



# Year End Review 2017, Ministry of Science & Technology

## Department of Bio-technology

Posted On: 22 DEC 2017 5:23PM by PIB Delhi

The **Department of Biotechnology (DBT)** is a department, under the Ministry of Science and Technology responsible for administrating development and commercialisation in the field of modern biology and biotechnology in India. It was set up in 1986.

The Mission and Vision of the Department is **“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 poor”**

Through several research and development projects, demonstrations, grants and creation of infrastructural facilities a clear visible impact of this field has been seen. The department has made significant achievements in the growth and application of biotechnology in the broad areas of agriculture, health care, animal sciences, environment, and industry. The proven technologies at the laboratory level have been scaled up and demonstrated in field.

Patenting of innovations, technology transfer to industries and close interaction with them have given a new direction to biotechnology research in India. Initiatives have been taken to promote transgenic research in plants with emphasis on pest and disease resistance, nutritional quality, silk-worm genome analysis etc.

On the other hand, molecular biology of human genetic disorders, brain research, plant genome research, development, validation and commercialisation of diagnostic kits and vaccines for communicable diseases, food biotechnology, biodiversity conservation and bioprospecting, setting up of micro propagation parks and biotechnology based development for SC/ST, rural areas, women and for different States.

### ***Major initiatives and achievements of the Department of Biotechnology (DBT) during 2017***

For the Department of Biotechnology, the year 2017 has been marked by path breaking research and cutting-edge technology in myriad of areas. The key areas span across healthcare, agriculture, food and nutrition, bio energy, and environment, which have reached people translating into benefits for them. The Department has also scored high in supporting innovations, start-ups and entrepreneurs, and in collaborating to pool international expertise to escalate science excellence. At the same time, it has worked relentlessly to nurture human resource excellence in biotechnology in several ways.

A summary of the achievements in across different areas are presented below.

### **Healthcare**

#### **National Biopharma Mission Launched**



In a bid to create a globally competitive biopharmaceutical industry that addresses the country's major concerns around barriers to affordable healthcare, Hon'ble Minister Dr. Harsh Vardhan, Union Minister of Science & Technology, launched the Innovate in India (I3) program on 30th June 2017, in New Delhi. The programme of DBT, with a funding to the tune of US\$ 250 million, is a first of its kind mission that brings together industry and academia to promote entrepreneurship and indigenous manufacturing in the bio-pharmaceutical sector. This flagship program of the Government of India, in collaboration with the World Bank, will be implemented by the Biotechnology Industry Research Assistance Council (BIRAC), a Public-Sector Enterprise set up by DBT.

### **India is now a leader in vaccine manufacture & development with several advancements**

## Dengue Vaccine

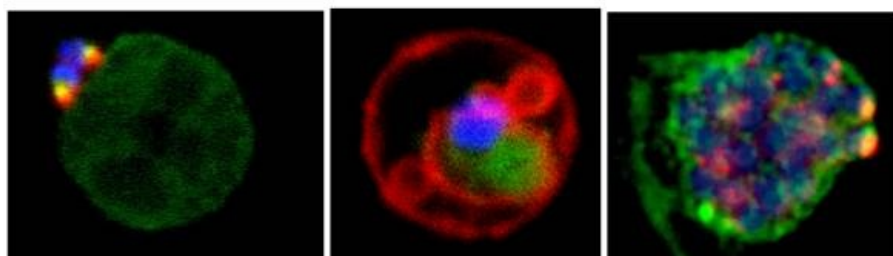
The International Centre for Genetic Engineering and Biotechnology (ICGEB) is collaborating with the drug major Sun Pharma to use the recombinant EDIII-based sub-unit dengue vaccine candidate, to develop an injectable vaccine that protects against all four dengue strains endemic to India.



## Malaria Vaccine

Vaccine for malaria caused by *Plasmodium falciparum* is under toxicology assessment (JAIVAC 2) and another vaccine for malaria caused by *Plasmodium vivax* has completed Phase I trial (JAIVAC1).

