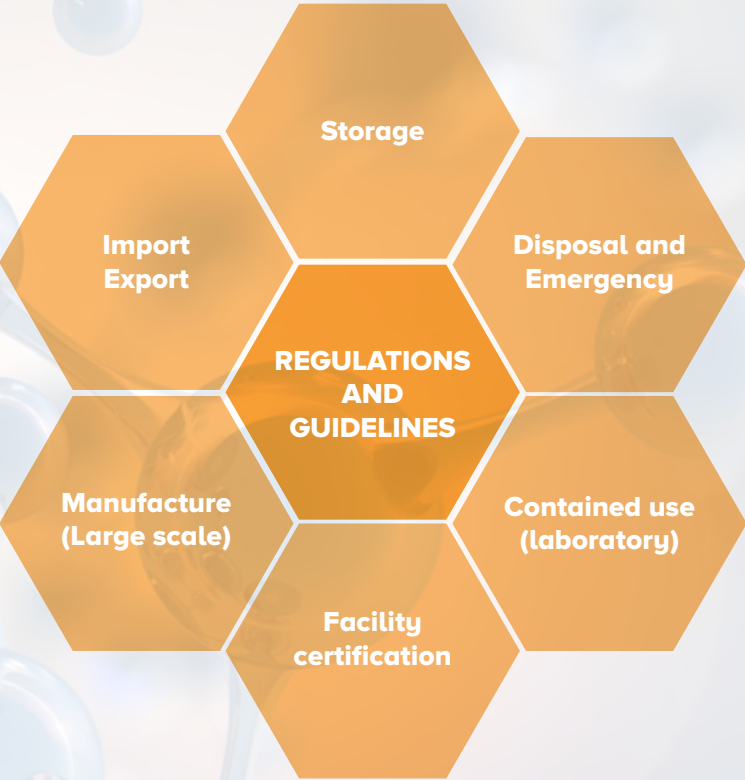
This flagship synergistic approach would be taken up in mission mode through networking with the elite institutions in the country

MoU between ICAR and DBT is for mutual collaboration to explore the possibility of cooperation, convergence and synergy to promote and accelerate the progress of research and training in various disciplines of agricultural biotechnology between ICAR and DBT.

The collaborations also encompass to promote agri-innovations and start-ups, through the well established BIRAC mechanism.

Biosafety of Recombinant DNA Research & Biocontainment

Guidelines on biosafety of recombinant DNA research & biocontainment 2017 were released by DBT, during the meeting of States Parties of the Biological Weapons Convention (BWC) at Geneva, Switzerland.



The Regional Centre for Biotechnology Act

The RCB bill was passed by both Houses of Parliament and was notified after the Presidential consent on 30th July 2016.

The bill seeks to establish a Regional Centre for Biotechnology, an institution of education, training and research, under the auspices of UNESCO in the National Capital.



The DNA Technology (Use and Application) Regulation Bill 2019

The Bill has been formulated for establishing identity of missing persons, victims, offenders, under trials and unknown deceased persons. The Bill is under consideration by the Government.

National Guidelines for Stem Cell Research

The “National Guidelines for Stem Cell Research, 2017” was jointly formulated by Department of Biotechnology and the Indian Council of Medical Research to lay down standards for Medical Research and ensure that research with human stem cells is conducted in a responsible and ethically sensitive manner in the country.



India-UK



India - UK Cancer Research Initiative launched in collaboration with Cancer Research UK (CRUK) focussing on affordability of cancer prevention and care, and the potential to make significant progress against cancer consequences.

The MoU was signed by Dr. Renu Swarup, Secretary, DBT and Prof. Sir Leszek Krzysztow Borysiewicz, Chair, CRUK on November 14th, 2018 in Delhi.

CRUK and the DBT will invest £5m (47 Crores INR) each on research towards affordable approaches to cancer care

The ICGC-India Team Successfully Traced the Drivers of Oral Cancer

India is part of International Cancer Genome Consortium to understand genomic basis of 50 different types of cancer with clinical & societal importance

Oral Cancer in Focus



India Team



Supported by

Crucial findings

Alterations in several genes & biological pathways are specific to driving the Indian variety of oral cancer—the gingivo-buccal oral cancer

- Study identified five new genes that harbour driver DNA alterations in oral cancer patients
- DNA alterations induced by chemicals in tobacco preferentially alter C nucleotides to A nucleotides
- Several genes found amplified or deleted, either partially or fully, in multiple oral cancer patients

Somatic mutations in arachidonic acid metabolism pathway genes enhance oral cancer post-treatment disease-free survival

In Gingivo-buccal Oral Cancer, the Arachidonic Acid Metabolism Pathway is enriched with Mutations that Enhance Disease-Free Survival by 17 months

India-Sweden



Programme of Cooperation (POC) signed with Swedish Governmental Agency for Innovation Systems (Vinnova), Sweden.

The broad subject areas of cooperation under the Protocol shall be, but not limited to: Circular and bio-based economy, including biomaterials, Health and life sciences including biomedical devices and Start-ups, incubators, testbeds and bioclusters.



India-Korea



A MoU has been signed between India and Republic of Korea in the field of Biotechnology, Bio-economy, Science and Technology at New Delhi on 9th July 2018 to expand and develop bilateral/multilateral relations in the area of Biotechnology.



The Union Minister for Science & Technology, Dr. Harsh Vardhan and the South Korean Minister for Science, Mr. You Young-Min signed the Memorandum of Understanding on Science & Technology, in New Delhi on July 09, 2018

India-Brazil



An MoU on Cooperation in the field of Biotechnology R&D and industry has been signed between Federative Republic of Brazil and Republic of India on 30th May 2018 at Brasilia, Brazil.

Six joint projects were recommended against second Joint call for Proposals in the areas of Bioenergy and Medical Biotechnology, entailing training of 18 doctoral fellows and award of fellowships for training and research in the country of collaboration.



Areas of Collaboration with Brazil

Biomedicine and health, Agriculture breeding practices, Biofuels and Bio-energy, Nanotechnology, Bioinstrumentation, Biodiversity and Taxonomy.

India-Cuba



Republic of India and Republic of Cuba, have signed an MoU on 22nd June 2018 to broaden cooperation in the field of Biotechnology.



Letter of Intent

BIRAC, Kalam Institute of Health Technologies (KIHT), India and BioCubaFarma, Cuba signed a Letter of Intent (LoI) at Cuba on 22 June 2018, with a focus on vaccines, cell-based therapies and Devices & Diagnostics, exchange of technologies, products, innovations, transfer of technologies and commercialization of innovative healthcare products of interest to both the countries.

Areas of Collaboration with Cuba

- Agriculture of sugarcane & vegetables and livestock health,
- Agro-ecology especially the integrated food & energy systems and urban agriculture,
- Human Biomedicines especially vaccines and molecules of immune system origin for infectious and Cancers such as Breast, Lung, Prostate and Cervical as well as for neurological restoration.
- Aquaculture especially transgenic fishes and marine bio-prospecting,
- Nanotechnology
- Neurosciences and Neuro-technologies

India-Finland



MoU between Business Finland and Department of Biotechnology, Ministry of Science and Technology, Government of India to promote long-term research and development and innovation on 30th November 2018



Government of India & European Molecular Biology Organization

879
Indian scientists
participated
in EMBO workshop

152
Travel scholarships
awarded to Indian
scientists

40
Short-term Fellowships
awarded between
laboratories in eligible
countries



India became an associate member of EMBO with a Co-operation Agreement between GOI and the European Molecular Biology Conference (EMBC) and European Molecular Biology Organization EMBO) signed on November 09, 2015.

3
Workshops
funded by
EMBO

3
Long-term scholarships
awarded for post-doctoral
research

3
**EMBO young
investigators**
awarded

Active MOUs/Agreements/POCs/LOIs/SOIs of the Department of Biotechnology

Government Agencies (2014 onwards)

S.No.	Collaborating Country	Agencies	Date of Signature
1.	Australia	The MoU signed with Department of Industry, Innovation and Science, Australia	19 April 2016
2.	Belgium	MoU between DBT and the research Foundation – Flanders (FWO) for cooperation in the field of Biotechnology, Govt of Belgium	2 May 2016
3.	Denmark	PoC signed between the Department of Biotechnology and Agency for Science and Higher Education (SFU) and Innovation Fund Denmark (IFD), Ministry of Higher Education and Science (UFM) of the Govt. of the Kingdom of Denmark in the field of Energy, Water, Material Science (Biomaterials), Life Science and Biotechnology	22 May 2018
4.	Finland	MoU between Business Finland and Department of Biotechnology, Ministry of Science and Technology, Government of India to promote long-term research and development and innovation	30 November 2018
5.	France	MoU between Department of Biotechnology of India and CNRS and UPMC on collaboration for establishment of a national institute of marine biology and biotechnology in India	10 April 2015
6.	Germany	POC between DBT and DFG for cooperation in the field of biotechnology.	Renewal on 8 October 2018
7.	Japan	Joint Research Contract (JRC) between DBT & AIST, Japan	13 September 2017
8.	Sweden	The Poc Between the Department of Biotechnology, Government of India and The Governmental Agency For Innovation Systems, Vinnova, Sweden	21 August 2018

S.No.	Collaborating Country	Agencies	Date of Signature
9.	Switzerland	Letter of Intent for joint partnerships between DBT and Swiss National Science Foundation (SNSF), Switzerland	21 November 2017
10.	The Netherlands	MoU between DBT, Bharat immunologicals and biological ltd and the Institute for translational vaccinology of the Kingdom of Netherlands on development of vaccines	5 June 2015
11.	UK	MoU for establishing a joint UK-India centre in Crop Science	24 February 2016
12.	USA	Letter of Intent between ICMR, M/o Health & FW; DBT, M/o S&T and NIAID, NIH, USA Statement of Intent between DBT and NIAID, NIH, USA	25 June 2015 12 April 2017

Non-Governmental Organization (2014 onwards)

S.No.	Collaborating Organizations	Agencies	Date of Signature
1.	Bill and Melinda Gates Foundation	MoU on collaboration between the Department of Biotechnology and Bill and Melinda Gates Foundation to address global health and development needs in developing countries.	Renewal on 18 July 2017
2.	Prakash Lab, Stanford University	Statement of Intent between DBT, Govt. of India and Prakash Lab Stanford University, USA for bringing FOLDScope to India	27 September 2015
3.	European Molecular Biology Organization	Cooperation agreement between the Department of Biotechnology, GoI and European Molecular Biology conference and European Molecular Organization aimed at increasing scientific exchanges between India and EMBC member states	9 November 2015
4.	Nobel Media AB of Nobel foundation	MoU signed between the Department of Biotechnology and Nobel Media AB, Sweden for joint programme on S&T awareness in India	01 September 2016
5.	Cancer Research UK	MoU between the Department of Biotechnology and Cancer Research UK to focus on low cost approaches to cancer treatment	14 November 2018

स्वच्छ भारत



**Towards
a Clean
and Green
India**



Photo Credit: Arun Sambhu Mishra / Shutterstock.com

The **Department of Biotechnology (DBT)** has flagged clean energy and Swachh Bharat (waste-to-energy) as two of its key missions

The Department of Biotechnology is contributing towards new technology development for a large number of initiatives under Swachh Bharat. International collaborations have been leveraged to develop technologies to provide clean water for various end uses like drinking and agriculture. DBT has recently achieved significant milestones in bio-energy research and scale up from fundamental research to applications to ensure nimbleness and constant access to the best technologies. It has developed cost effective and efficient ways to convert waste to energy and has set up plants for scaling up the production of energy in different forms.

First Biomass to Ethanol Plant & its Commercialization

India's first home grown technology to convert biomass to ethanol along with speed and efficiency by converting agricultural waste into ethyl alcohol or bio-ethanol.



Agricultural waste is converted in 18-20 hours into ethanol at about 300 litres of ethanol per ton of biomass

Collaboration with Netherlands Aggregates Technologies to Clean Delhi's Barapullah Drain

Wastewater management to ensure good quality fresh water free of risk-causing contaminants. This promotes productive, safe reuse of water, thereby enhancing human and environmental health conditions.



June
2018



July
2018



October
2018

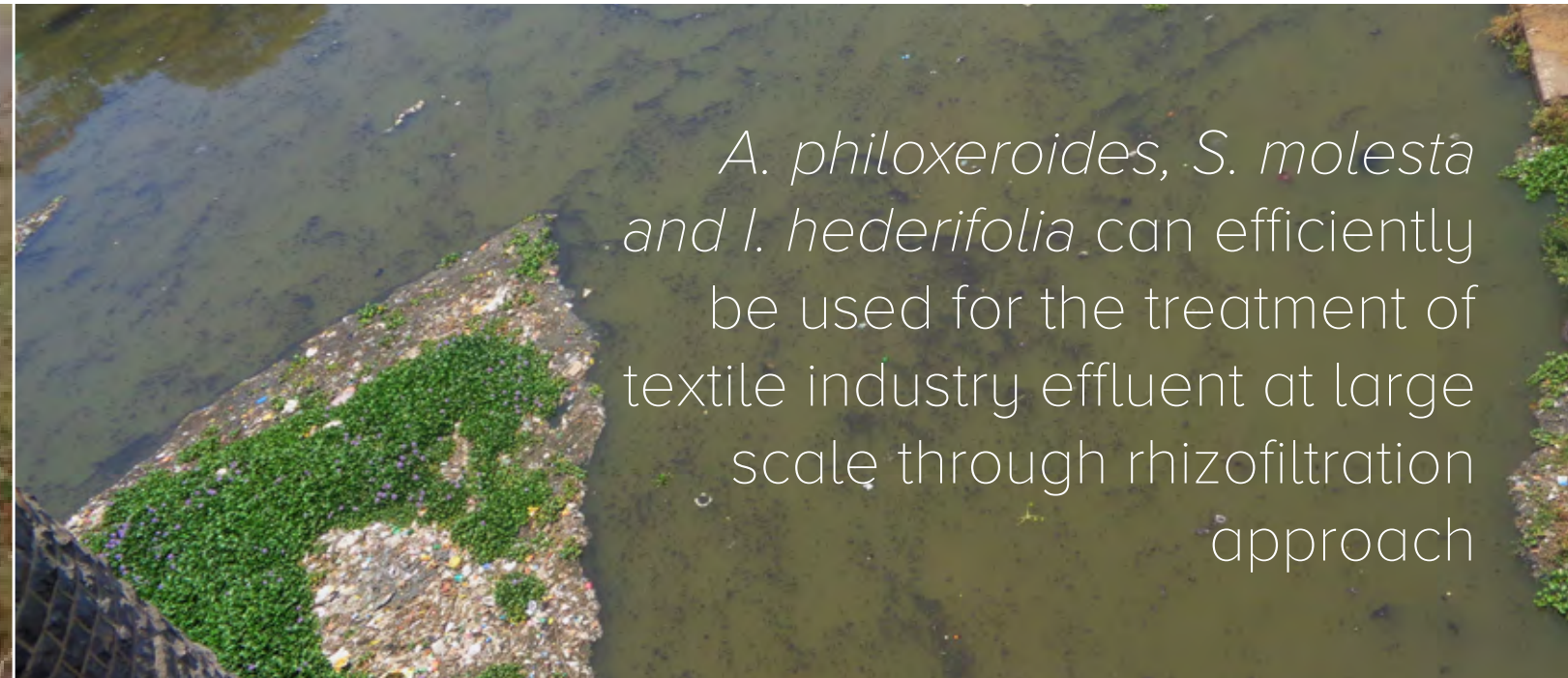


December
2018



5 reactors running 24/7 for waste water treatment and 4 pilots are operational for anaerobic pre-treatment and energy recovery. Micro-algae technology is used for nutrient recovery and vital urban filter for safe agriculture water

Green Remediation Technology for Wastewater Treatment



A. philoxeroides, *S. molesta*
and *I. hederifolia* can efficiently
be used for the treatment of
textile industry effluent at large
scale through rhizofiltration
approach

Phytoremediation treatment
process was developed for
the degradation of dyes from
textile industrial effluent.

Novel Bio-toilet Technologies

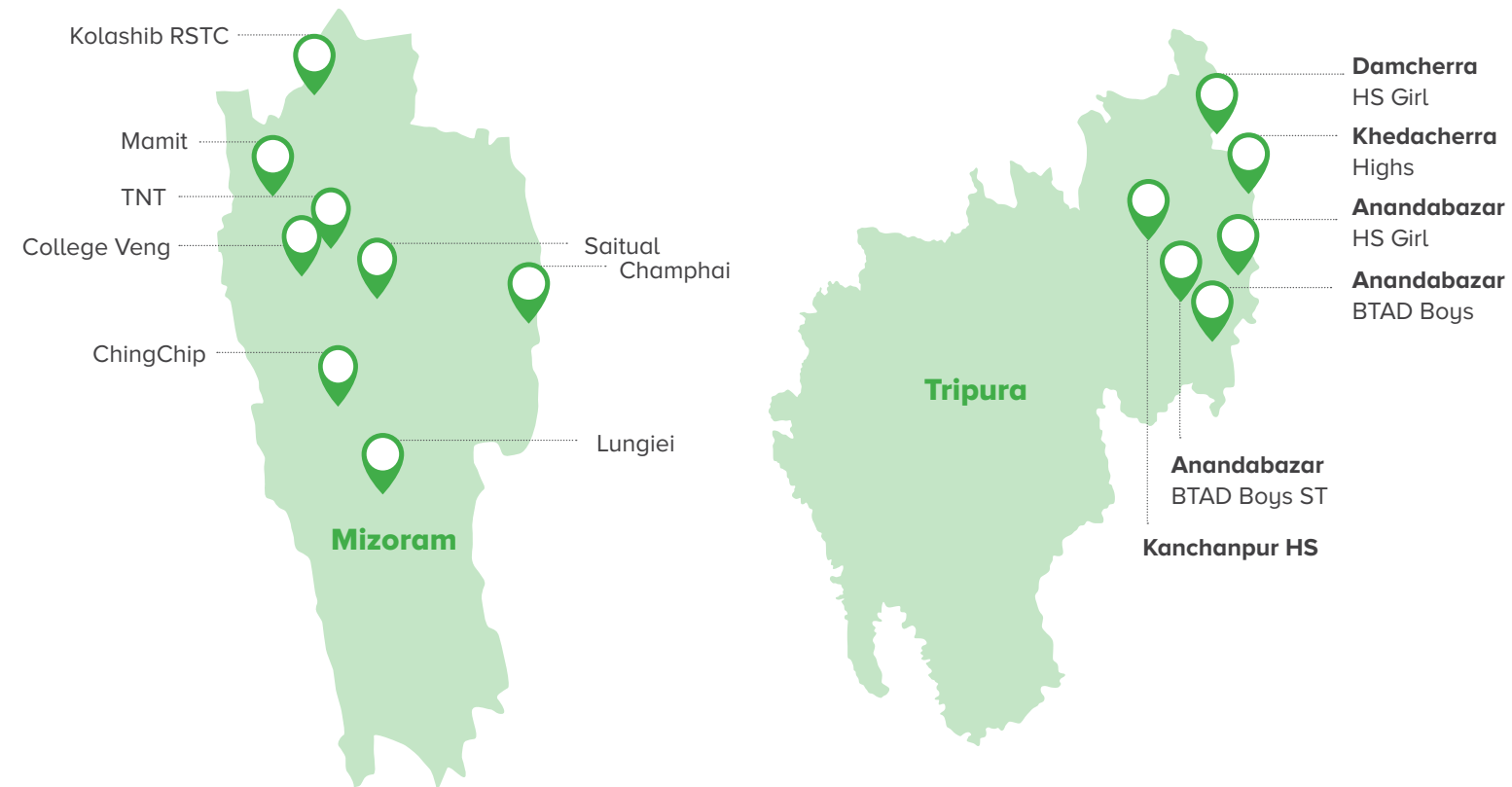
Innovative Bio-Toilets design ideas were generated through “**Grand Challenge on reinventing of toilets**”. Eram Scientific Solutions Pvt Ltd and University of South Florida developed Newgen Technology along with electronic toilets.



Innovative solutions developed for less water usage, pathogen free and odour free discharge and biodigestion of the waste



◆ Bio-toilet Installation Sites in Tripura and Mizoram



- Data monitoring for the treatment of the faecal sludge is also being done.
- Bio-toilets have been installed in schools in the 7 states of North East India.
- Districts as far as Serchhip and Champhai in Mizoram, Kakching and Kangpokpi in Manipur, Papumpare in Arunachal Pradesh have been covered.



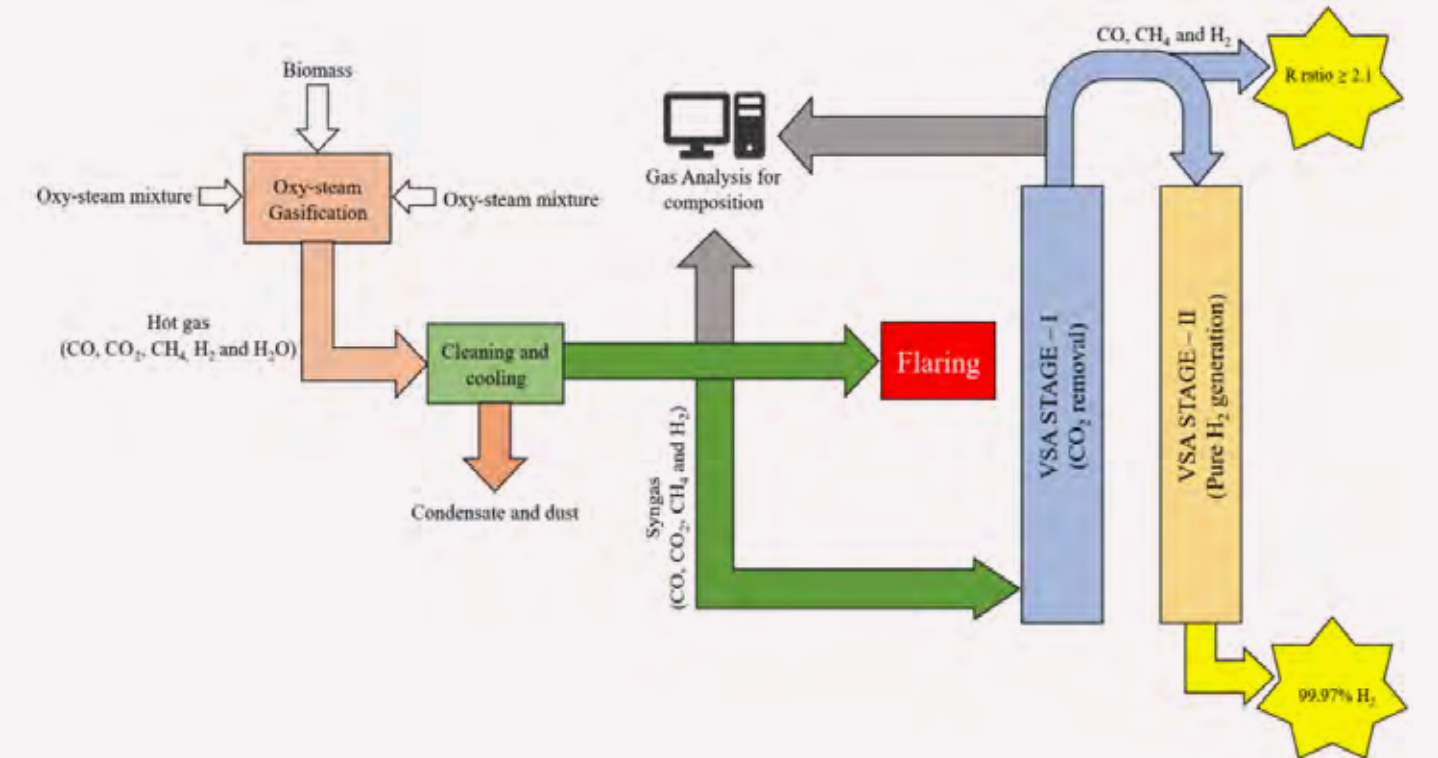
Image of the biotoilet installed in the Assam state

Rhino Digester



A sealed, compact odor free and easy to use system which converts food waste to biogas.

Production of Methanol using Biomass/Municipal Solid Waste



DBT supported IISC Bangalore for demonstration of technology for production of suitable quality syngas from biomass. Cost economics for production of methanol at 100 kg/hr is being worked out

Four Centres of Excellence Pioneering in Bioenergy



DBT-ICT Centre for Energy Biosciences, Mumbai
Pioneering in 2G Ethanol technology.



DBT IOC Centre for Advanced Bioenergy Research, Faridabad
Established with an aim to develop process for CO₂ fermentation and conversion to lipids.



DBT-ICGEB centre for Advanced Bioenergy Research
Developed key technologies such as potent enzymes composition for biomass hydrolysis and engineered bacteria for C5 fermentation to ethanol.



PAN IIT Bio-energy Centre
Constitutes a network of 32 investigators from five IITs working on five thematic areas.



Capacity Building in Bioenergy



Launching the Bioenergy Awards for Cutting Edge Research — India and United States have joined hands to support a fellowship that will allow a group of fellows and interns to pursue cutting edge research in various areas of bio-energy in US institutes of repute. This will help build capacity in clean and environmentally safe energy.

10 post doc fellows under the Energy Bioscience Overseas Fellowships are now placed in some of the centres of excellences on bio-energy in the country.

Technology for Removal of Hydrogen Sulphide from Biogas

Removal of Hydrogen Sulphide from Biogas by recovering sulphur from it. Technology is ready and operational at 1000 L scale.

Innovator /Company: Daurala Sugar Works



India Participates in Mission Innovation—a Global Initiative to Double Clean Energy R&D

Mission Innovation (MI) is a global initiative of 22 countries and the European Union to dramatically accelerate global clean energy innovation. Participating countries have committed to seek to double their governments’ clean energy research and development (R&D) investments over five years.

Startups from 23 participating EU countries can potentially come & incubate in India and likewise startups from this incubator can go to the partnering countries facilitating access to global opportunities



1st Clean Energy International Incubator has been set up under Mission Innovation



India-Europe Collaboration on Water4Crops

Integrated Bio-treated
Wastewater Reuse with Enhanced Water
Efficiency to Support
Agriculture



Indian consortium partners have demonstrated the use of constructed wetland as decentralized wastewater treatment systems for both industrial and municipal wastewater in Telangana, Andhra Pradesh, Maharashtra, Uttar Pradesh, and Karnataka.

Septic Tank as Decentralized Wastewater Treatment System

Affordable and simple-to-operate decentralized wastewater treatment system through bio-electrolysis for a community of 100 people equivalent.



कृषि विकास



Improving
Farmer
Livelihoods

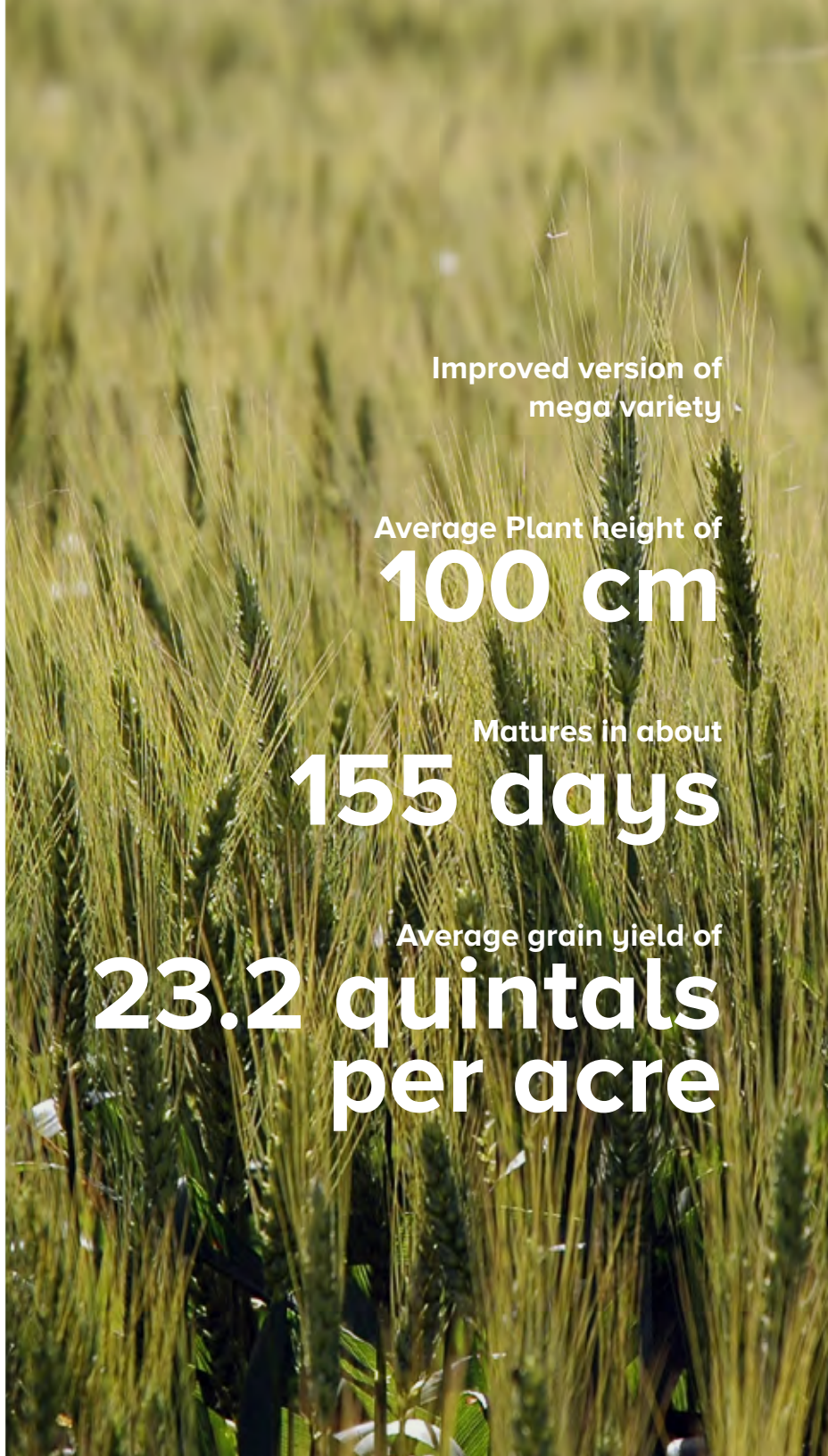


DBT has been instrumental in supporting projects, programs and developing technologies aimed at **enhancing farmer's income** and ensuring **food and nutritional security**. The Department is also contributing to the Animal Biotechnology sector by addressing the need for development of **superior quality livestock germplasm**. Efforts are also being made to augment the blue economy through various programmes

Crop Varieties Developed Through DBT Sponsored Projects

Unnat PBW343

Wheat variety Unnat PBW343-
resistant to leaf rust and stripe rust as
developed by PAU, Ludhiana through marker
assisted backcross breeding approach.



Pusa Basmati 1728

Rice variety resistant to bacterial
blight disease developed. Variety
released for commercial cultivation
in Punjab, Haryana, Delhi,
Uttarakhand and Uttar Pradesh.



Improved White Ponni

Rice variety resistant to
drought and heat
released to farmers.



CARI Dhan

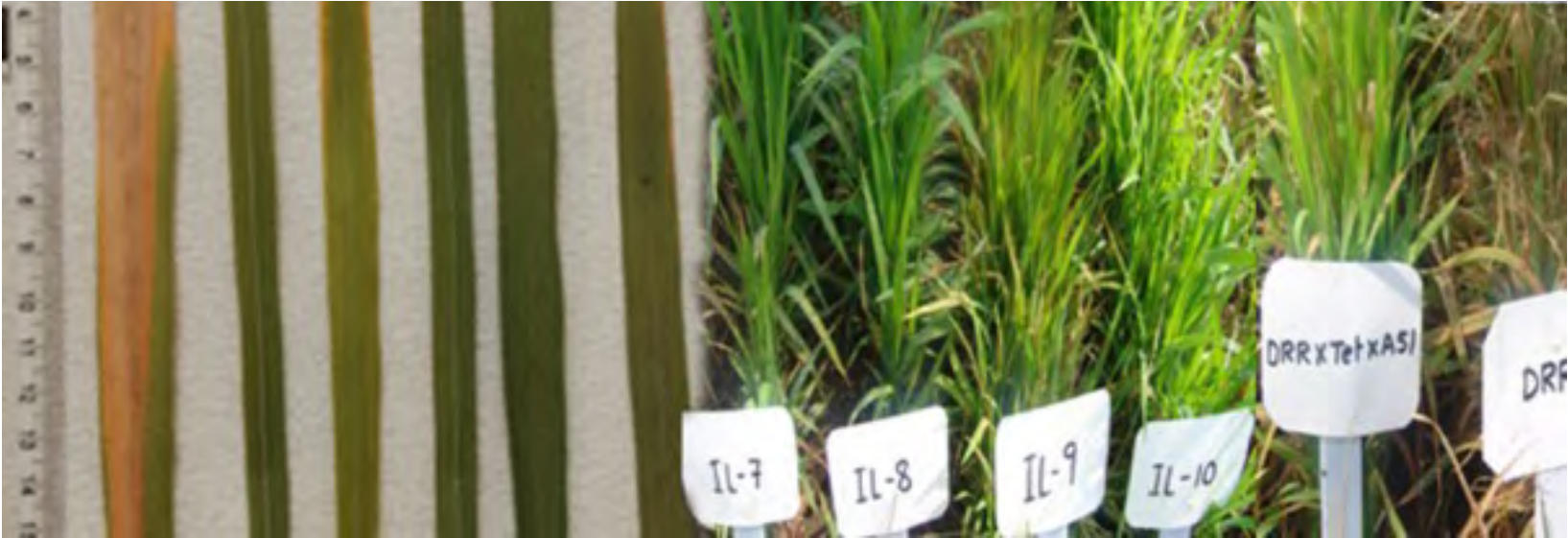
The variety showed resistance to
Bacterial Blight reaction after artificial
inoculation with Bacterial Blight isolates
collected.

High yielding rice developed through
silencing of a specific cytokinin oxidase,
making it possible to obtain “More grains
per plant”.

Samba Mahsuri

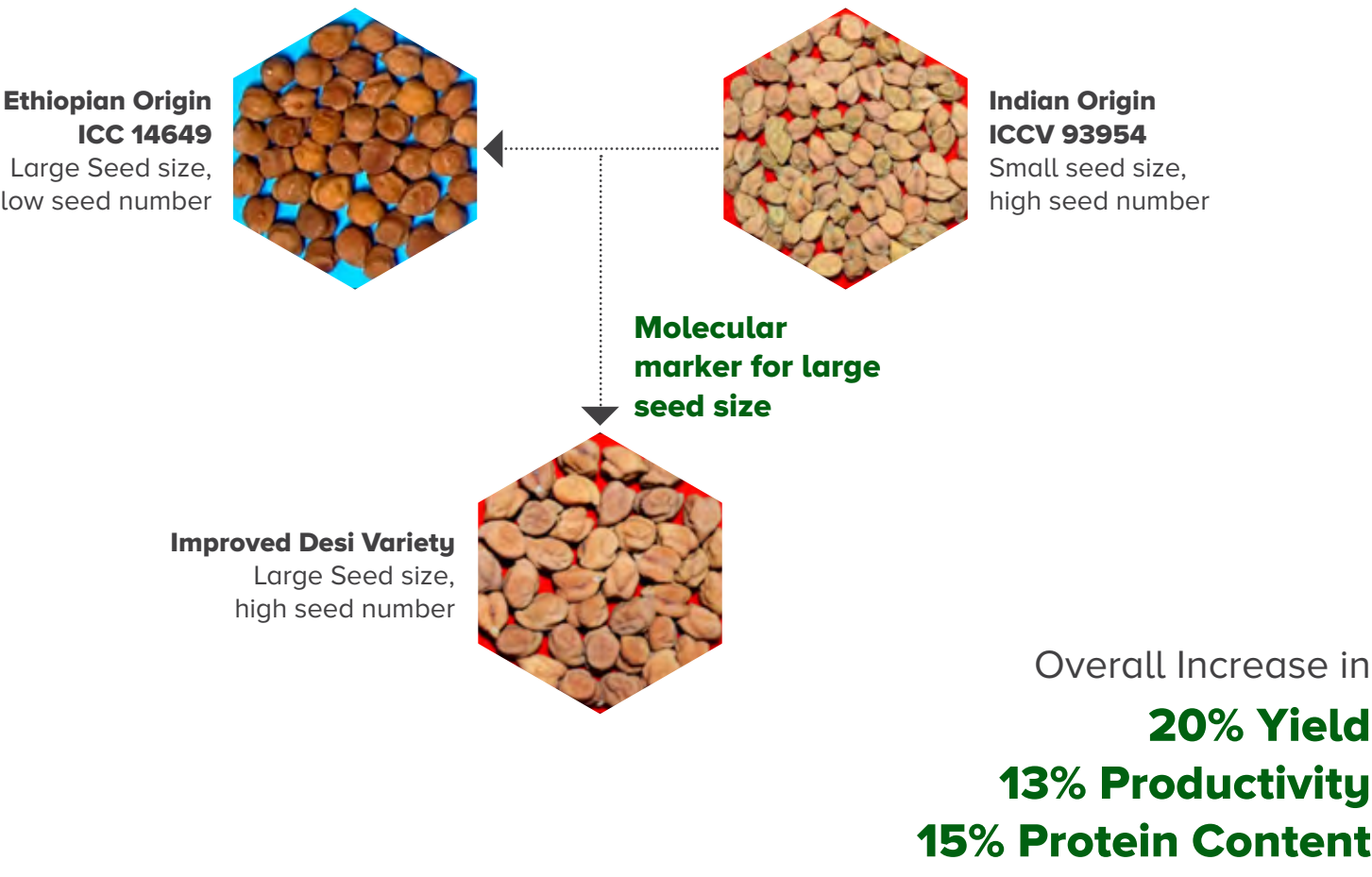
Samba Mahsuri rice variety resistant to bacterial blight developed with DBT support through Marker Assisted Selection and Backcross Breeding and spread to 90,000 ha in Tamil Nadu, Karnataka, Telangana & Andhra Pradesh.

A bacterial blight-resistant variety of Samba Mahsuri that has fine quality and yield



Chickpea

New chickpea lines developed with 13-20% enhancement of yield as well as 15% increase in protein content as compared to the parent line ICCV 93954.



Soybean

CO 3(Soybean I) & JSS 35 (Soybean M) varieties with resistance to Phytophthora and powdery mildew disease.



Susceptible lines



Disease resistant lines

Tomato

Punjab Chuhhara(improved) with resistance to Leaf curl virus, late blight & root knot nematode (Mi).



RSTW -122-4-5-12



RSTW -124-7-8-21



RSTW -124-12-2-21



RSTW -128-9G-3-1



RSTW -128-10G-2-1



RSTW -130-1E-4-1



RSTW -130-7-2-22



RSTW -130-8-3-21

Grape

H90.24 and H98.23 with Downy mildew resistance.



Transfer and Characterization of Anthocyanins from Blue, Purple and Black Grain Colored Germplasm to High-yielding Indian Wheat Cultivars



Biofortified, black, blue and purple wheat rich in anthocyanin developed. FSSAI approval obtained and product information and multiple MOUs transferred to commercial companies.