*Plasmodium falciparum* cysteine proteases at asexual blood stages



Invasion

Trophozoite

Schizont

## Innovative devices to nurture mother & child health

### DBT launched “Sohum” an innovative newborn hearing screening device

The Hon'ble Minister of State, Ministry of Science & Technology and Earth Sciences, Shri Y. S. Chowdary, launched Sohumi - a hearing screening device for the newborns developed by the Stanford India Biodesign (SIB) programme's start-up M/s Sohumi Innovation Labs India Pvt. Ltd. on July 17th, 2017 at Prithvi Bhavan, New Delhi. The event was attended by Prof. K. VijayRaghavan, Secretary DBT, and other dignitaries. It has been one of the key contributions to the 'Make in India' campaign of the Government of India.

### Neonatal Resuscitation Device (Neo Breathe)

The device is a 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.

### Feto-maternal Parameter Monitoring System (Brun)

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



India Bio-design makes new advances

India Bio-design program has developed innovative technologies for day-to-day patient use such as:

- Ostomy management device
- Emergency medical alert device
- Breathable and customized cast for immobilization of the fractured limb
- Fluid extraction device
- Posture support device

## Agriculture, Food and Nutrition

### Agriculture

### Biotech-KISAN scheme announced - Impacting Farmers Lives through Science



A new, farmer-centric programme called 'Biotech-KISAN' was announced that would create a major impact on rural livelihood. The objective of the programme is to demonstrate, scale-up and address issues of local farmers related to water, soil, seed and marketing, with validated technologies. This programme is also expected to create strong a strong interaction platform between scientists and farmers. The programme also includes thematic fellowships in science laboratories located across all the agro-climatic zones.

### **Regulations and guidelines on biosafety of recombinant DNA research & biocontainment, 2017 released**

In view of the recent developments in the field of biotechnology, biosafety & biosecurity, and based on the experience gained during implementing the biosafety frameworks within the country, a new guideline on 'Regulations and guidelines on biosafety of recombinant DNA research and biocontainment, 2017' has been prepared by the Review Committee on Genetic Manipulation (RCGM), Department of Biotechnology, New Delhi.

The regulations were released by Prof. K VijayRaghavan, Secretary, DBT, on 5th December 2017, during a meeting of states parties of the Biological Weapons Convention (BWC) at Geneva, Switzerland.

The guidelines have been prepared after incorporating views from researchers, experts, academicians, concerned Ministries/Departments and other stakeholders. The document specifies practices for handling hazardous biological material, recombinant nucleic acid molecules and cells, and organisms and viruses containing such molecules, in order to ensure an optimal protection of public health and of the environment.

### **New programme for brucella-free villages**

Launch of "Brucella Free Villages" was announced for implementation on a pilot scale in 50 villages covering 10 states. Brucellosis is a zoonotic disease, seen in animals, and causes economic losses of about ₹ 28,000 crores per year. Three new Brucella diagnostic kits were launched as a part of this programme.



### **Food and Nutrition**

Under the food and nutritional sciences programme the Department of Biotechnology (DBT) is fostering translational research and is developing novel products and processes and to generate new knowledge, which can be utilised by the industry. Some of the notable achievements this year are highlighted below.

### **DBT supports food formulations for Severe Acute Malnutrition in children**

The Ready to Use Food (RUTF) supplement with brand name BIB POSHAN, was developed with financial support from DBT.

RUTF is equivalent to the F-100 formula (milk-based) used at hospitals across India, but is instead made as a paste that can be safely given to a child to take home. It is not a supplementary food or a method to prevent malnutrition, but is a treatment for a fixed amount of time to get a child back on its normal growth pattern and prevent death.

The product is made from 100% local ingredients such as soybean oil, sugar, milk powder and peanuts and is dense in calories (550 Kcal / 100 g), high in proteins, vitamins and minerals. Since it is in the form of a paste, it is simple to deliver and administer, easy to use, fast acting, affordable and inexpensive. It also does not require a trained staff to administer (parents can deliver it to a child), is culturally acceptable, is packed in single-serve packets (each packet contains fixed amount of calories, i.e., 500 calories), requires little preparation before use, has a shelf life of 2 years. It can be stored in varied climatic conditions and temperatures, is resistant to bacterial contamination, and does not cause addiction in the child.