Bread

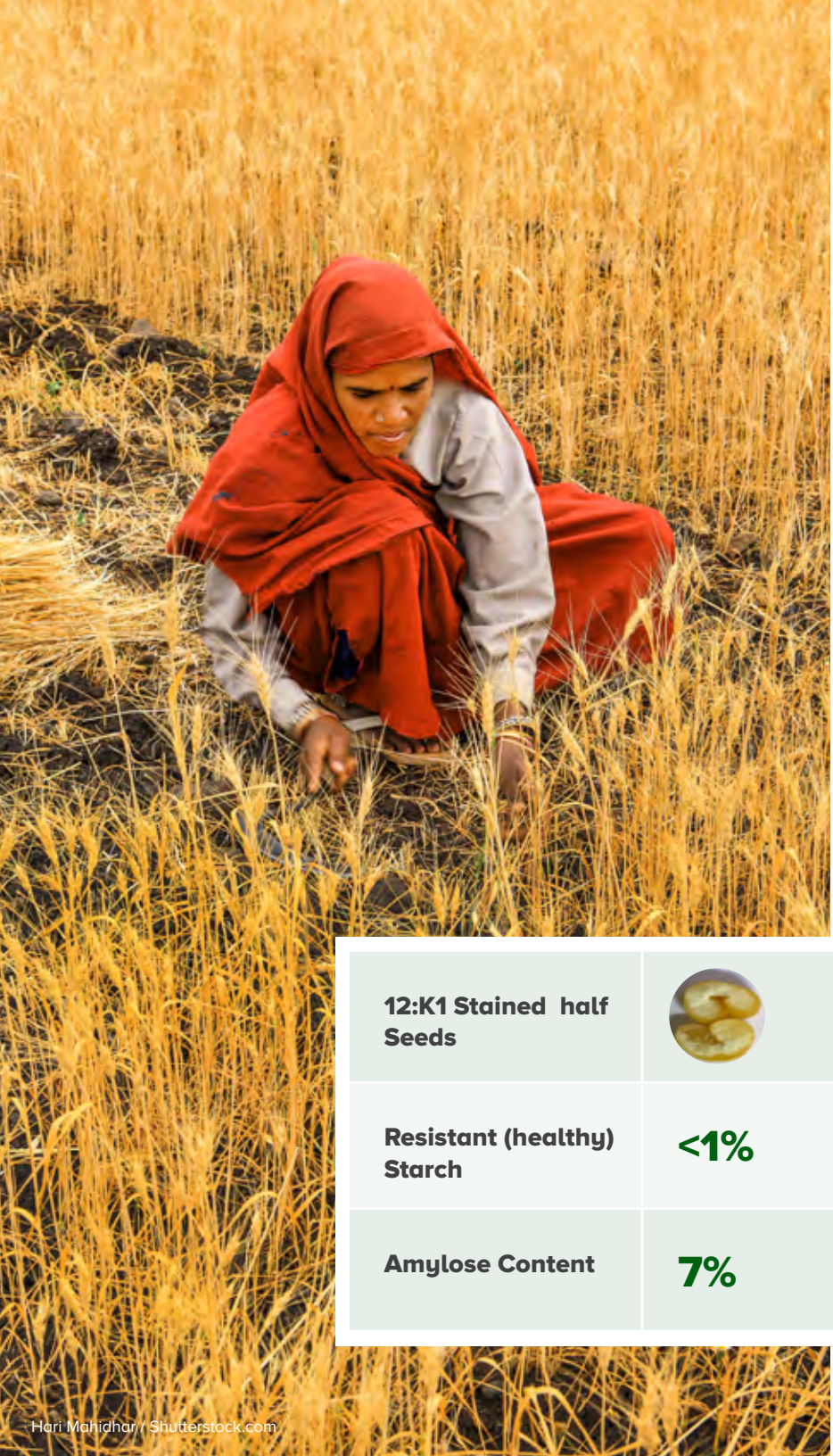
Purple Amber Black

Cookies

Amber Black Purple

Chapattis

Purple Amber Black



Hari Mahidhar / Shutterstock.com

Bread Wheat (Triticum aestivum) Lines with High Amylose or Resistant Starch in Seeds were Developed

12:K1 Stained half Seeds			
Resistant (healthy) Starch	<1%	<1%	45%
Amylose Content	7%	26%	76%

DBT-PGGF Plant Genotyping and Genomics Facility

DBT-PGGF “Plant Genotyping and Genomics Facility” (PGGF) is anchored in NIPGR, New Delhi and is being established on PPP mode. This national facility is a “single-window service system” for advanced genomics technology services that could positively influence the Indian Seed industry.



The “Facility” will have the potential to evolve into a “leading edge” genotyping service provider and a consulting facility that will positively impact agriculture in India while also serving as a global model

FarmerZone™ for Smart Agriculture

A collective open-source data platform for smart agriculture. “FarmerZone” uses biological research and data to improve the lives of small and marginal farmers. The first sentinel site of FarmerZone on potato crop has been initiated.



FarmerZone—a multi-purpose window for solutions on climate change, weather predictions, land, soil, disease, pest, water, planting material and marketing being made available for farmers anywhere in India and the world

Wheat Genome Decoded through Indian Participation in 15 Country Partnership Research

India was part of a strong consortium of 15 countries which joined hands to decode wheat genome.



Bread wheat, with an estimated world harvest of more than 550 million tonnes, is one of the most important food crops in the world





Biotech-KISAN Scheme

Impacting Farmers' Lives through Science

The programme provides solutions to challenges of small and marginal farmers.

- Thematic Mahila Kisan Biotech Fellowships instituted in each zone.
- Strong Scientists-Farmers Interaction Platform created
- Demonstrations and scale up of programmes to address water, soil, seed and marketing issues of local farmers with validated technologies
- Biotech hubs established in 9 Agro-Climatic zones
- 5300 farmers benefitted and trained

Android, IOT-based Analysis Advice System for Plants

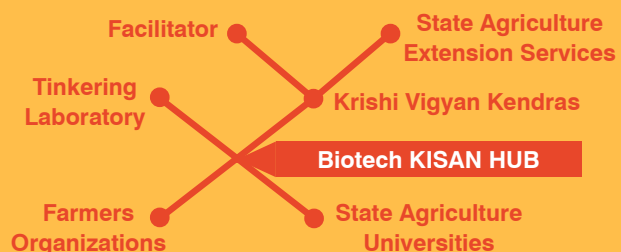
Swasti Agro and Bioproducts has developed preventive “vaccines,” eco-friendly sustainable technology; and “healthcare system”— android, IOT based analysis-advice system for plants.



Completely organic, sprayable biotechnology based products derisk the farmers by preventing diseases with a three pronged approach

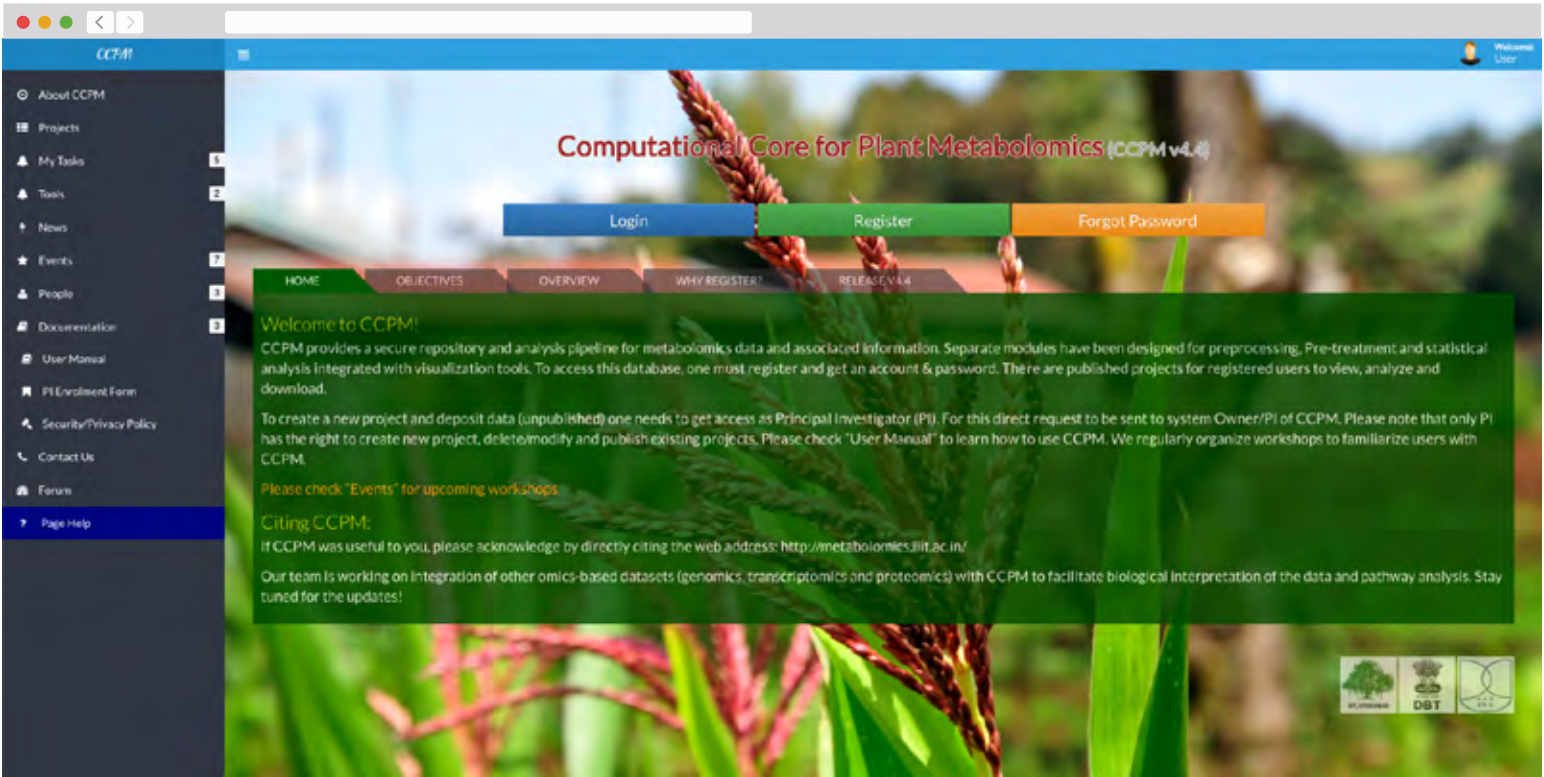


Biotech-Krishi Innovation Science Application Network (Biotech-Kisan) Scheme



India's Farmers to Partner with Indian and Global Best in Science for India's Future

Computational Core for Plant Metabolomics (CCPM)



Comprehensive software modules developed for analysis of data generated through metabolomics through multi – institutional collaborative project, funded by the Department of Biotechnology, Govt. of India, being carried out at two institutes: IIIT Hyderabad and JNU, New Delhi.

Project objectives:

- Develop a data repository which can capture, secure and serve metabolomic data.
- Provide tools and metabolomics web resources for analysis of the data.
- Provide connectivity for integration of metabolomics data with genomic, transcriptomic and proteomic databases.

Fortified Vermicompost



DBT supported Biotechnological interventions to improve soil fertility and biological health for high crop productivity in Jalandhar and Amritsar districts of Punjab and Kaithal and Karnal in Haryana.

National Certification System for Tissue Culture Raised Plants (NCS-TCP)

Developed as a First of its Kind Quality Management System



80 Companies

are recognized for getting their planting material certified from the Accredited Test Laboratories

5 Test Laboratories

are accredited under this system

275 Million+ Tissue Culture Plants

certified through this system



DBT-IRRI Initiative Innovations in Rice Farming Technologies



A training programme on
“Advance in Rice Production for
Women farmers” across India in
Bhubaneshwar.



35
Women farmers
from 7 states
attended training
programme

4
women farmers were from
the Aspirational Districts
of **Karnataka** (Raipur) and
Assam (Darrang)

7
farmers underwent
advanced training at Los
Banos, Philippines, in the
Phase II of the programme

Brucellosis Free Villages Mission

‘Brucellosis Free Villages’ Mission was launched and implemented across 50 villages in 10 states in a phased manner. Three new Brucella diagnostic kits were introduced under this mission. 27 countries collaborated to discuss one directive health approach for Brucella.



Development of Various Technologies to Support Animal Husbandry

Five technologies developed to support animal husbandry through innovation.



KETOCHECK for the detection of Ketosis



Conductivity Meter for the detection of Subclinical mastitis



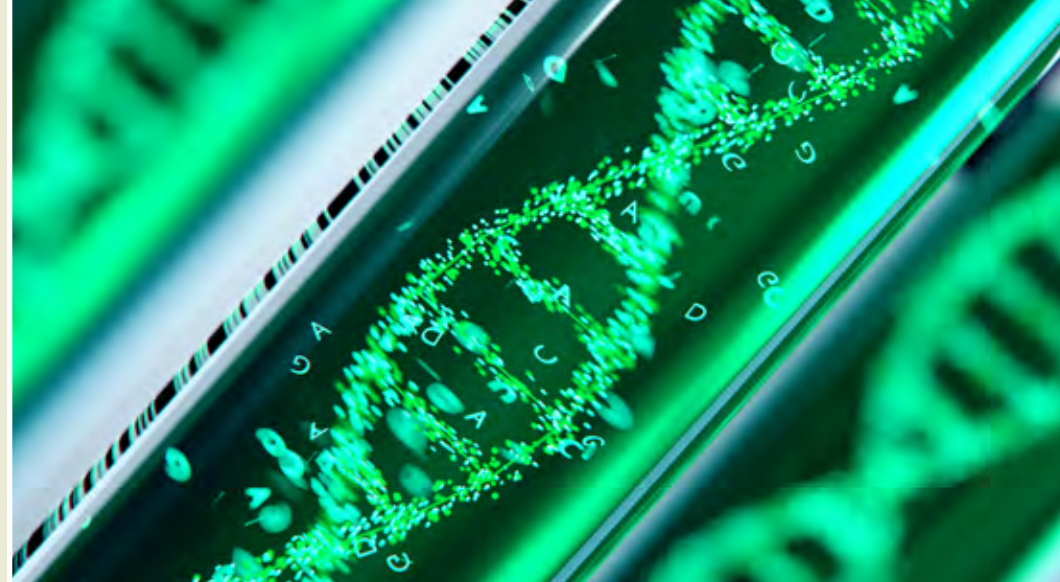
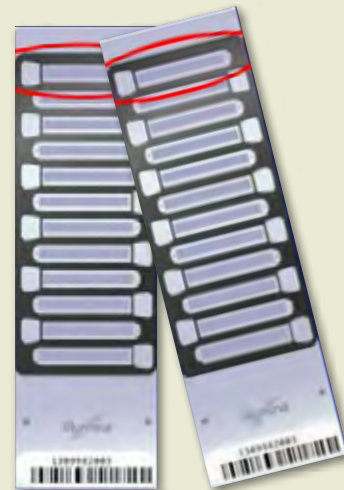
Lepto Lat for the detection of leptospirosis



LFA kit for the detection of CPV maternal antibody level in pups



Egg yolk semen extender for the cryopreservation of bull semen



India has the largest repertoire of cattle in the world. Indian cattle population is highly heterogeneous. 69% of Indian cows are owned by the poor

Cattle Genomics

The cattle genomics programme has been initiated at the National Institute of Animal Biotechnology, Hyderabad. Whole genome sequencing of five important milch breeds of cattle has been initiated.

High and low SNP chips will be developed to help identify pure elite animal of a particular cattle breed in its early age and also for conservation.

Based on the results, Phase-II programme of genomic selection will be carried out by involving farmers in breeding programme.



Whole Genome Sequencing and Development of Allied Genomic Research

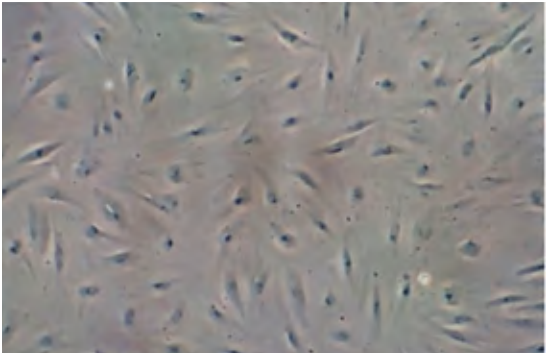
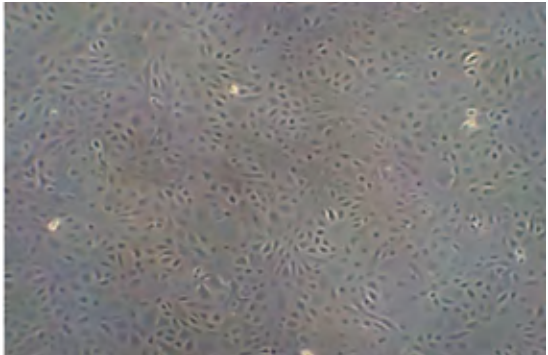
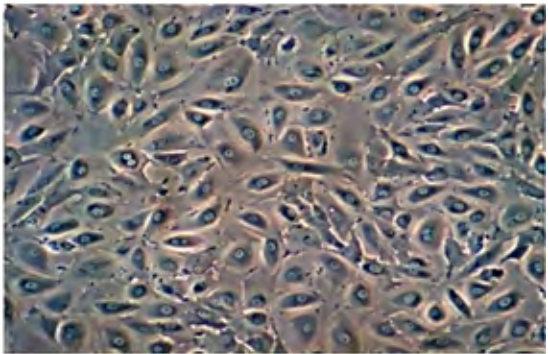
Project initiated for two commercially important Fish- Rohu (*Labeo rohita*) and Magur (*Clarias batrachus*) through five next-generation sequencing platforms.



Magur (*Clarias batrachus*)



Rohu (*Labeo rohita*)



National Repository for Fish Cell Lines

Cell lines are being used for virological, toxicological and gene expression studies

54+ Fish cell lines

have been developed and are being maintained in National Repository established at ICAR-NBFGR, Lucknow and C. Abdul Hakeem College, Vellore.

आयुष्मान भारत



Healthcare
for All



The National Health Policy 2017 announced by the Government aims to strengthen and prioritize the road map of Government in **shaping health systems**. The Department of Biotechnology has created various projects to support this vision by developing new **affordable health care** interventions for prevention and treatment of diseases, creating **healthcare delivery systems** and developing important products of high medicinal value

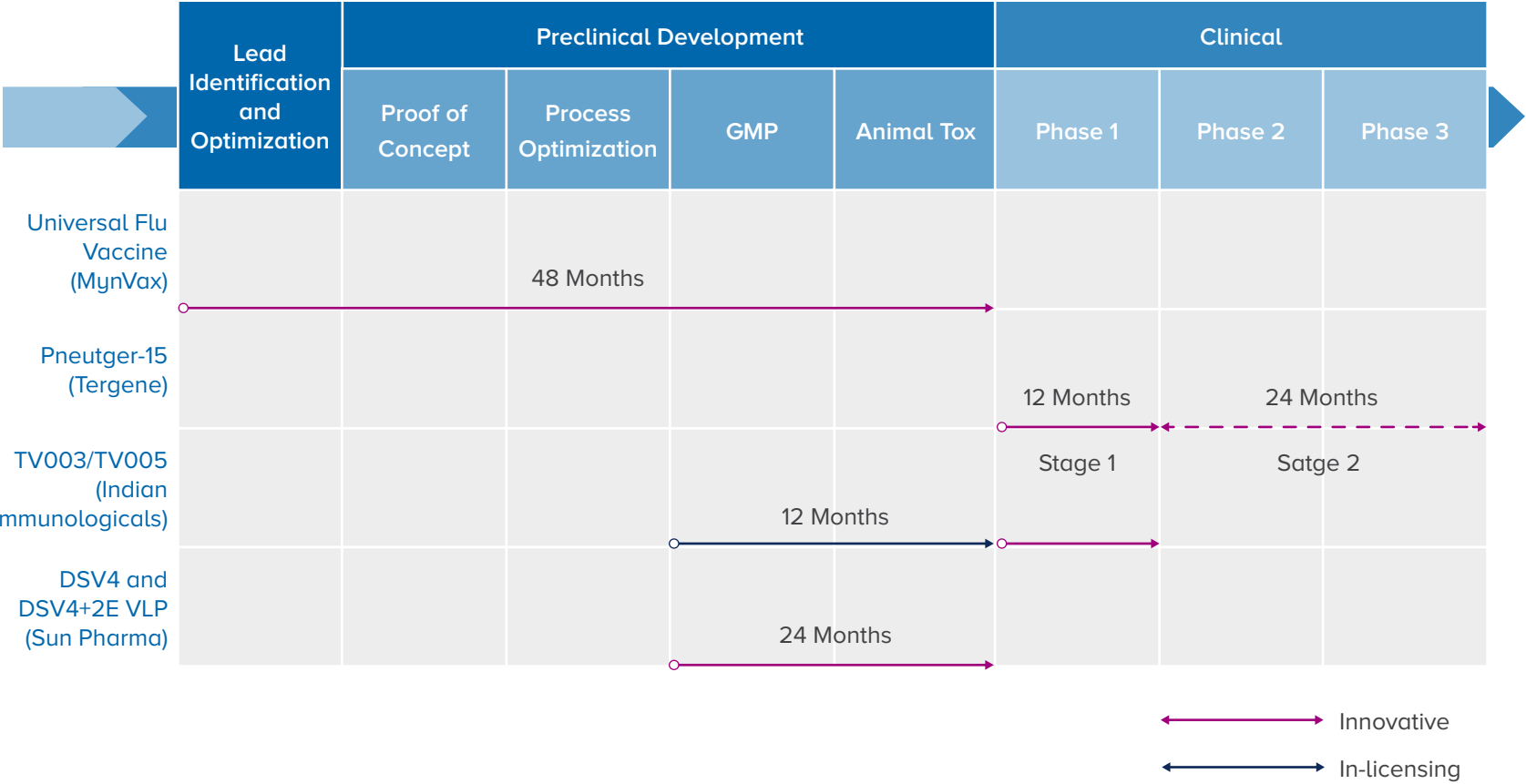
National Biopharma Mission

The first ever Industry-Academia mission to accelerate biopharmaceutical development in India was launched by the Cabinet Minister for Science and Technology, Earth Sciences, Environment, Forests and Climate Change, Dr. Harsh Vardhan in New Delhi in June 2017.