Iron fortification in rice and wheat to address anaemia in school children



Iron deficiency (ID) and iron deficiency anaemia (IDA) are widespread globally. Forty percent of the world's children in their school going years are reported to be anaemic and cereal flour fortification with iron (Fe) is the most cost effective and sustainable way in reducing the prevalence of ID and IDA. In order to address this, Department of Biotechnology has undertaken iron fortification in rice and wheat.

#### Iron fortified wheat flour

Wheat is currently the primary staple food for nearly one-third of the world's population and forms the major cereal food consumed by the people living in Northern India.

Wheat flour fortification with elemental iron is technically challenging, primarily due to poor absorption from elemental iron and the presence of phytic acid. Sodium iron ethylenediaminetetraacetic acid (NaFeEDTA) is a unique fortificant, since it protects Fe from the phytic acid present in foods by binding more strongly to ferric Fe at the pH of the gastric juice in the stomach and then exchanging the ferric (Fe) for other metals in the duodenum as the pH rises. It is two-to-four fold more bio-available than ferrous sulphate, particularly in meals with high phytate content, thereby making it ideal for use in wheat flour.

Sensory assessments showed wheat flour fortified with NaFeEDTA was not different in appearance, taste, colour or texture from non-fortified wheat flour, and children consumed all the meals provided over the study period. Over 7 months, the prevalence of ID and IDA in the treatment group significantly decreased from 62% to 21% and 18 % to 9%, respectively. Iron status indicators such as Hb, serum ferritin, transferrin receptor, zinc protoporphyrin and BIS showed significant improvements by the end of the study (all  $P < 0.0001$ ). Testing of urinary zinc over the trial period showed that NaFeEDTA did not affect urinary zinc excretion. As per FSSAI standards, NaFeEDTA, due to its better bioavailability, can be fortified to a lower level than other iron salts in atta, maida or rice to a level of 14-21.25 mg/Kg.

A randomised controlled study (RCT) was carried out by St. John's Medical College, Bangalore to test if NaFeEDTA-fortified whole wheat flour could reduce ID and improve body iron stores (BIS), and iron parameters. Iron deficient (ID) school children (6-12-year-olds,  $n=401$ ) were randomly assigned to either a daily wheat-based lunch meal fortified with 6 mg of iron as NaFeEDTA (as chappatis or dosa), or an otherwise identical unfortified control meal. Haemoglobin (Hb) and iron status were measured at baseline, 3.5 and 7 months.

#### Iron fortification in Rice

In order to address the problem of anaemia DBT has developed appropriate technology on iron fortified rice premix from broken rice kernels. This iron fortified rice premix matches with the normal rice kernel in shape and size, and when mixed with normal rice in the ratio of 1:100 it provides 50 per cent of recommended daily allowance (RDA) of iron to the children. The rice is fortified through a process called extrusion in which dough made of rice flour, vitamin and mineral mix, and water, is passed through an extruder and cut into grain-like structures that resemble rice grains. Clinical studies have substantiated that regular feeding for one-year increases iron store and decreases anaemia, in school going children.

### Bioenergy

#### India's first biomass to ethanol plant & its commercialization



*Biomass to Ethanol plant at Kashipur being inaugurated and photo of the Ethanol producing plant*

The Institute of Chemical Technology (ICT), Mumbai, has developed India's first home grown technology to convert biomass to ethanol with speed and efficiency. The technology, which converts agricultural waste into ethyl alcohol, or bio-ethanol, is superior to other prevalent technologies as the rate of conversion is four times faster than those available in the international market. While the time taken to convert biomass to biofuel is about 4 to 7 days with prevalent technologies, the one developed by the team at DBT-ICT does the same in about 18-20 hours, and produces about 300 litres of ethanol per ton of biomass. The produce can be blended with petrol to be used in vehicles as fuel.