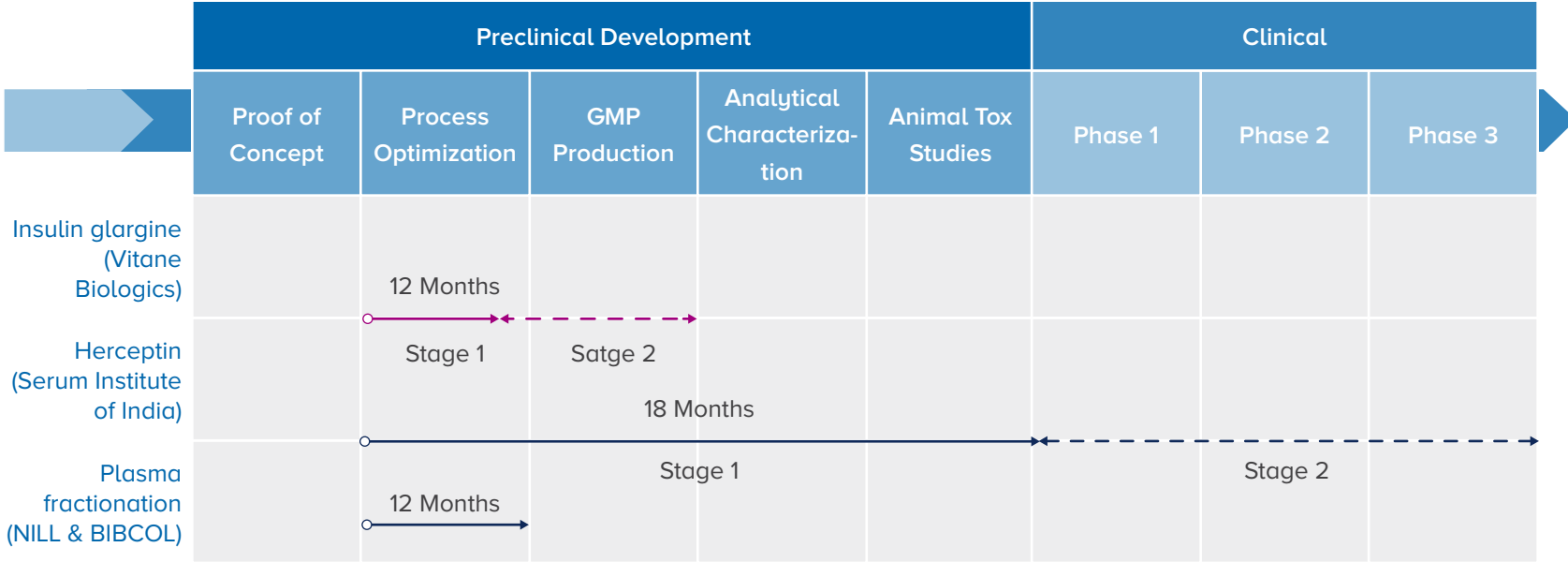


Department of Biotechnology's PSU Biotechnology Industry Research Assistance Council (BIRAC) in collaboration with World Bank is implementing this mission with the goal to bring to the market 5 Biopharma products vaccine, Biotherapeutics Medical devices & diagnostic and creating an ecosystem to facilitate the pipeline of products.

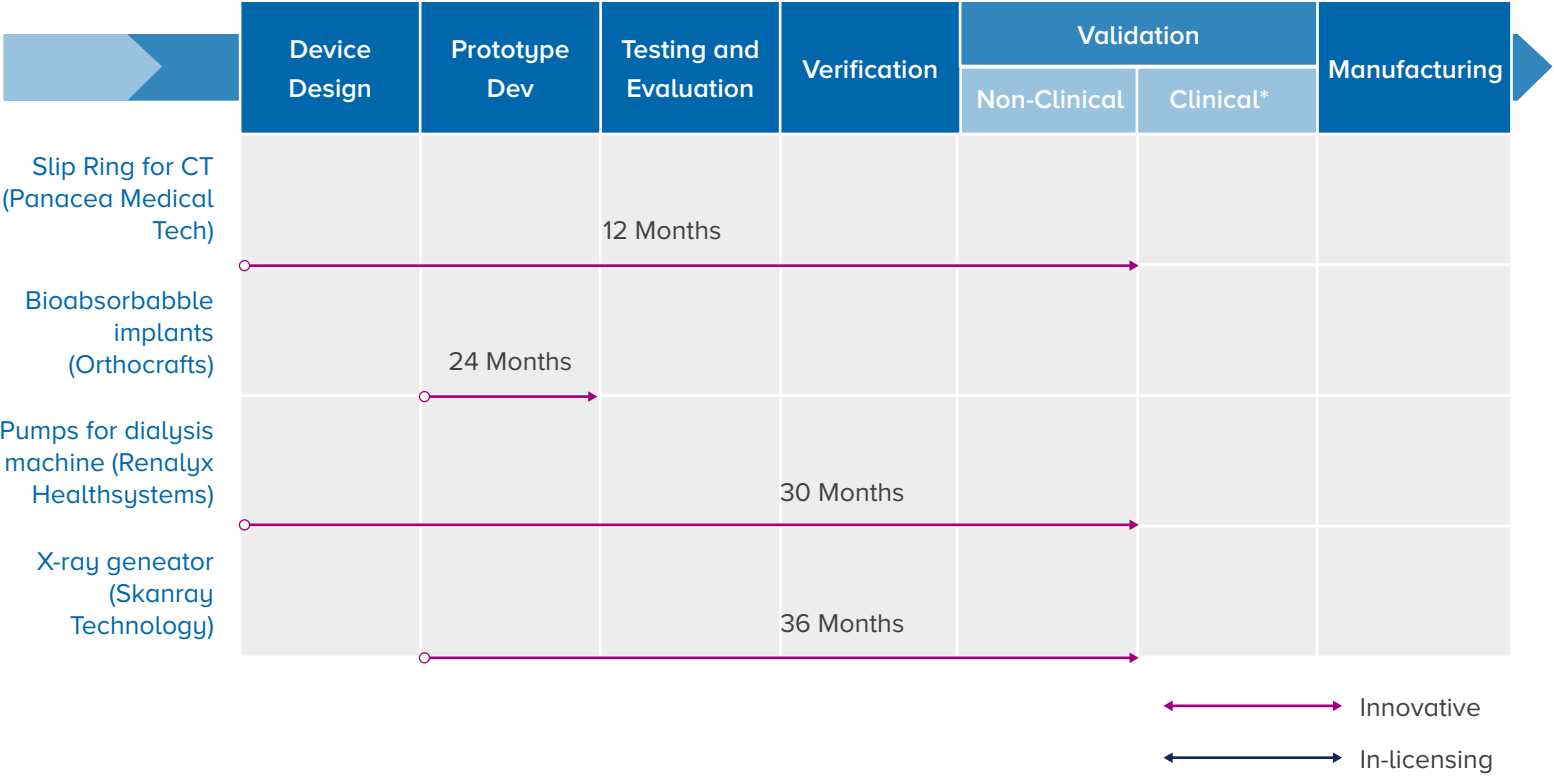
Vaccine Candidates
 being Supported under
 the National Biopharma
 Mission



Biotherapeutics
 Supported under the
 Mission



Medical Devices and Diagnostics Supported under the Mission



Coalition for Epidemic Preparedness and Innovations (CEPI)

The Department of Biotechnology (DBT) on behalf of Government of India is **collaborating in the Coalition for Epidemic Preparedness and Innovations (CEPI)**, a new global alliance among governments, industries, academia, philanthropy, inter-governmental institutions, the World Health Organization and civil society.



CEPI will assess the feasibility of vaccine development against priority pathogens identified by the WHO R&D blueprint and other processes and fund vaccine preparedness efforts



A parallel or joint Indian programme under the IndCEPI Mission will facilitate India's R&D capabilities in emerging infectious disease vaccines to capitalize on the position of the Indian vaccine industry as an emerging leader in the vaccine field and make substantial contributions to global public health.

RePORT India

(Regional Prospective Observational Research for Tuberculosis)

- Bilateral, multi-organizational, collaborative effort established in 2013 under the Indo-US Vaccine Action Program (VAP).
- Consists of six distinct TB Cohort Research Units (CRUs) at seven Indian clinical sites located in Western and Southern India.
- 33 Articles published so far through this initiative.

The aim is to establish an Indian bio-repository of well-characterized and standardized specimens with associated clinical data for future TB research



RePORT India Research Sites

RePORT
International
Consortium

Repository
well of
characterized
samples

Linked by common
protocol in 2017, Central
Data Management
Centre and Central
Respository

Vaccine Trails:
Serum Institute
of India using
VPM1002

Mission Program on Antimicrobial Resistance (AMR)



The India-UK Strategic Group on Antimicrobial Resistance (AMR) was launched November 2016 by the Hon'ble Minister for Science & Technology, Minister of Environment, Forest and Climate Change and Minister of Earth Sciences, Dr Harsh Vardhan and the UK Minister of State for Universities, Science, Research and Innovation Jo Johnson. Prime Ministers of India and the United Kingdom announced a £6.5 million joint contribution dedicated to research on AMR.



DBT-AMR Mission

A major Mission program on Antimicrobial Resistance (AMR) was launched in October, 2018 with the following vision and mission:

- Development of indigenous and cost-effective therapies against AMR,
- Categorization of AMR-specific pathogen priority list of India,
- Establishment of Bio-repository for AMR-specific pathogens,
- Development of rapid and cost-effective diagnostic kits to identify AMR-specific pathogens.

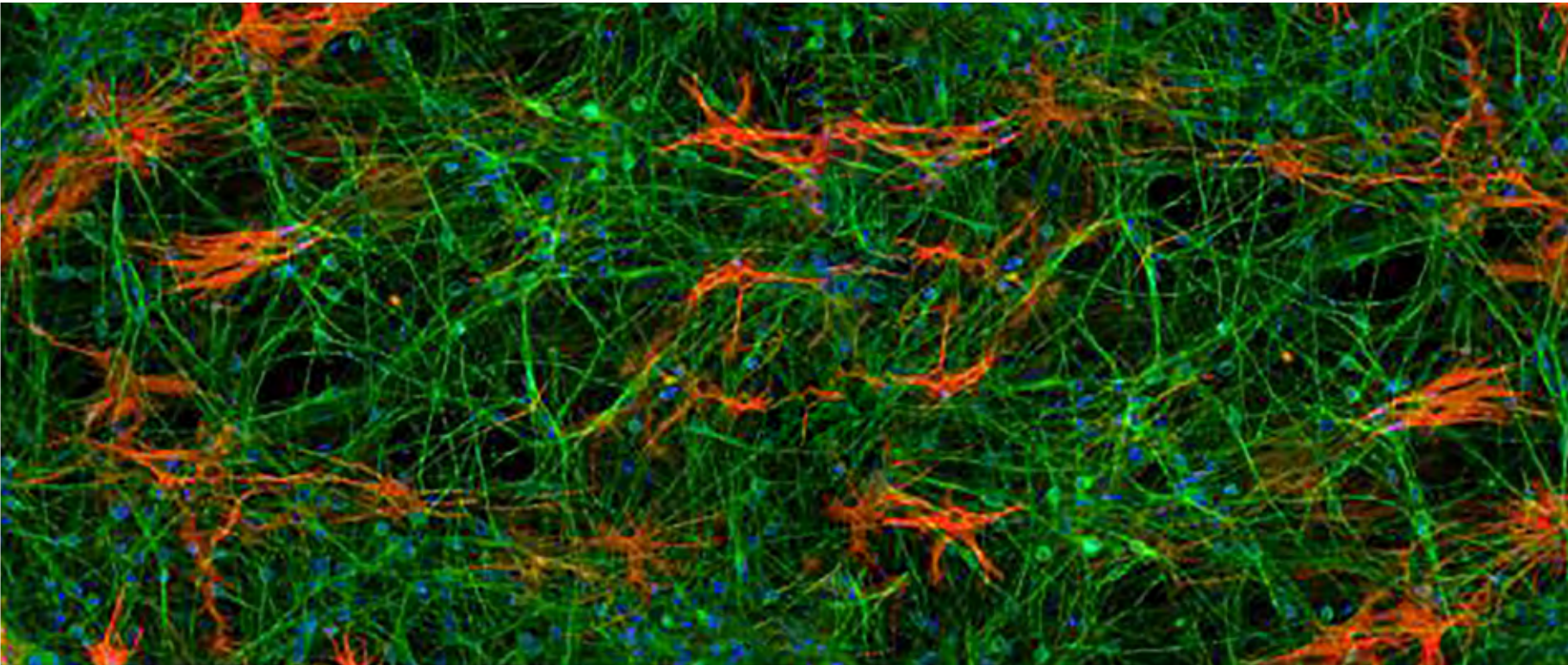
Centre for Neurosynaptopathies (CNS) - inStem, Bengaluru

Developed new rat models of highly penetrant single-gene causes of ASD/ID to better model autistic and cognitive behaviors.

lovastatin administration restores normal associative memory which is maintained 4-months after treatment cessation.

In-vitro system based on human induced pluripotent stem cell (iPSC) has also been established to study cellular and synaptic mechanisms underlying ASD/ID.

Transformative program between inStem, NCBS, Bangalore and the University of Edinburgh (UoE) bringing together world-class expertise in several crucial fields **to understanding ASD/ID neurobiology including neurodevelopment**, synaptic function and plasticity, human stem cells and cognitive behaviour.



Human iPSC-derived cortical neurons co-cultured (8 weeks in vitro) on rodent cortical astrocyte feeder layer. The cells have been immune-labeled for DAPI (blue), MAP2ab (green) and GFAP (orange).

Pune Maternal Nutrition Study (PMNS) 18-Year Follow up

The program addresses the question ‘why Indians are so susceptible to diabetes and what may be done about it.



At 18 years of age
28% offsprings have
‘prediabetes’, predicted
by lower birth weight but
relatively higher current
BMI (19 kg/m2)

Despite a relatively low BMI (~50% are underweight by WHO criteria) there is high prevalence of pre-diabetes, twice in boys compared to girls.

Babies who are born light and grow relatively heavier are at the highest risk, illustrating the effect of intrauterine programming and subsequent transition in the risk of non-communicable diseases.

356	N	307
42	Underweight %	55
8	Over wt and Obese %	4
11	Stunted %	10
27	IFG %	8
10	IGT %	9
0	DM (n)	2
Hyperglycemic (190, 28.7%)		
Males: 133, 37%, Females: 57, 18.5%		

First Low-cost Rotavirus Vaccine

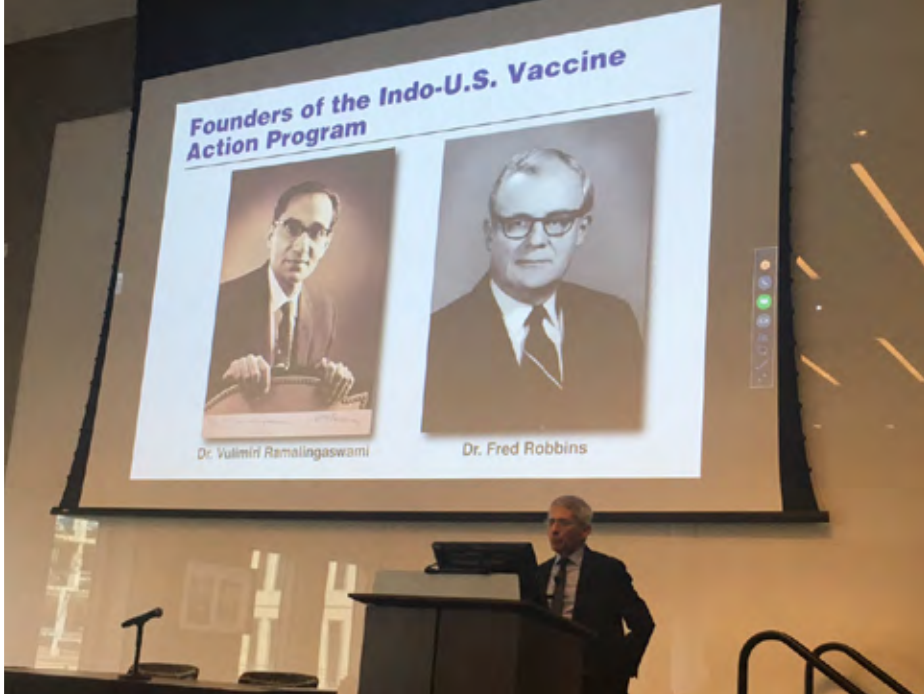


The first indigenous low cost Rotavirus Vaccine from an Indian strain, 116E was launched by the Hon'ble Prime Minister in 2015. This vaccine is efficacious in preventing severe Rotavirus diarrhoea in low-resource settings of India. The ROTAVAC® vaccine has received WHO prequalification in 2018 and has been included in India's Universal Immunization Program (UIP). DBT's Indo-US Vaccine Action Programme (VAP) and the Vaccine Grand Challenge Programme (VGCP) scored high with achievements like lowest cost Rotavirus vaccine becoming part of universal immunization programme and major strides towards vaccine for diseases like malaria & dengue.

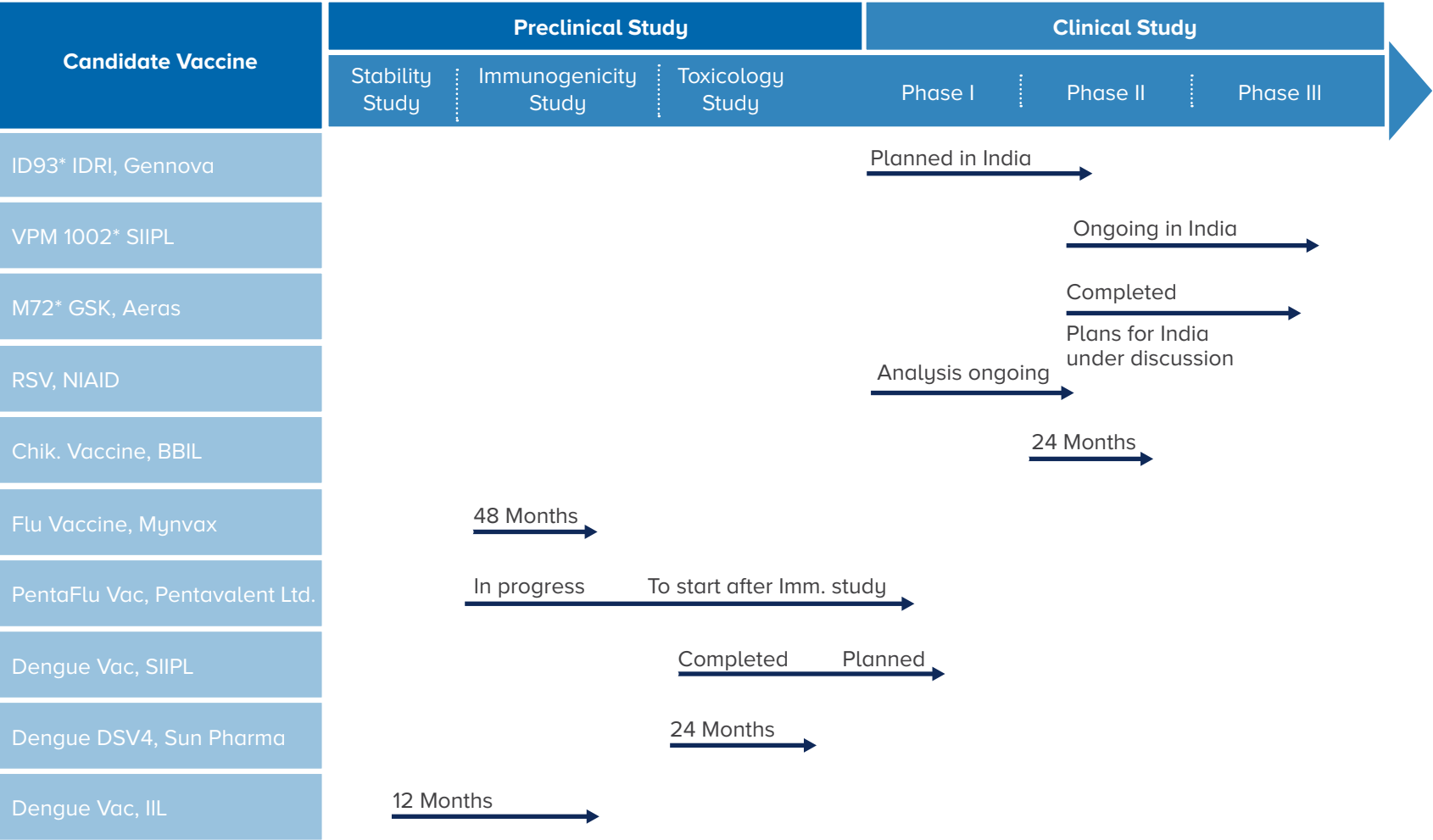
1 out of every 6 children over the world receives vaccines manufactured in India

Vaccine Action Programme (VAP) and the Vaccine Grand Challenge Programme

The collaboration determines important achievements like the lowest cost Rotavirus vaccine and major strides towards vaccine for diseases like malaria & dengue.