The country's first second-generation (2G) Ethanol plant was inaugurated by the Union Minister for Science and Technology and Earth Sciences, Dr. Harsh Vardhan, at Kashipur in Uttarakhand.

Subsequently, the technology was transferred to Bharat Petroleum Corporation Limited (BPCL) and Hindustan Petroleum Corporation Limited (HPCL) to build commercial scale biomass ethanol plants based on the technology. The plants, one at Bina in MP and another at Bathinda in Punjab, are scheduled to be operational by

2018.

### **Bio-CNG from industrial/municipal waste**

The DBT-ICT Centre, Mumbai has also developed the Rapid-Anaerobic Digester technology, which can handle any bio-waste (including agri-waste) – dry or wet – and generate biogas within 24 hours. The technology gives a methane yield of greater than 90% and generates zero waste. It is now being scaled up to 2 demonstration /commercial plants.

### **Environment and Sanitation**

#### **Environment**

#### **Green remediation technology for wastewater**



*The green remediation technology &*

*the cleaned-up waste water*

DBT is participating in the Swachh Bharat Abhiyan through a range of initiatives including bioremediation of filthy water.

A DBT supported project developed phytoremediation treatment process for the degradation of dyes from textile industrial effluent. The study showed that Macrophytes *Ipomea neumeon*, *Alternanthera philoxeroides* (a massively rooted macrophyte), and *Salvinia molesta* demonstrated a potential for treating textile dyes and effluents in large scale (constructed wetland system) through rhizofiltration approach. Field application of *I. neumeon*, *S. Molesta* and *A. Philoxeroides* in wastewater lagoon systems was also successfully carried out. Studies to explore these plants in a constructed wetland system for textile effluent treatment at an industrial scale are underway.

### **Waste treatment technologies galore**

#### **Anaerobic membrane bioreactor removes organic waste from municipal wastewater with 95% efficiency**

With the support of BIRAC, a technology for removing organic waste from municipal waste water at 95% efficiency has been developed. The technology, called anaerobic membrane bioreactor AnMBR (2000L), is a product of a company called Thermax.

#### **Vortex diode based cavitation devices for enhancing biogas yield and throughput of anaerobic digesters during treatment of wastewater in distillery industry**

A technology for treatment of wastewater from the distillery industry with enhanced biogas yield, called Vortex diode based cavitation devices, has been developed by a company called Vivira Process Technologies. The technology has shown an increase of 15% in biogas yield over currently available technologies at trials carried out in Dhampur Sugar Mills and Lokmangal Sugar Mills.

#### **The Rhino Digester - cost effective appliance for decentralized waste processing developed**

Localised treatment of organic waste generated in apartments and societies is an urgent requirement in rapidly developing cities. Keeping this in mind, BIRAC has supported a technology called Rhino Digester. It is a novel, robust, versatile, modular, compact and cost-effective appliance for decentralized waste processing which can obviate requirements for costly disposal and treatment system for entire cities or regions. It can be installed at the source of waste generation–society, apartment or organization, and can convert all organic content of the waste into readily usable resources. A prototype of the appliance has been installed in a canteen to get feedback in a field situation.

#### **Co-treatment of domestic septage & municipal solid waste & landfill leachate producing biogas and biofertilizer**

Domestic septage, municipal solid waste and landfill leachate are major sources of waste from cities. Treatment systems that can tackle these are major requirements for sustainable cities. In order to meet this need, a technology has been developed for co-treatment of these wastes by using a process called dry thermophilic

anaerobic digestion (DTAD). The technology produces bio-fertilizer. DTAD of 5 L volume has been fabricated and is being operated in a steady state. A remote monitoring system has been developed and is under testing.

### **Molasses Spent Wash Treatment: Decolourization, Detoxification leading to algal biofuels**

A new technology supported by BIRAC can remediate pollution from wastewater of sugar or distillery industry and use it to grow algal biofuel. Microbes to be used in this process have been screened, isolated and optimized. The fungi that produces enzymes for decolourisation of the water, has been grown.