Roadmap of Vaccines reviewed by Candidate Vaccine Advisory Committee (CVAC) of Indo-US Vaccine Action Program (VAP)



Technology for Rapid Diagnosis of Celiac Disease (CD) in Humans

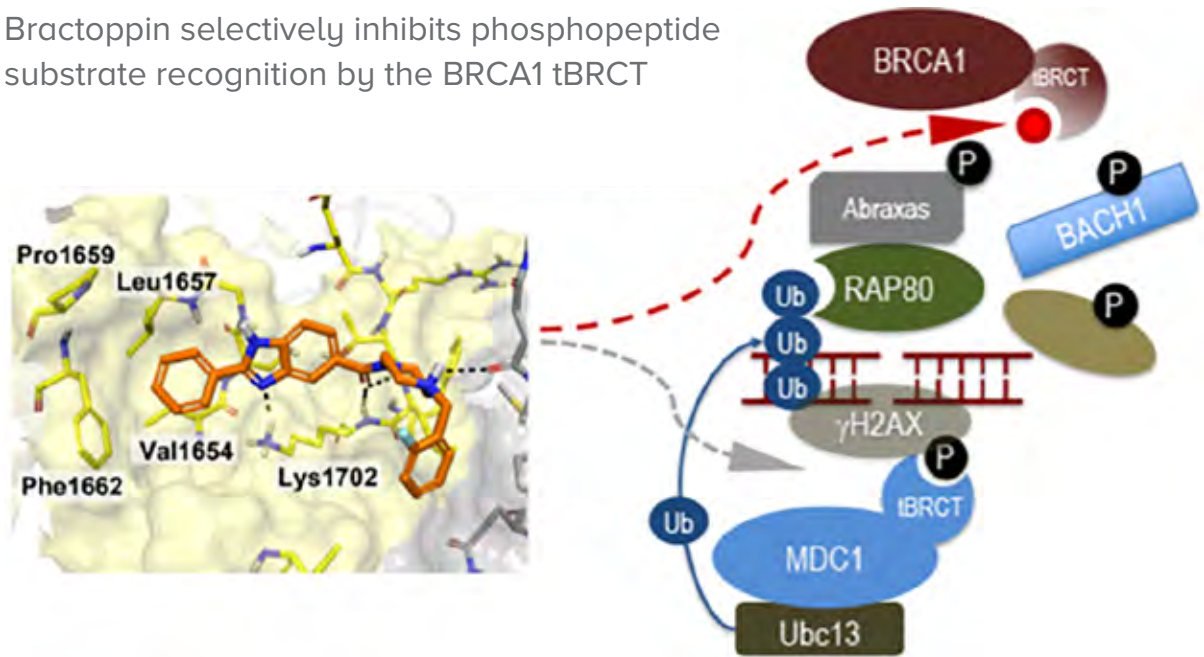
Diagnostic kits for Celiac Disease supported by the Department of Biotechnology launched in 2014. These kits were developed through a collaborative, multi-institutional, inter-disciplinary approach and are rapid, sensitive, specific, and much cheaper than imported kits.



Discovery of New Drug Candidate Molecules Processes and Technologies Developed

Compounds targeting tandem BRCT domains of BRCA1, compositions and methods thereof:

Bractoppin selectively inhibits phosphopeptide substrate recognition by the BRCA1 tBRCT

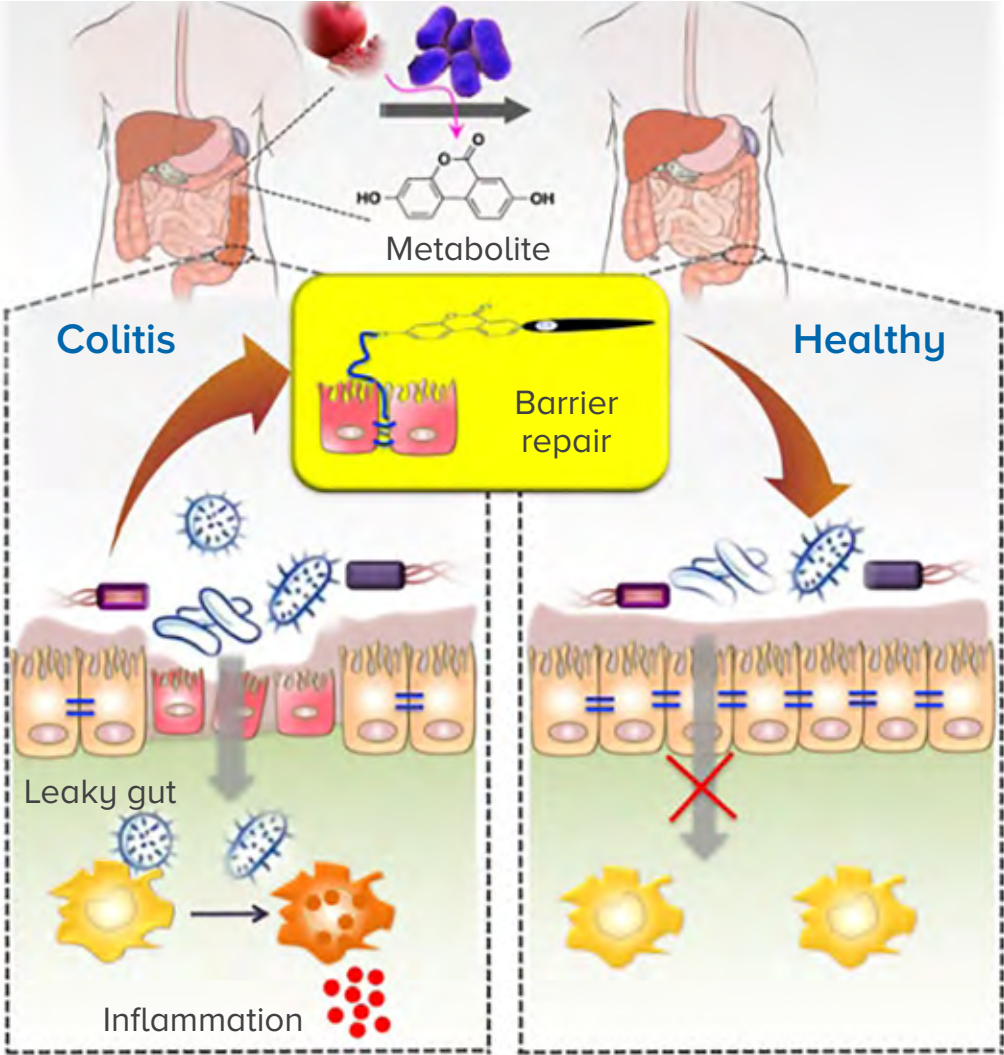


...to interrupt BRCA1 - dependent signalling after DNA damage

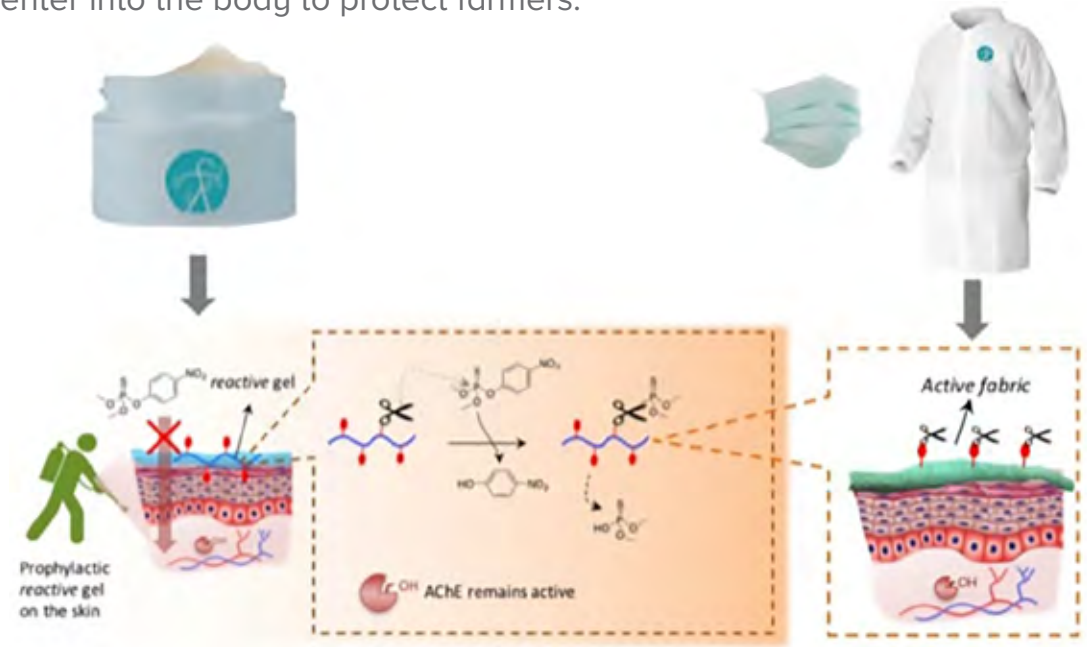
A first-in-class drug-like inhibitor of substrate recognition by human BRCA1 tBRCT domains with evidence of biochemical selectivity has been developed by InStem.

◆ **Synthetic Analogs of Gut Microbial Metabolites for Protection of Endothelial and Epithelial Barriers and Applications thereof:**

Inflammatory Bowel Diseases (Ulcerative Colitis and Crohn’s Disease) are chronic colonic inflammatory diseases. Instem scientists have generated small molecules, which have the dual role of protecting gut barrier dysfunction and reducing inflammation.



SKIN CREAM and CLOTH (suit/mask) have been developed to chemically deactivate pesticides before enter into the body to protect farmers.



Deactivation of pesticides outside of the body prevents toxicity

Exposure to pesticides occurs through skin and inhalation with severe side effects that can result in death. In this innovation, a gel for skin application, which can deactivate pesticides has been developed by inStem. Similarly, an “active” fabric, with the potential use as masks/ body suits, which can deactivate pesticides has also been developed.

Institute of Life Sciences, Bhubaneswar, has indigenously developed magnetic nanoparticles and magnetic device for cell separation

Highly Sensitive and Specific Rapid 1-Day Dengue Diagnostic Kit Developed

This kit detects Dengue Virus (DENV) infection from Day 1 of fever, Cost of the test is Rs 145/test to the distributors. The kit's performance was tested by Drug Controller Govt. of India& being exported.



Innovative Devices to Nurture Mother & Child Health

DBT unfolds cutting edge research and innovation in the field of healthacare. Innovations under this programme include:

Feto-maternal Parameter Monitoring System- This system is a safe, easy and cost-effective way to continuously monitor feto-maternal vitals to reduce neonatal mortality



Sohum - a hearing screening device for the newborns developed by the Stanford India Biodesign (SIB) programme's start-up



NeoBreath - Foot operated resuscitation system that can free-up a hand of the device operator, thereby allowing him or her to use both the hands for holding the mask, leading to effective sealing and better ventilation.



Sishunetra- First of its kind and a low cost wide field eye screening device for premature and term developed



Fetal Mom- This device functions as a fetal electrocardiogram and also uterine activity through signal extraction from maternal electrocardiogram, eliminating the need for the use of conventional transducers.



Technologies for In-patient and Out-patient Care

Point-of-care Diagnostics

VAPcare
Intelligent system for secretions and oral hygiene management in patients on ventilator



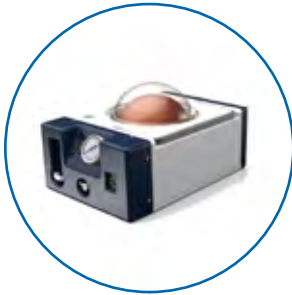
FlexiOH
Breathable, lightweight cast immobilization device for bone-fracture



Poorti Kit
Post-mastectomy breast prosthesis kit



Saans Device
Low-cost multi-powered neonatal Continuous Positive Airway Pressure (CPAP) machine for low resource settings including transport



CHIRON EYE
a machine learning based software for the detection of diabetic retinopathy



OptraScan
Digital Pathology Scanner for automated PAP smear imaging for cervical cancer screening



3 Nethra Neo (Shishunethra)
Point of Care device and system for screening Retinopathy of Prematures (ROP)



Epidome
Portable Epilepsy screening EEG system



Dozee
a contactless health monitoring device for tracking sleep patterns, heart rate, respiratory rate etc.



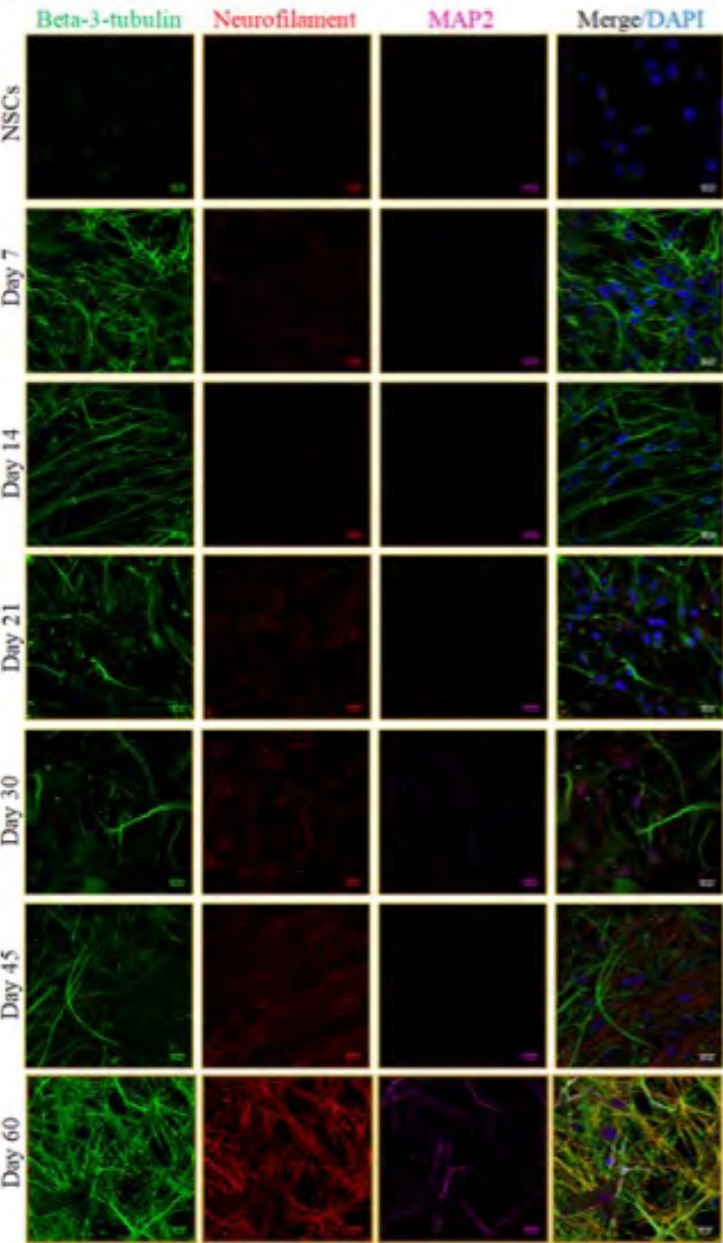
Accelerating the Application of Stem Cell Technology in Human Disease (ASHD)– an Indo-Japan Programme

Various training programs have been conducted on the generation and maintenance of iPSC cultures, attended by researchers across the country.

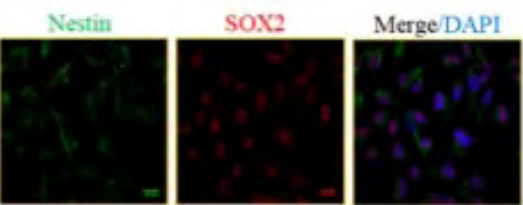
Differentiating neurons from human neural stem cell line A) Expression of neuronal markers beta-3-tubulin (green), neurofilament heavy polypeptide (red) and MAP2 (magenta). B) Immunostaining of neural stem cell markers Nestin (green) and SOX2 (red). C) Expression of specific neuronal markers: Deeper cortical neuronal marker CTIP2 (green) with neuronal marker DCX (red), presynaptic marker synaptophysin (red) with beta-3-tubulin (green), synaptic marker synapsin (red) with MAP2 (magenta). All the antibodies were costained with DAPI (blue).



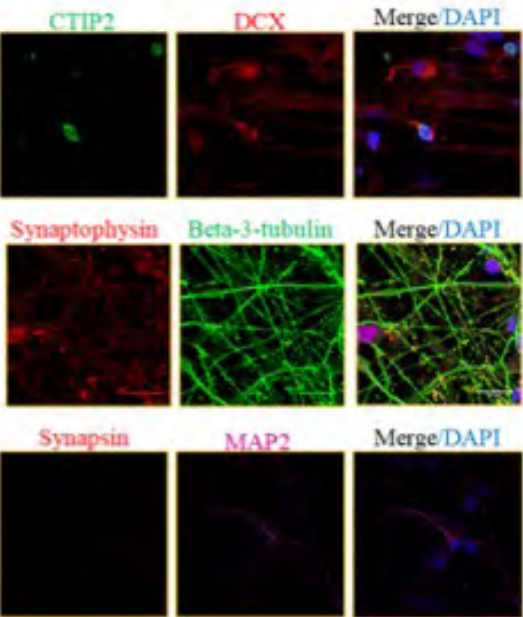
A) Neuronal Markers



B) Neural Stem Cell Markers



C) Specific Neuronal Markers



GARBH-Ini (Interdisciplinary Group for Advanced Research in Birth Outcomes– DBT India Initiative)

An inter-institutional and inter-disciplinary Programme was established by DBT in 2014 to acquire deep fundamental knowledge of pre-term birth to find efficient and sustainable hypothesis driven solutions. The Programme is coordinated by Translational Health Science and Technology Institute (THSTI) in collaboration between research institutes National Institute of Biomedical Genomics, Kalyani, Regional Centre for Biotechnology, Delhi NCR, and districts Gurugram Civil Hospital (GCH), Haryana and tertiary care hospitals [Safdarjung Hospital (SJH)].



A cohort identified as the GARBH-Ini (Interdisciplinary Group for Advanced Research in Birth Outcomes - DBT India Initiative) for pregnant women has been initiated in May 2015 at the Civil Hospital in Gurugram, Haryana, India. Till now, 5716 pregnant women have been enrolled for which outcomes are being documented

DALI (Dyslexia Assessment in Languages of India)



DALI is a kit for early detection of dyslexia. It is a tool developed for school teachers and for psychologists in Indian Languages to identify dyslexia.

The tools are available in Hindi, Marathi, Kannada and English and are being developed in other languages



21 improved genetic molecular diagnosis tools have been developed which has benefited more than 5 lakh affected families and more than 1 lakh tribal families

Diagnosis & Treatment of Human Genetic Disorders Significantly Augmented

The Department of Biotechnology initiated a major programme on Human Genetics & Genome Analysis which provides genetic diagnosis and counselling to families affected by common genetic disorders in India; and help them with improved molecular medicine tools.



DBT supports Government of India's National Nutrition Mission

Under the Mission, technology have been developed on Iron, Vit B12, folate fortified rice premix from broken rice kernels through extrusion process. An indigenously designed and fabricated pilot scale demonstration facility with a production capacity of producing 100 kg/day iron fortified rice premix has been established at IIT Kharagpur with the financial support from the Department of Biotechnology. A scientific sub-committee of 'National Technical Board on Nutrition' (SSC-NTBN) was constituted by NITI Aayog with Secretary, DBT and Secretary DHR as Co-chairs.



Poshan Abhiyan targets to reduce stunting, underweight by **2%** each, reduce anemia among young children, women and adolescent girls by **3%** and reduce the prevalence of low birth weight by **2%**, per annum respectively.

SSC-NTBN is monitoring evaluation of Poshan Abhiyan which is a multi-sectoral nutrition programme aimed at creating synergy and linking various schemes with each other in order to arrive at the common goal of reducing malnutrition in India.



कौशल भारत



Skill Development and Capacity Building



The Department's major emphasis is on **enabling innovations, nurturing** start ups ecosystem, developing world class research infrastructure and supporting **Make in India** and **Startup India** missions through skill and **capacity building** and generation of critical mass of scientific and technical manpower

BIRAC Supporting Govt. of India's 'Make in India' and 'Startup India' Flagship Programmes



BIRAC along with Department of Biotechnology (DBT) is playing a crucial role in the implementation and delivery of the flagship programmes of the Indian Government, such as 'Make in India' and 'Startup India'. BIRAC recognizes the necessity for entrepreneurship development among the youth in the country and hence has taken initiatives to build, support and promote Indian Biotech Ecosystem in Healthcare, Agriculture and Industrial Biotechnology.