### **De-metalizer Kit for heavy metal removal from mining wastewater**

Surface water and groundwater around mines are often laced with heavy metals, making them unsuitable for use. A technology for removing such heavy metal ions from the surface and underground water bodies, called novel de-metalizer kit, has been developed from biopolymers. Bio-sorption was carried out for the removal of lead ions from aqueous solution containing known concentration of Lead-Pb (II) by implementing hybrid polymers as biosorbent. Nearly 65% of the contaminated lead ions could be removed through dipping approach, whereas nearly 83% of such ions could be removed through direct addition approach at higher concentration level.

### **Conversion of waste to green chemicals**

An economical, end-to-end process to convert waste to chemicals via biogas has been developed with the help of engineered strains. Lactate dehydrogenase genes from different hosts have been expressed and tested in methanotrophs. Recombinant strains show higher levels of lactic acid compared to wild strains.

## **Sanitation**

### **Bio-toilet technologies**

#### **Novel bio-toilet technologies promise cleaner India**



The Hon'ble Prime Minister's Swachh Bharat initiative has given an impetus for creating innovative solutions to the pressing sanitation problems and challenges faced by our country. In an effort to provide cleaner toilets to the nation, DBT & BIRAC, in collaboration with the Bill and Melinda Gates Foundation (BMGF) has supported many novel bio-toilet technologies through 'Reinvent the Toilet Challenge for India (RTTC)' programme. Six new bio-toilet technologies have so far been supported and different aspects of waste collection and management process addressed. The Energy and Resources Institute, with the support from DBT, has set up 100 toilets to demonstrate these technologies. Several bio-toilets will be setup in schools of North Eastern states.

The eco-toilet project of Pradin technologies Pvt. Ltd. In Bengaluru, Karnataka has redesigned the toilet seat. It has also made the entire process eco-friendlier by using ultrasound to dispose and settle neumo matter, thus reducing the use of water.

An off-grid, self-sustained, modular, electronic toilet for slums with solar energy, integrated with mixed waste processing unit, water and energy/fertilizer recovery was supported by BIRAC. Undertaken by Eram Scientific Solutions, Kerala, along with the University of South Florida, the system showcased closed-loop resource recovery by integrating the slum e-Toilet with a novel onsite wastewater treatment and recovery solution termed The NEWgenerator™, which can be deployed in high-density urban areas and areas suffering from water scarcity and low-electrical grid connectivity.

Realizing that the waste in septic tanks is a rich source of nutrients for fertilizers, Bactreat Environmental Solutions LLP, a Goa based company, has converted this waste to sanitized soil and fertilizers. The technology is a collaborative outcome of BITS Pilani, Goa Campus, and Ghent University, Belgium, to improve septic tanks by converting them into decentralized wastewater treatment system. It can treat septage (biological waste) for a single household, as well as for a gated community of 100 people equivalent to 25 families.

The other technologies include use of viral agents, microbial fuel cell and effective recycling strategy to improve the economics of human waste disposal using granular material for hygienic water-free toilet. The efforts have started reaping results as the recent UN report shows a substantial decrease in open defecation in India.

### **River clean-up technologies**



*Sampling of water at the site*

*Laboratory being set up at the site*

DBT is contributing to national efforts to clean up Indian rivers by supporting a major effort along with the Netherlands to implement novel technologies for cleaning up of the Barapullah canal and then finally initiate efforts to keep the Yamuna clean.

The collaborative effort will support high quality research and development programmes aiming at 'new' wastewater management to ensure good quality, fresh water, free of risk-causing contaminants and promote productive, safe reuse of water, thereby enhancing human and environmental health conditions.

In the next five years, a wastewater treatment plant to make the filthy water potable is scheduled to be set up besides removing heavy metals from the water for reuse. Most of the technology choices for cleaning the Barapullah drain would be biological in nature.

It would demonstrate a novel holistic (waste-) water management approach, that will produce clean water that can be reused for various proposes (e.g. industry, agriculture, construction etc.), while simultaneously recovering nutrients and energy from the urban wastewater, thus converting drain into profitable mines. Special attention will be paid to removing pathogen and conventional and emerging pollutants (which are only partly retained in the existing WWTPs).