Biotechnology Industry Research Assistance Council (BIRAC) along with Department of Biotechnology (DBT) is mandated to implement and deliver the objectives of **Make in India**



Startup India

To further strengthen and empower the emerging biotech startup ecosystem, DBT along with BIRAC has drafted a detailed action plan with a mandate of promoting and nurturing the innovation research ecosystem in the country with special focus on startups and SMEs.

Main Features of the Action Plan:
To scale up the number of Startups in the challenging Biotech sector to around 2,000 Startups by 2020.

Setting up of
35
state-of-art
Bioincubators

1st
International Incubator
- Clean Energy
International Incubator
has been set up under
Mission Innovation by
DBT & BIRAC

Support to
4
Bioculsters (NCR,
Kalyani, Bangalore
and Pune)

**AcE Fund &
SEED Fund**
to provide capital
assistance to start-ups and
act as a bridge between
promoters' investment and
venture/angel investors

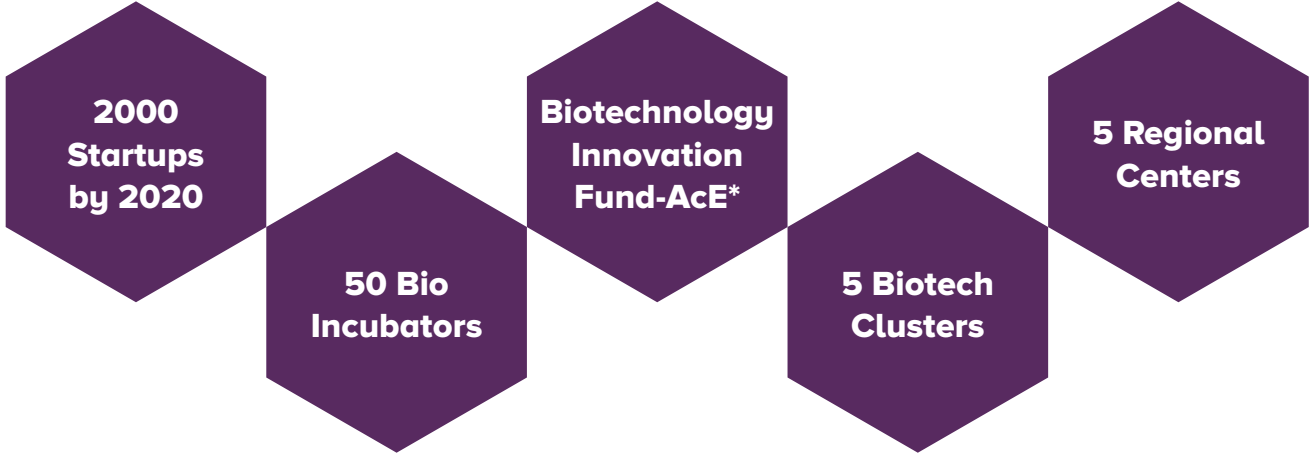
Simplification and
Handholding

Funding Support
and Incentives

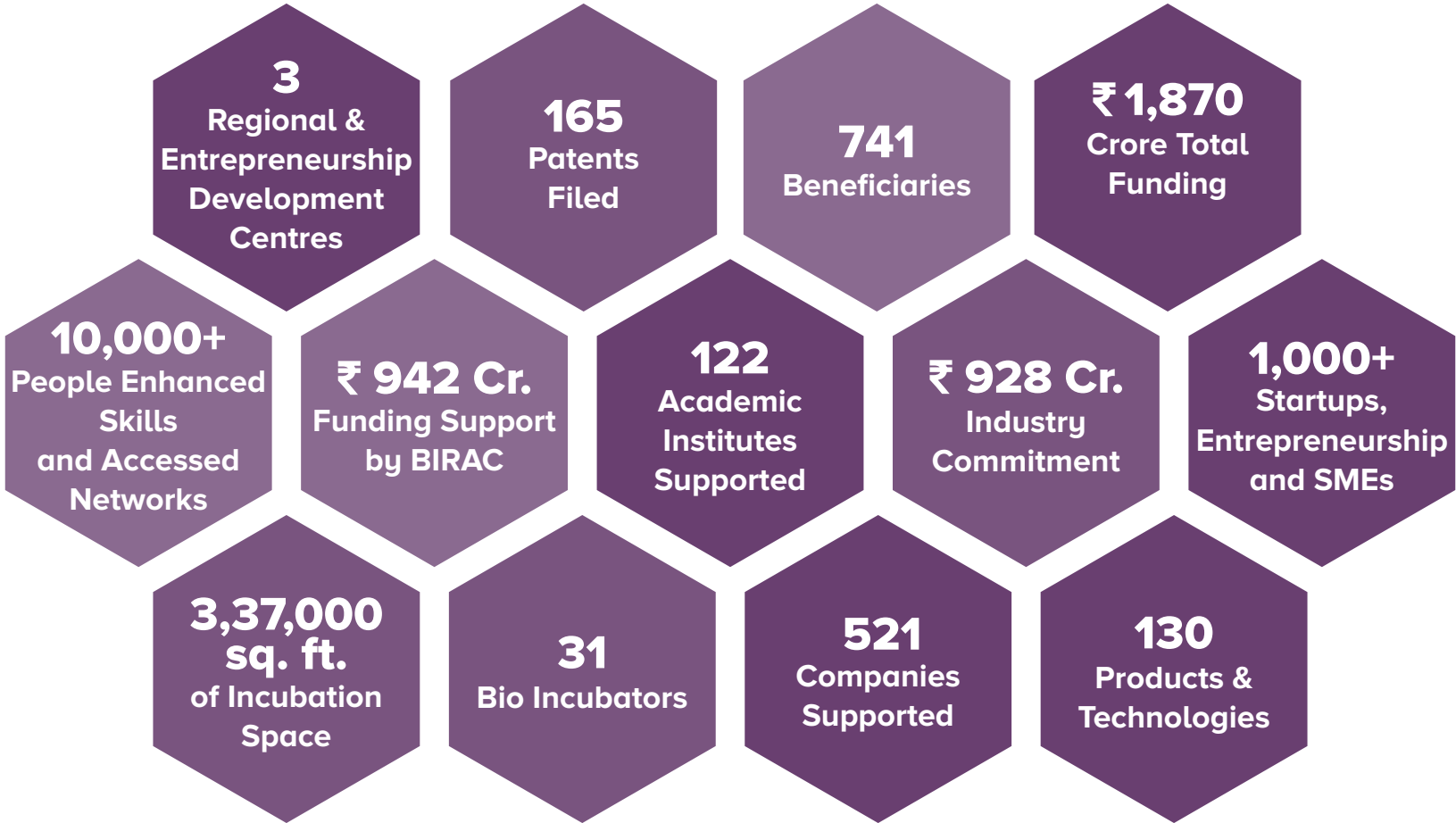
Industry-Academia
Partnership and
Incubation



Action Plan for Biotechnology 2016-2020



Since its inception BIRAC has created an ecosystem which supports affordable product development by empowering and enabling Indian biotech companies. Through its various funding schemes, BIRAC has been able to create the following impact:



BIRAC 7th Innovators Meet was held in September 2018 with the theme ‘Vigyan Se Vikas’. The conclave witnessed confluence of 300 scientists, entrepreneurs, academicians and industry experts.



◆ Biotech Science Clusters

An Advanced Technology Platform Centre (ATPC) that would act as a catalyst for multidisciplinary basic and translational research

Establishment of SyMeC – an intellectual and logistical platform for generating required biological and medical evidence to accelerate systems medicine

Establishment of a national structural biology facility with electron cryo-microscope and other instruments

Recognising the need for creating an enabling ecosystem for connecting university and academic researchers, national laboratories, incubators, technology management units, Industry SMEs, start-ups and entrepreneurs, the concept of setting-up of Bioclusters across the country was developed and approved in the National Biotechnology Development Strategy. Four bioclusters have been established at Faridabad, Bangalore, Kalyani and Pune.



An incubator facility that will facilitate prototype-to-product conversion for devices and implants

◆ **Biotechnology Parks and Incubators**

DBT has established Biotechnology Parks and Incubators across the country to translate research into products and services by providing necessary infrastructural support. Biotechnology Parks offer facilities to scientists, and SMEs for technology incubation, technology demonstration and pilot plant studies for accelerated commercial development of promising technologies.



TICEL Biotech Park, Chennai, Tamil Nadu



9

Biotech Parks Established

Biotech Park, Lucknow, Uttar Pradesh

Biotechnology Incubation Centre,
Hyderabad, Telangana

Tidco Centre For Life Sciences (TICEL)
Biotech Park, Chennai, Tamil Nadu

The Golden Jubilee Biotech Park For Women, Chennai, Tamil Nadu

Biotech Park Technology Incubation Centre, Guwahati, Assam

Biotechnology Incubation Centre,
Cochin, Kerala

Biotechnology Park, Bangalore,
Karnataka

Industrial Biotechnology Parks (IBTPs),
Jammu & Kashmir

Chhattisgarh Biotech Park

◆ Bio-NEST Scheme

The Bio-NEST Scheme provides incubation space to start-ups and entrepreneurs while connecting industry and academia and enabling interactions for efficient exchange of knowledge.



Bio-NEST facilitates technical and business mentorship while providing services for IP and technology management, legal and contract, resource mobilization and networking platform by establishing an efficient governance platform. So far, 35 bioincubators have been supported under the Scheme

Healthcare Technology Innovation Centre (HTIC) of IIT Madras

Healthcare Technology Innovation Centre (HTIC) at IIT Madras is an R&D centre established through a joint initiative of DBT and IIT Madras.

HTIC in collaboration with engineers, researchers and clinicians are developing technologies in areas of cardiovascular, ultrasound, neonatal, oncology, intensive care, ophthalmology, diagnostics, etc.

Mobile Eye Surgical Unit



12,000 Surgeries
 90 Camps
 2 Units in field

Mobile Eye Surgical Unit



70,000 Screenings
 70 Devices
 6 Countries

3nethra - Forus



2.5 Million Screenings
 2500 Devices
 26 Countries

iQuant® - J Mitra



350 Instruments manufactured
 5000 Targeted labs (10 million tests/yr)

With 22 companies incubated, HTIC has become an integrated medtech center with R&D, technology development commercialisation and incubation

◆ SIB Programme

School of International Biodesign (SIB) is a DBT funded biomedical technology innovation programme initiated as Stanford India Biodesign Programme in 2008 with the aim to train next generation of medical technology innovators in the country. This programme is centered at All India Institute of Medical Sciences (AIIMS) and Indian Institute of Technology, Delhi (IIT-D) and was implemented in collaboration with the Stanford University, USA and partnership with Indo-US S&T Forum from 2008 to 2015. The focus is on invention/innovation and early stage development of frugal medical device technologies as per the unmet needs of the country.



SIB is an indigenous programme running in collaboration with international partners viz. Queensland University of Technology (QUT), Australia, Hiroshima University and Totorri University, Japan



100
Fellows and
Interns

21
Products/technologies
transferred to established
medical device companies

11
Start-ups
supported

47
Technologies
developed

4
International
collaborations

5
Products
launched

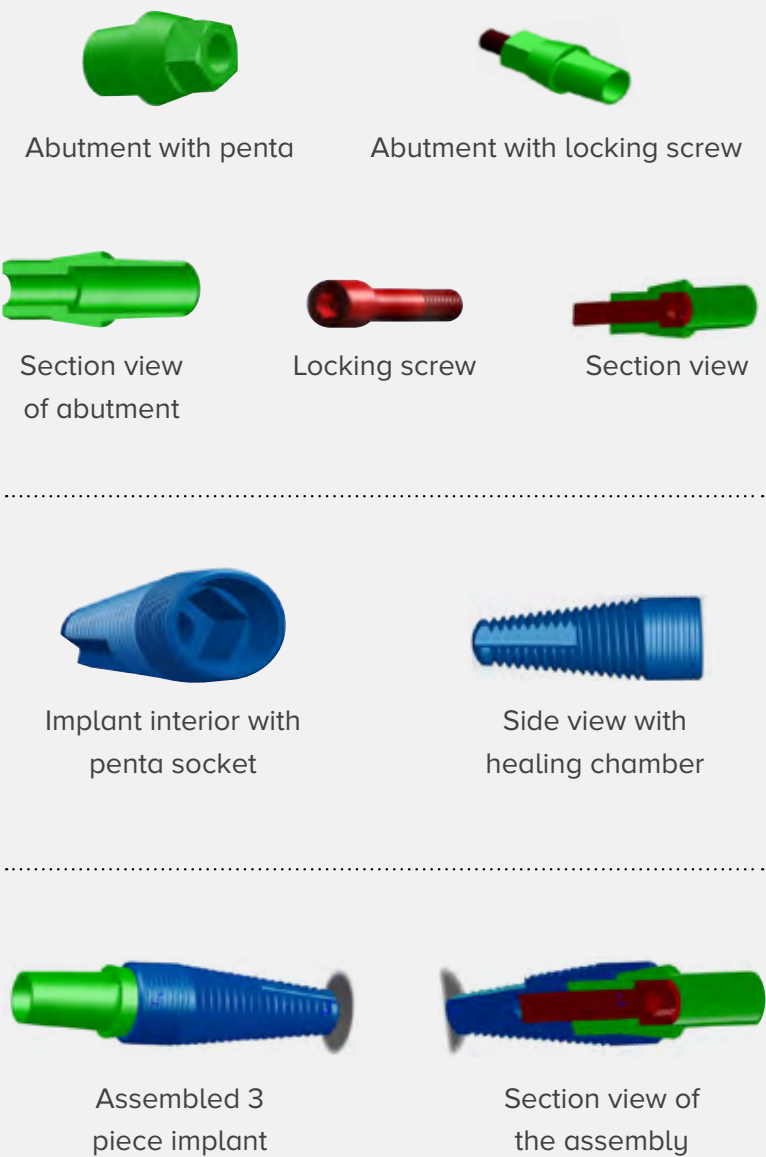
Translational Centre of Excellence

Biomaterials for
 Orthopedic and
 Dental Applications
 supported at Indian
 Institute of Science,
 Bangalore

A new generation of polymer-
 ceramic hybrid acetabular socket
 of different sizes (40,44,46 mm) has
 been fabricated.

CAD based 3D models of a
 complete 3 piece-dental implant
 system has been developed.

3D models of a complete 3 piece-dental implant system



National Cryo EM Facility

National CryoEM Facility was
 operationalised in Institute for
 Stem Cell Science & Regenerative
 Medicine (InStem), Bangalore. The
 facility is equipped with a 300 kV
 Transmission Electron Microscope
 (TEM) that is capable of high-
 resolution structure determination
 of macromolecules in solution
 as well as in-situ in cells by
 tomography.

◆ **Scientific Infrastructure
Access for Harnessing
Academia University
Research Joint
Collaboration (SAHAJ)**



The Department of Biotechnology announced Access of its Research Resources and Facilities supported across the country, by way of Scientific Infrastructure Access for Harnessing Academia University Research Joint Collaboration (SAHAJ).



Each DBT Autonomous Institute and DBT supported Infrastructure programme will make available its high end equipments and infrastructure to Research Institutes, Universities, colleges and start-ups / entrepreneurs.

For Students/ researcher who do not have any government or other funding /fellowship or research grant, a special infrastructure Access Grant capped at Rs10.0Lakh/ year will be made available to the host institute to allow these students/ researchers to access the infrastructure on competitive basis.

The National Liver Disease Biobank (NLDB)

The National Liver Disease Biobank (NLDB), the first liver disease biobank in India, a DBT-supported facility established at ILBS, New Delhi in 2017, to accelerate translational research in the field of acute and chronic liver and biliary diseases, gallbladder and various hepato-biliary tumours. NLDB has developed their in-house Biobank Information Management System (BIMS) for management of biosamples.

It is a nodal centre for provide researchers and industries with high quality biosamples and patient data with follow-up in order to facilitate high quality research in the field of liver disease, genetics, biomarker research, molecular diagnostics, drug discovery, and new therapeutics.



14,153
 biosamples collected,
 processes and stored

9
 collaborative
 projects

10,719
 patients contributed
 to biosamples

6
 publications

4
 storage services

1,444
 analytical tests

18
 people trained on BIMS Software,
 Automated Immunostainer, Histopathology,
 Molecular Laboratory and cell sorting

◆ Biorepository at Translational Health Science and Technology Institute

The biorepository is currently storing 6,00,000 biospecimens from this cohort that are processed using a set of customized Standard Operating Protocols (SOPs) and validated lab processes.



The Translational Health Science and Technology Institute (THSTI) have established a biorepository in 2015 under a DBT funded cohort study entitled Garbh-Ini, (Interdisciplinary Group for Advanced Research On Birth Outcomes – DBT India Initiative).

The biospecimen include maternal serum, blood, plasma, DNA, blood as PAX gene tubes, saliva, urine, high vaginal swabs, feces, cord blood, umbilical cord tissue, placental tissue punches, placental membranes, paternal saliva and neonatal heel prick venous blood that are being collected across pregnancy, at delivery and post- delivery.

◆ Advanced Technology Platforms Centre (ATPC)



The Advanced Technology Platforms Centre (ATPC) has been set up at RCB with an aim to provide access to cutting-edge technologies to researchers within the wider area of the NCR.

ATPC includes the following facilities:

- Electron Microscopy Platform including Cryo-TEM, SEM, Cryo Ultra-Microtome,
- Protein Expression and Purification Facility,
- Flow Cytometry Platform,
- Optical Microscopy Facility with Super-Resolution Microscopy Platform,
- Mass Spectrometry Platform with ESI MS/MS,
- Molecular Interactions Facility including label-free platform technologies to probe macromolecular interactions,
- Genetics and Genomics Facility with quantitative gene expression platforms, DNA Sequencer and accessories.

Make in India

Make in India (MII) is a flagship program of Government of India which was launched on September 25, 2014. MII has introduced multiple new initiatives, promoting foreign direct investments, implementing intellectual property rights and developing the manufacturing sector. Biotechnology Industry Research Assistance Council (BIRAC) along with Department of Biotechnology (DBT) is mandated to implement and deliver the objectives of 'Make in India'. The Make in India Cell ensures wider dissemination of the Government programmes and other information relevant to the establishment and growth of startups, SMEs and Companies



BIRAC support to start ups entrepreneurs and SMEs has resulted in development and commercialisation of several affordable products which is in line with the Governments focus on Make in India

◆ FIRST HUB

FIRST (Facilitation of Innovation and Regulations for Start-ups and Innovators) HUB was created at BIRAC to consider the queries of Start-ups, Entrepreneurs, Researchers, Academicians, Incubation Centres, SMEs etc.

The FIRST HUB has representation from DBT, CDSCO, ICMR, BIS, NIB and BIRAC along with KIHT

Kalam Institute of Health Technology ◆

Kalam Institute of Health Technology has been supported by DBT to facilitate research for developing healthcare technologies in partnership with BIRAC.

Biotech FIRST HUB
Facilitation of Innovation & Regulation for Start-ups and Innovators

DBT, BIRAC, ICMR, CDSCO representatives will be available for taking queries

A facilitation unit, set up by BIRAC, to address the queries of Start-ups, Entrepreneurs, Researchers, Academicians, Incubation Centres, SMEs, etc.

FIRST HUB will be open every first Friday of the month at BIRAC office from 3:00pm-5:00pm

- REGULATORY PATHWAYS & REGULATION
- FUNDING OPPORTUNITIES
- MENTORSHIP
- INVESTMENT OPPORTUNITIES
- MARKET ACCESS
- INDUSTRY ACADEMIC PARTNERSHIPS
- INTELLECTUAL PROPERTY

* Prior appointment is essential as only 5-6 innovator slots are available
 * Details such as Company name, Address, Contact, Technology/Innovation Summary, Stage of Development and Specific Queries can be shared through the online portal at www.birac.nic.in
 * For any further details, please contact Sonia Gandhi, Senior Manager-Investments, BIRAC at sgandhi.birac@nic.in

Promoting Make in India

BIRAC & KIHT, in partnership, will facilitate start-ups, entrepreneurs, researchers, academicians, incubation centres & SMEs in Testing and Standardization of Medical Devices

- Standards that can be tested:
 - Electromagnetic Interference (IEC 60601 Series)
 - Electromagnetic Compatibility (IEC 60601-1-2 Series)
 - Electrical Safety Testing
 - Biocompatibility (ISO 10993)
 - GMP (ISO 13485)
 - Software Testing (IEC 62304)
 - Material Testing (Relevant ASTM Standards)
 - Radiation Protection (IEC 60601-1-3)
- Additional Services:
 - Rapid Prototyping
 - Health Technology Assessment
 - NIPUN Certificate application

Cost will vary depending on parameters, such as:

- Duration of Testing
- Testing Chamber Configurations
- No. of units required to be tested

* Testing charges are subsidized for BIRAC referred start-ups to an extent of 40%-70%
 * For getting reference through BIRAC & availing the subsidized cost e-request may be sent to Sonia Gandhi, Senior Manager-Investments, BIRAC at sgandhi.birac@nic.in

Integrated Human Resource Development Programme

Integrated Human Resource Development Programme is working in multi-disciplinary areas of biotechnology, comprising of Post Graduate Teaching Programme, Star College Programme, Fellowships for different levels, Finishing School, Re-entry Fellowships to reverse brain drain, international fellowships and industrial training for biotechnology students.

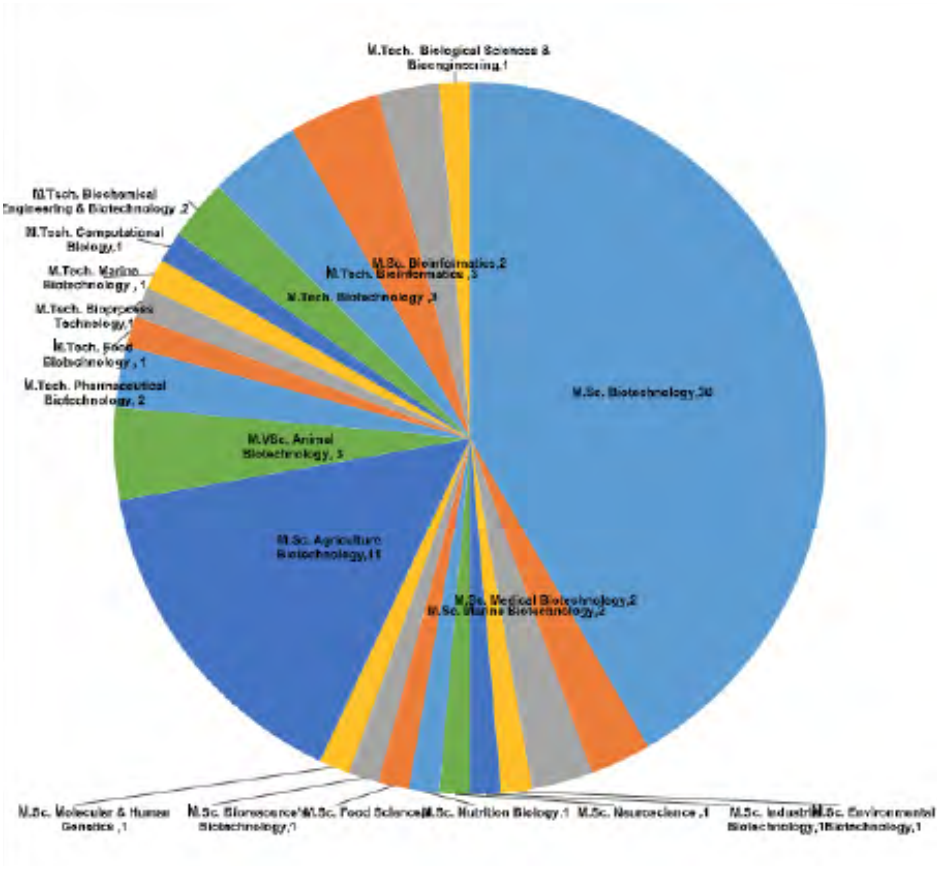


PG Programme and Star College

Postgraduate Teaching Programme was initiated in 1985-86 to ensure high standard of teaching and to generate critical mass of trained manpower in the country.

Implemented on the basis of core faculty strength, expertise, infrastructural facilities, R&D grants received by university on competitive funding basis, nearby institutions engaged in biotechnology R&D. A total of 72 courses are being offered under this Programme.

Star College Scheme was initiated by DBT to support colleges and university departments offering undergraduate education to improve science teaching. This scheme **aims to improve the skills of teachers by organizing faculty training, improved curriculum** and emphasis on practical training to students by providing access to specialized infrastructure and consumables.



72
PG programmes
supported

189
Star colleges
supported

Number of Students
Supported

2,983
DBT BITP Scheme

3,977
DBT JRF Scheme

1,035
DBT RA Scheme

598
Finishing School
Scheme

◆ **Biotechnology
Career Advancement
and Re-orientation
Programme
(Bio-CaRe)**

BioCaRe Scheme was launched to enhance the participation of women scientists in biotechnology research.



The programme is mainly for career development of employed/unemployed women scientists upto the age of 55 years for whom it is the first extramural research grant. **Bio-CaRe has so far supported more than 250 young women scientists under this Scheme**



4

calls have been announced so far since inception of the scheme in 2011

2,129

LOIs/proposals received in initial 3 calls

214

(113 employed and 101 unemployed) **projects/ women scientists supported**

109

selected **applications under process** for release of funds

51.42

crores rupees budget funded so far

1,027

applications received under 4th call through ePROMIS

15

Women Scientists employed after getting BioCARE projects

90

papers published

2

patents filed



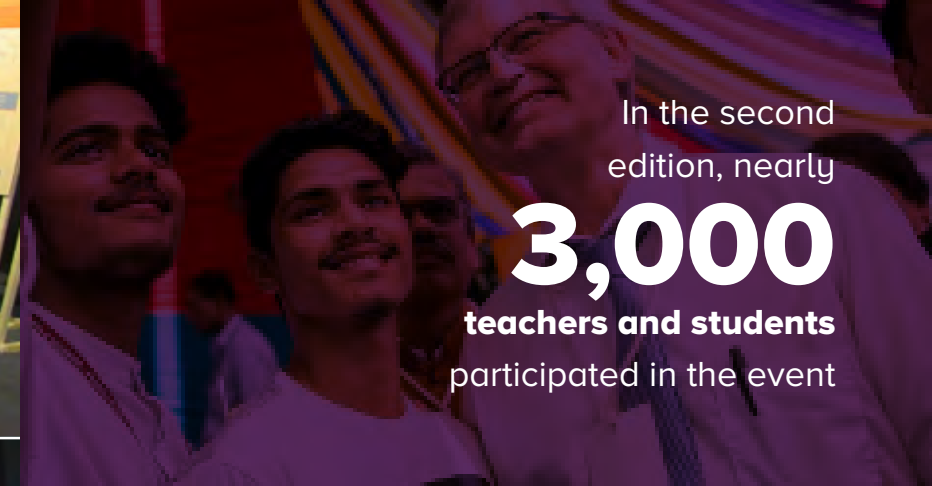
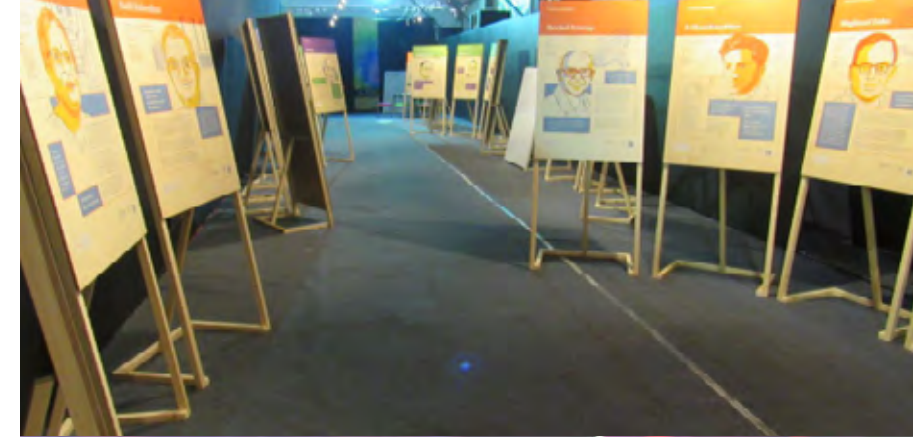
A young Bio-CARe awardee with Sir Tim Hunt - Nobel Laureate for “cell cycle regulation discovery” at Future Leaders Programme of 15th Annual STS-forum meeting held in 2018 at Kyoto, Japan. She has now been invited as a speaker in the 16th Annual STS-forum meeting to be held in 2019.



A young women scientist presented her journey and work supported under Bio-CARe getting felicitated in “Women Scientists and Entrepreneurs” conclave held on 7th and 8th October, 2018 in Lucknow, India.

◆ Nobel Prize Series

Two editions of the Nobel Prize Series were organised by DBT in partnership with the Nobel Foundation in Ahmedabad and Goa in 2017 and 2018 respectively.



In the second edition, nearly

3,000
teachers and students
participated in the event



Nobel Laureates from various fields of science engaged with students, researchers, teachers and the industry through a vibrant dialogue on science and innovation

Wellcome Trust/DBT India Alliance

£160 million partnership

2,600 applications received with an average funding rate of 10%

Fellows at 79 institutions (across 25 cities) in India

The Wellcome Trust/DBT India Alliance, a public charity funded by the Department of Biotechnology, Govt. of India and Wellcome Trust, UK, aims to build a strong biomedical research ecosystem in India.



India Alliance Celebrates 10 Years of Enabling Biomedical Research in India

This initiative nurtures biomedical research in basic, clinical and public health through funding and engagement

◆ Ramalingaswami Re-entry Fellowship

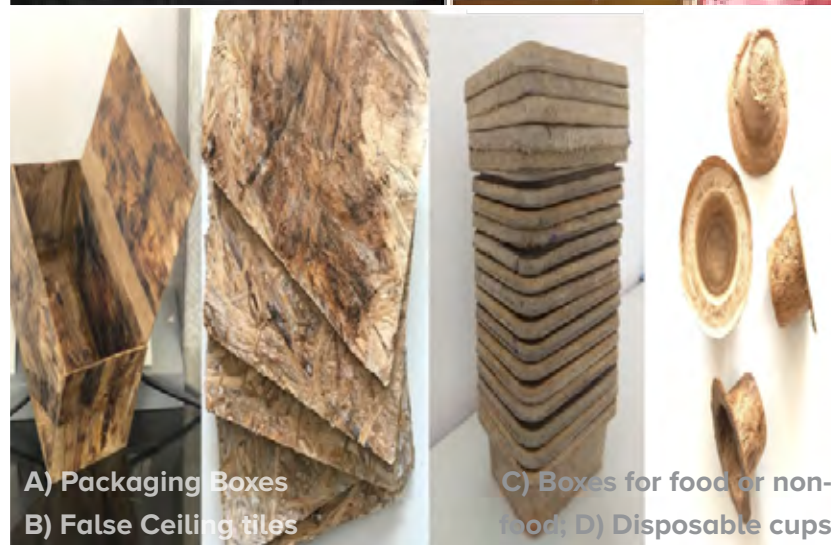
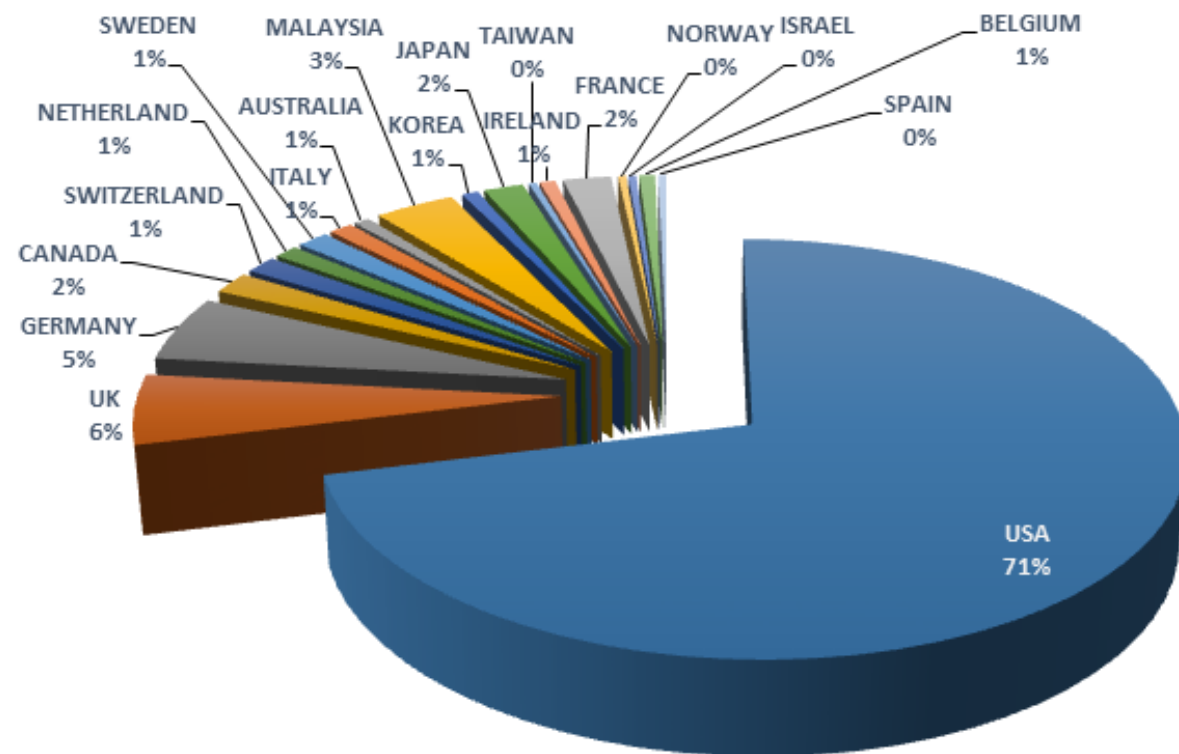
The Fellowship Scheme was conceived in the year 2006-07 with the idea of encouraging scientists (Indian Nationals) working outside the country, who would like to return to the home country to pursue their research interests in life sciences, biotechnology, and other related areas.

200 fellows have already been able to seek permanent faculty positions in various host institutes in India. The fellowship over the years has picked up the momentum and resulted in creating a brand value in itself.



In the last 10 years, 1492 applications were received and out of these 396 were offered fellowship and 295 have already taken up positions in Indian laboratories





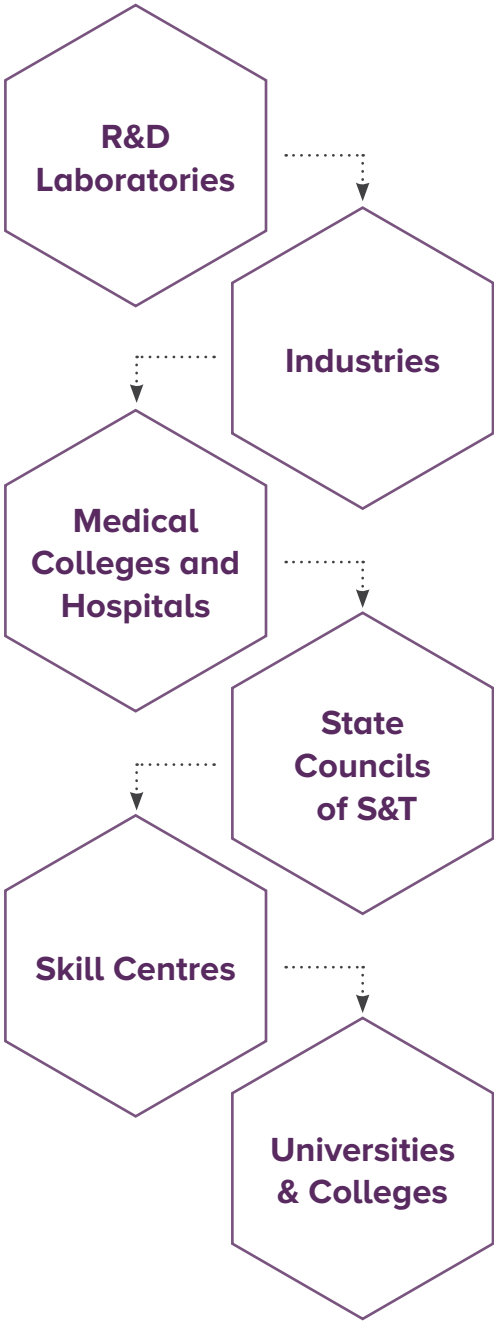
Success stories under the Ramalingaswami Re-entry Fellowship

- Technology developed for pesticide detection in food and produce by mass spectrophotometry. Field tested on 20 acre land. This technology enables to analyze 500-1000 samples per day compared to currently used imported technology (50 samples per day).
- This technology/IP has been sub-licensed for commercialization to a spin off company - Barefeet Analytics Pvt. Ltd.
- Methodology developed for prognosis of diabetes using mass spectrometry. This will help in monitoring diabetic progression. Currently demonstrated on 70 patients.
- Hydrogel based drug delivery system developed to prevent organ rejection (animal model trials done in both small (rats) and large animals (pigs). Clinical trials underway.
- Devised a non-invasive method for cancer detection using (PIMNP). Preclinical validation currently in progress.
- Assembled a unique single molecule based super resolution platform for nanoscale imaging (first one in India).
- A method for production of fragrant compounds by fermentation from resinous chips of *Aquilaria malaccensis* developed. Further, scale up for commercialization is underway.
- Enhanced expression of anti-malarial drug artemisinin using tobacco plants as bio-factories. The concept has been validated & proven effective with whole plant material as compared to pure artemisinin.
- Completely bio-degradable packaging boxes (food and non-food) have been developed using agricultural wastes.
- Partition boards and false ceilings from rice straw and sugarcane bagasse; disposable and low cost cups and containers for food applications; biodegradable diapers and sorbent materials from agricultural wastes have been developed.

◆ Skill Vigyan Programme

The aim of the Skill Vigyan Programme is to provide high quality hands on training in tools and techniques in multidisciplinary areas of biotechnology for entry level students (10+2 and Graduates in Biotechnology) in partnership with State Councils of Science & Technology. Hub and spoke model has been adapted for the implementation of Skill Vigyan Programme.

Training component includes Students Training Programme, Technician Training Programme, Faculty Training Programme and Entrepreneurship Training Programme.



15

new skill development
courses for Post Graduate
Certificate/Diploma

539

Students underwent
training

Biotechnology Finishing School Programme

Established jointly with
Department of IT, BT and S&T
Government of Karnataka
with an objective to provide
high quality hands on training
in tools and techniques in
Medical Biotechnology,
Agricultural Biotechnology
and Computational Biology.

◆ **Foldscope, Microscopy
for all**

DBT in partnership with Foldscope
Instruments Inc. and Prakash Lab (Stanford)
trained school students, teachers, scientists
& citizen-scientists from across India to
support the use of Foldscope in order to
popularize science.



approx.
38,000
Students Trained

approx.
2,800
Trainers Created

approx.
800
Trainers Created

439
Colleges under
Foldscope Project

114
Schools under
Foldscope Project

◆ India International Science Festival (IISF)

DBT in association with Department of Science & Technology and Ministry of Earth Sciences organized 4th India International Science Festival from 5th to 8th October, 2018 at Lucknow, Uttar Pradesh. The 4th India International Science Festival 2018 was inaugurated by the Hon'ble President of India, Shri Ram Nath Kovind, at a function held at Indira Gandhi Pratishthan, Lucknow.



21,425+
Participants

including delegates,
students, researchers
and scientists

1,130
farmers

participated

Global Indian Science & Technology Stakeholder (GIST), Industry Academia Meet, National Social Organization & Institutions Meet (NSOIM), National Science Teachers' Congress (NSTC), North East Students Conclave (NESC), Women Scientist Entrepreneur Conclave, Students Science Village, International Science Film & Literature Festival, Green Good Deeds, Agriculture Conclave, etc. were some of the major highlights of the IISF 2018



Students' Science Village

The prime goal of science village is to give exposure to the students from rural India and make them aware of India's achievements in frontier areas of Science & Technology. The programme made attempts to reach out and propagate science to the greater extent seeking innovative and scientific solutions to the diverse challenges faced by Indian society, particularly rural India.



Guinness World Records for

Creating world's largest First Aid lesson

&

Highest number of people conducting a DNA isolation experiment simultaneously from bananas



पूर्वोत्तर राज्य योजनाएं



Northeast Region Initiatives



Rich bioresources spread across **Northeast Region's (NER) diverse ecosystems** nurtured by indigenous communities, provide ample opportunities for **furthering economic development** of the region. To facilitate this, DBT has proactively launched **several region-specific programmes** through the intervention of biotechnology in the region

Twinning R&D Programme



The Twinning R&D programme for NER was initiated in 2010-2011 towards developing core competence and core capacity in different areas of biotechnology. viz. health science, agricultural science, veterinary science, pharmaceutical science, biomedical engineering, bioinformatics, food and nutrition, biotechnology.