Cleaning Barapullah, the second largest drain in Delhi would contribute to cleaning of rivers, perhaps the most important and noblest of our missions. The project will develop an innovative pilot scale plant, suitable to Indian conditions in a location specific manner. Immediate goals of the project are to set up toilets run by primary treated water from the drain and an on-site bio-compost unit.

## **Industry**

### **BIRAC bio-innovations: Propelling the bio-economy**

The Biotechnology Industry Research Assistance Council (BIRAC), a public sector undertaking of the Department of Biotechnology (DBT), organized a two-day 'Innovators Conclave & Bio-Innovation Fair' at the India Habitat Centre, New Delhi. The theme for the conclave was 'BIRAC Bio-Innovations: Propelling the Bio-economy'. The conclave was inaugurated by the Hon'ble Union Minister for Science & Technology and Earth Sciences, Dr. Harsh Vardhan, and was attended by Guest of Honour, Mr. YS Chowdary, Hon'ble Minister of State (MoS), Science & Technology and Earth Sciences. The conclave brought together nearly 300 innovators and start-ups, scientists from industry and academia, professionals from public and private sector, policy makers, and national and international organisations.

### **BIRAC Success Impact**

BIRAC has been able to create a pan-India presence supporting over 700 biotech companies, research institutes, small and medium scale enterprises (SMEs), which includes 500 start-ups and entrepreneurs. 147 Intellectual Property Rights (Ips) have been generated with the support of BIRAC. In addition, 30 bio-incubators are supported across India and around 70 products are being commercialized.

BIRAC's BIG programme has become one of the largest early stage programs and has supported more than 230 start-ups and entrepreneurs. Many of these BIG grantees have been able to generate and follow on funding from both public and private agencies.

### **Entrepreneurial Success Stories**

A number of successful entrepreneurs have been supported who have brought out useful technologies

#### **Pandorum Technologies**

*A biotechnology start-up with distinct synergy of life science and engineering competencies*

#### **Product**

In-vitro 3D human liver tissues are undergoing validations. This product can be used for in-vitro medical research - hepatotoxicity & drug metabolism



The company plans to expand 3D tissue portfolio to skin, cardiac, cornea, nephron, neuro etc. And integrate them as 'animal on chip' or 'homo-chippiens' for in-vitro medical research. It also plans to develop clinically implantable tissues

### **Bugworks Research India**

*Developed a stealth strategy by which antibiotics can successfully bypass efflux pumps*

#### **Product**

The company is developing a first-in-class novel chemical entity (NCE) that exhibits potential of killing superbugs resistant to colistin, beta-lactams, cephalosporins, carbapenems, fluoroquinolones, and difficult to treat pathogens such as *E. Coli (including ESBLs, NDM-1)*, *S. Aureus (including MRSA)*, *K. pneumonia (including KPCs)*, *A. Baumannii*, *P. Aeruginosa*, *E. Faecalis (including VRE)*, *N. Gonorrhoeae*, *H. Influenza*, *Proteus sp.*, *Citrobacter sp.*, *C. Difficile*, *S. Pyogenes*, *S. pneumonia*, *S. Epidermidis* etc. It is now under pre-clinical development, and is planned to enter clinical development in 2019.

### **Aarna Biomedical Products**

#### **Product**

An affordable high-quality post mastectomy kit in which each component of the kit has been developed with iterative feedback as per the needs of the end user, leading to both technical and anthropometric betterment than the alternatives available through imports.

The kit comprises of lightweight, external, silicone gel breast prosthesis, a two-pocketed brassieres with two prosthesis covers, a prosthesis holder, information and usage manual and an outer waterproof kit.

This product can be used by breast cancer patients, who have lost their breast as part of surgical intervention, and benefits their physical and mental wellbeing as it boosts their confidence and dignity and prevents postural and gait issues.

### **Jeevtronics**

*Devised a low-cost defibrillator that works without electricity*

#### **Product**

The company has developed the world's first dual powered (electricity + hand cranked) defibrillator that works in areas without electricity, and will be priced at  $\frac{1}{4}^{\text{th}}$  the price of big brands, while maintaining similar or better-quality levels.