670
Twinning programmes
supported in 70 Institutes
across 8 States of NER

250
Research papers
published in peer
reviewed journals

2,000
Young researchers/students
of NER received training in
cutting-edge technologies

The Twinning Programme has made a huge impact by catalysing vibrant collaborations, evolving NER-specific projects and their implementation across all eight states of the region



Units of Excellence in NER

With a view to recognize promising mid-career scientists in NER, a programme of awarding Unit of Excellence grant to them has been initiated so as to enable them to pursue their innovative research in frontier areas of biotechnology.



34

outstanding **scientists from the NER** have been supported to pursue innovative projects

3

Patents filed

45

research articles published in peer reviewed journals

In-situ forming silk hydrogel for **treating third degree burn** wounds

In-situ Bioresponsive Silk Hydrogels for **Spinal Disc Degeneration Therapy**

Antioxidant rich black rice beverage

Therapeutically **important drug molecule** from Indian snake venom

Agriculture Biotechnology

Centre of Excellence established at
Assam Agriculture University, Jorhat



Daniel J. Rao / Shutterstock.com



3
Drought tolerant
rice lines
developed

15
Biofertilizer
formulations
developed and
10 transferred for
commercialisation

51
Workshops for farmers and
entrepreneurs on use of
biofertilizers and biopesticides
conducted

Scented Rice Programme

Recognising the rich biodiversity of the region, DBT is promoting the development of NER-Scented Rice. The aromatic rice, especially Joha and Black rice, are of premium value because of their aroma and high medicinal characteristics.



12 NER
Institutional
Partners

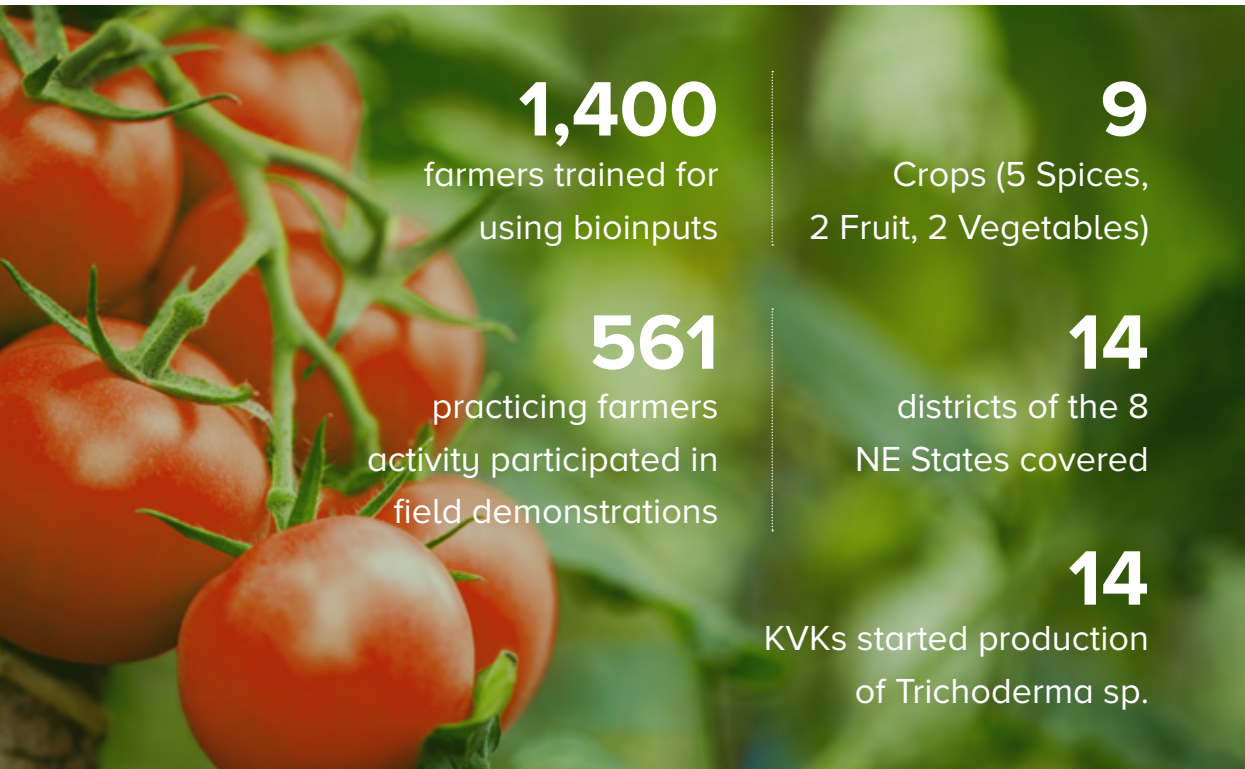
106 aromatic
rice germplasms
collected

Rice bran oil from
scented rice (Joha)
variety are rich in
Omega 6 and Omega 3
fatty acids

Eco-Friendly Farming Using Bio-inputs

This programme has emphasized upon the application of bio-inputs (biopesticides, biofertilizers) for organic farming of key high value crops (HVCs) of NER, mass multiplication of required bio-inputs and evaluation of their efficacy.

Implemented by ICAR-RC, Umiam, Meghalaya,
14 KVKs and IBSD, Imphal, Manipur



1,400
farmers trained for
using bioinputs

561
practicing farmers
activity participated in
field demonstrations

9
Crops (5 Spices,
2 Fruit, 2 Vegetables)

14
districts of the 8
NE States covered

14
KVKs started production
of Trichoderma sp.

Value Addition & Commercialization of Jackfruit



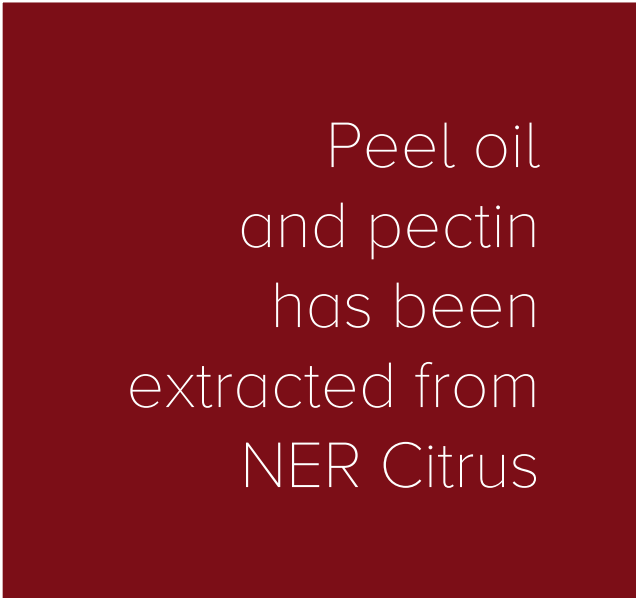
107
local Jackfruit genotypes
for table purpose

43
local genotypes for
vegetable purpose identified

Jackfruit for multiplication of elite planting materials has been standardised. Ready to cook (RTC) tender jackfruit for vegetable purpose has been developed.



Value Addition from Citrus of NER



Peel oil
and pectin
has been
extracted from
NER Citrus

Value chain development in Citrus programme aims at using modern technologies for mass production of citrus plants and value-added citrus products. Lemons of interest are Assam lemon, kachai lemon, mandarin and sweet orange.

Bioresource and Environmental Biotechnology



Centre of Excellence on Bioresources and Sustainable development is being established in Arunachal Pradesh. Aims to document the state's abundant biodiversity and bio resource.

Setting up of fruit processing units, banana fibre extraction & processing unit, mushroom propagation units, vermin-composting units, units for Orchid and Medicinal & Aromatic plants cultivation.

Chemical Ecology of the North East Region (NER) of India

Laibakcin, isolated from the *Artemisia vulgaris* has shown toxicity against stored grain pests.

Promising botanical extract for controlling insect vectors (*Aedes aegypti*) from *Artemisia* spp has been isolated.



A two day hands-on training organized on Chemical Ecology for the college students of Nagaland on sample collection, DNA isolation and PCR techniques.

Animal and Aquaculture Biotechnology



Phase-I of Centre of Fisheries at Tripura



Technology for aquaponic on-farm production of protein-rich wolffia and its utilization as feed ingredient has been developed. Societal outreach of the technologies/packages developed are being taken up in the Phase-II programme supported this year.

300 fish species inventorized and DNA bar coding completed for **144** species breeding protocols have been standardized for food fishes including Pengba, Pabda and Reba

Advanced Animal Diagnostic and Management Consortium (ADMαC)

A major network programme being implemented with 3 NER Institutes, 4 National Institutes and 8 State Veterinary and Animal Husbandry Departments.

Disease maps of important diseases have been developed based on which real-time in-situ disease outbreaks can now be depicted in NER.

Important isolates including new pathogens (about 4500), have been deposited in national and regional repository at AAU-Khanapara.



Experimental production has been initiated for cell line adopted swine fever vaccine and duck plague vaccines.

Confirmatory field diagnostic tests have been developed for several diseases like Swine Fever, Duck Plague, Circo virus, goat pox, PRRS, etc.

Project has resulted in 32 publications and 2 patents so far.

Sophisticated biotech infrastructural facilities have been created at National Research Centre on Mithun at Jharnapani, Medziphema (Nagaland) and National Research Centre on Yak at Dirang (Arunachal Pradesh).

Mandate is to strengthen research dynamics for desirable gains in Mithun husbandry, Yak husbandry, improving research activities on genomics and conservation.

Medical Biotechnology

DBT initiated a program on Development of Molecular Diagnostic Laboratories in 11 Medical Colleges of NER.



The program is now operational in all 11 medical colleges/ institutions in four states of the Region, namely Assam, Nagaland, Tripura & Manipur



Crucial support was provided for establishment of sophisticated infrastructure for improved diagnostic services in pathology, hematology and genetics departments at the North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS), Shillong (Meghalaya)

Demonstration and Scale-up Programmes for Societal Upliftment in NER

A Technology Business Incubation Centre was established at the campus of the Institute of Bioresources and Sustainable Development (IBSD), an autonomous Institute under Department of Biotechnology in Imphal, Manipur.



This initiative will help unemployed youth and farmers of the North-East region to survive and grow their businesses through the early stages of development and also would nurture new and small biotechnology-based enterprises



Mushroom Incubator set up at Bodoland University, in Kokrajhar, a remote region in Assam

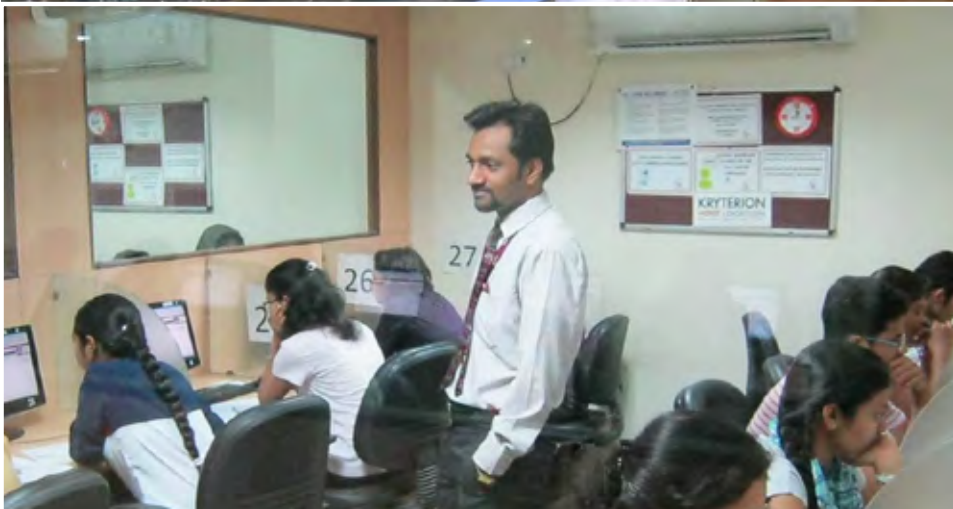
11 entrepreneurs supported for setting up of **24 new mushroom** Unit at Bodoland region of Assam

650 families have benefitted

Production of mushroom in Bodoland and adjoining areas has been enhanced by **20 to 25 tonnes** annually

Establishment of Biotech Hubs

The programme aims at providing necessary infrastructure in universities and institutions as well as to impart necessary training in sophisticated technologies so as to support and promote biotech education and research.



126
active Bio-
tech Hubs–6
State-Level and
120 Institutional
level–spread
across all eight
states of NER

300
training
programmes
conducted

250+
research
papers
published in
peer reviewed
journals

300+
PG and PhD
students
supported

Exceptional growth in the field of biotechnology makes it imperative to create school-level awareness and to provide access to a well-equipped laboratory

Overseas Associateship Scheme for NER Scientists



205

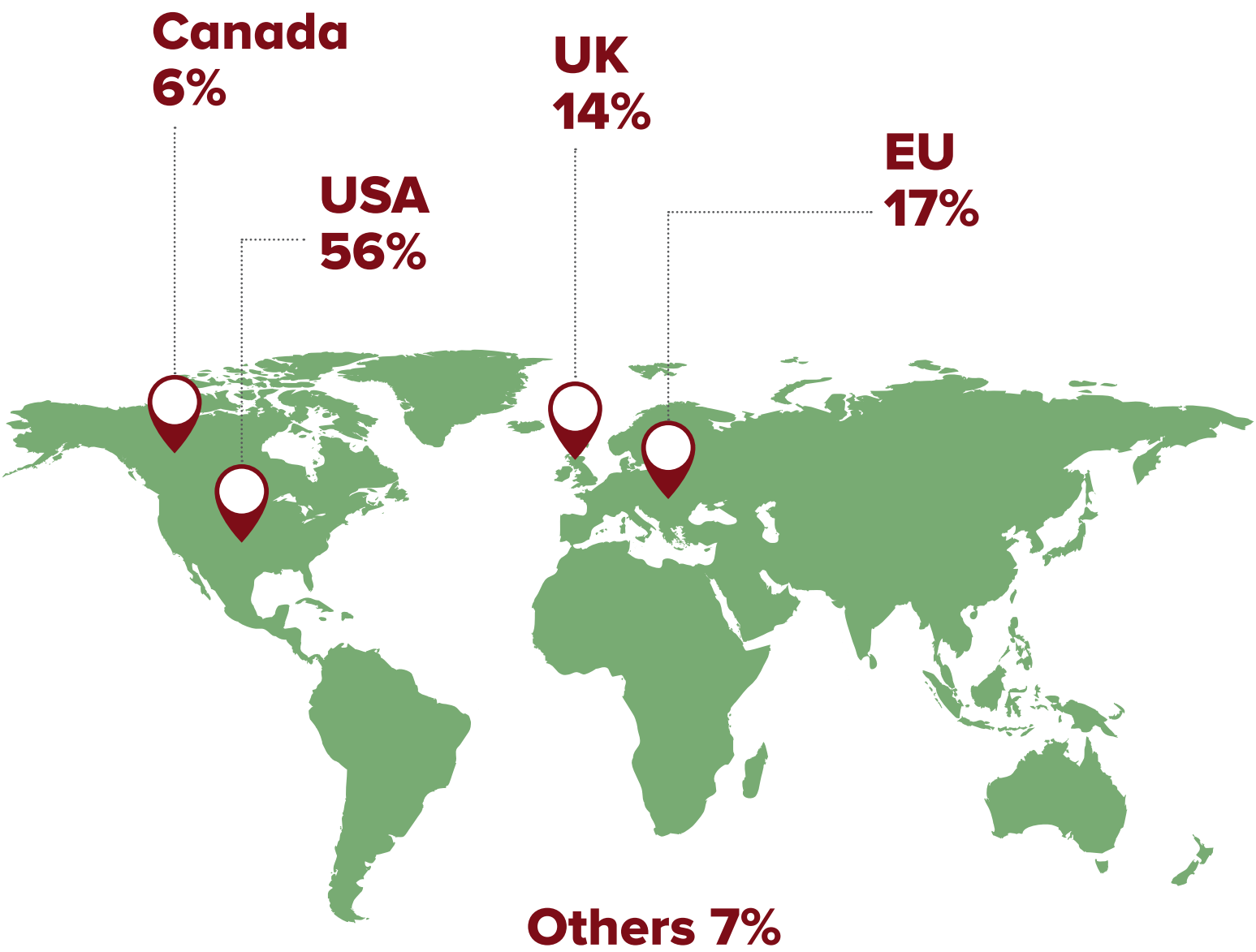
scientists have been awarded associateship in many reputed overseas institutions

60

scholars awarded PhDs

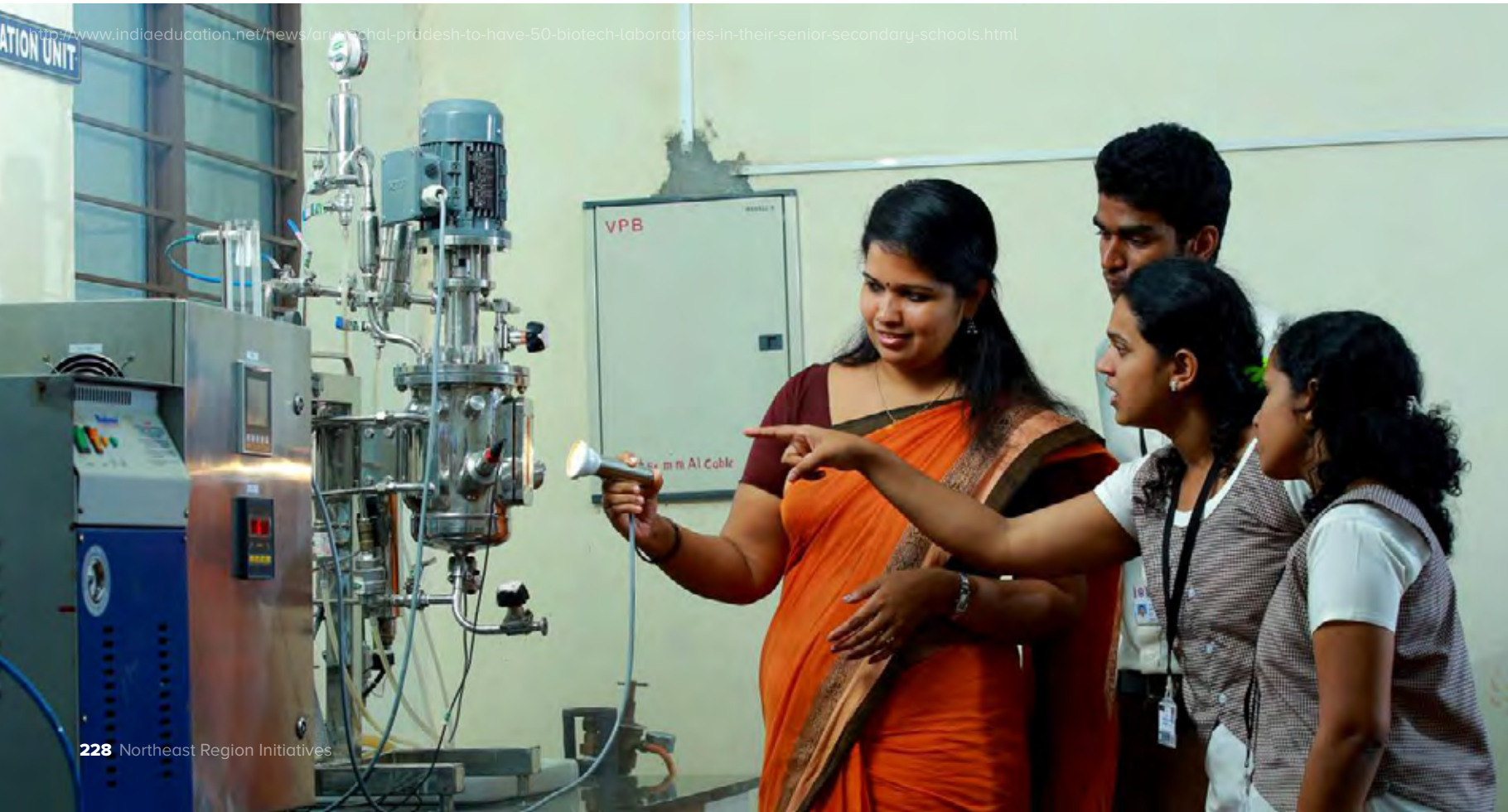
63

Research associates/scholars trained by the programme got placements as faculty/scientists



Percentage Distribution of NER Scientists Trained at Major Overseas Institutions

Biotechnology Labs in Senior Secondary School (BLISS) of NER



88

schools' practical teaching experience strengthened under BLISS programme

16

BLISS schools are in 6 aspirational districts identified by Government in NER

40

BLISS teachers from NER BLISS schools were trained in New Delhi in August 2018 with exposure to the laboratories of national institutions

Our Motto:

विज्ञान से विकास

Science Impacting Society



DEPARTMENT OF BIOTECHNOLOGY
Ministry of Science & Technology

सत्यमेव जयते