Thousands of primary and community healthcare centres (PHC/ CHC), sub-centres, small hospitals lacking diesel generators, ambulances, factories, army/border security force posts in India, Africa, Asia & South America could benefit from such a device.

### **CycaOncosolutions Pvt Ltd.**

#### **Products**

Oncology product transforming poisons to remedy by on site delivery of low doses of drugs: tested in laboratory cell model.

CyPlatin is a novel composite of CyCa delivery device with generic anticancer drug Cisplatin. It retains the efficacy of Cisplatin with just  $\frac{1}{10}^{\text{th}}$  of the dose and potentially reduces the extracellular toxicity by at least ten times in vivo. This product is a versatile 'non-toxic, high speed, high precision molecular machine that can carry drugs directly into living cells like a drug delivery device.

CyGlo series is a reagent to track live cells. The reagent labels the cytoplasm of 90 % living cells in just 10 minutes. The kit has reagents to label cells in three different colours and can be customized into any available colour. The bio-molecular machine can be programmed to target cell organelles and specific proteins inside the cell.

### **Women scientists & entrepreneurs: Game Changers driving science for new India**

A conclave on 'Women Scientist & Entrepreneurs' was inaugurated by the Hon'ble Union Minister Dr. Harsh Vardhan as a part of the Indian International Science Festival (IISF). The Minister highlighted the increasing role of women in science based start-ups and entrepreneurship programmes.





The conclave, a unique programme of IISF 2017, organized to promote science and entrepreneurship among the young women brought together around 350 scientists, researchers and entrepreneurs from across the country.

On the same occasion, the BIRAC Women Bio-Incubator was inaugurated at the Golden Jubilee Women Biotech Park, Chennai, in the presence of Prof. M S Swaminathan, Founder Chairman, Women Biotech Park & Hon'ble State Minister of Industry, Government of Tamilnadu – Shri M C Sampath. Dr Harsh Vardhan said that it was good example of a centre-state government partnership and will drive many important initiatives under 'Start-up India' and 'Make in India' initiatives.

### **International Collaboration**

The Department of Biotechnology has initiated a process of constant dialogue with the international scientific communities regarding new ideas and concepts in all areas of biotechnology and life sciences. Below is a brief summary of the activities in this regard.

### **Healthcare**

DBT has taken a lead in tackling the emerging global challenge of Anti-Microbial Resistance (AMR) by collaborating with international partners, both bilaterally and multilaterally, to address the challenge of AMR. The Department has collaborated with the United Kingdom and has set up an India-UK strategic group on AMR with all stakeholder Ministries/Departments on board from both the countries.

Under the initiative announced by the Prime Ministers of India and the UK, a £6.5 million joint contribution is dedicated to research on AMR. In addition, the Department is also a member of the Joint Programme Initiative on AMR (JPIAMR), in partnership with the European Union. In order to address the alarming issue of AMR, Germany has also desired to partner with DBT and has invited the Department to join the Global AMR R&D hub as a member of the Interim Board to participate in shaping the hub to maximize the impact of international research activities.

### **Agriculture**

The Department is positioning itself to take the lead in developing a commercial model for the Indian farmer and her farming needs by setting up "FarmerZone", a cloud-service with curated data. This data caters to all needs of the farmer-from dealing with climate change, weather predictions to problems faced by the farmer on matters of land, soil, disease, pest, water, planting material and marketing. This would be a multi-purpose window for solutions and will be available for farmers anywhere in India and probably the world. Solutions will be provided at the farm, like how an e-commerce company delivers its service at the customer's doorstep. The farmer can access the service directly or through an intermediate structure such as local cooperatives.

The FarmerZone will include a MarketZone where farmers can directly sell their produce which can be picked up by directly from the farm.

An international conclave was organized by DBT during 30-31<sup>st</sup> of August 2017 where, in addition to farmers, experts in science and technology, world agri-leaders and policy makers and global companies who work in big-data and e-commerce segments participated.

The conclave debated on:

1. Capturing and curating agriculture related data.
2. Applying data analytics and machine learning to problems faced in small and marginal farm holdings.
3. Using the above to provide solutions in resource-constrained farming conditions and in the context of climate-change challenges.
4. Roadmap/action plan for setting up the cloud service is being developed, and is expected to be ready by the end of this year.
5. Two sentinel sites – one for potato farmers and the other for rice farmers will be initiated in three months' time.

### **Bioeconomy**

The Department is partnering with the European Union and other countries to quickly implement the concept of waste to wealth at various levels.

One such project is LOTUSHR (Local Treatment of Urban Sewage Streams for Healthy Reuse) being implemented in collaboration with the Netherlands, with the objective of cleaning the sewage water of the Barapullah drain – the second largest drain in Delhi, while simultaneously recovering resources from it. The first pilot unit will be operational in Jan 2018, which will study the changing microbial consortium and the thermodynamics/flow of the water, with the changing weather, through the year. The final pilot will be in operation by Jan 2019.

DBT will also partner with the EU to setup pilot water cleaning units using microorganisms for cleaning water; this being a pioneering effort in India.

## **EduTech**

The Department has assumed leadership role in the country by partnering with Finland, the country with the best education system, in the area of EduTech. The proposed programme aims to develop futuristic education based on EduGames and EduTech for India. The programme will be carried on a pilot scale and will be based on a co-creation model to reboot higher education in life sciences and conduct a pilot study for EduGaming and EduTech for life sciences. EduGaming has been used for educational purposes in life sciences everywhere in the world. Various funding agencies in the US hold edugaming contests for students to predict protein folding. Proginator 'X' is a game where while destroying zombies, students learn the connection between cells, tissues and organs. This is the future of education, and a pilot study on life science edugaming can be a model for future education in India.

Some of the steps taken by the Department in the field of EduTech are:

- The Department of Biotechnology, Ministry of Science and Technology organised “Edutech and EduGaming: The future of Education” at C-CAMP, Bangalore during Oct 9- 12, 2017.
- Thirteen EduTech and EduGaming companies from Finland participated with Tekes, the Finnish Funding Agency for Technology and Innovation, as an observer.
- The Atal Innovation Mission (AIM) and NITI Ayog partnered in the event, which allowed connecting tinkering labs supported by AIM with pilots of Finnish EduTech.
- The objective of the seminar was to leverage the best education system of the world, the Finnish model of education, through EduTech and EduGaming to prepare our education system for the skill sets needed for 21<sup>st</sup> century education.
- EduTech Campus will facilitate long-term collaboration with Finnish EduGaming companies for co-creation of EduGaming/EduTech for Indian school systems. A pilot study in one or more Indian schools and introduction of a course in technical skills needed to develop EduGames in the university system are also planned.

The Department of Biotechnology, Government of India, is working with Tekes to put out a joint call for proposals to create EduTech and EduGaming products and services for Indian schools and colleges.

In the meanwhile, a pilot with TeamIndus, Bangalore and Kerbal Space Program will develop an EduGame for introducing space engineering and life science in space to budding vyomanauts. Once the platform is developed, TeamIndus would help spread the impact across India through various programs that run like the Moon shot Wheels or Moon shot Cadets programme.

The long-term strategic objective of this project is to create a bridge between India and Finland, integrating the Finnish educational excellence and the expansive education system of India in an attempt to “Reboot education for Indian schools”.

## **Democratisation of Science**

DBT has taken the lead to develop a process, which no other funding agency across the world does, to bring science to the most resource constraint regions of the country, and to a citizen scientist. By opening a call for proposals inviting schools, colleges and citizen scientists to apply for Foldscope (a frugal microscope) with application in education and research, DBT has opened the doors for bringing science to the least privileged in a step towards truly democratising science.

Foldscope is a low-cost paper origami microscope which costs about \$1 with a magnification of 125x developed by Prakash Lab at Stanford University, USA. It is hoped that all students of India will eventually carry a foldscope like they do a geometry box.

Workshops at municipality Urdu school at Sangharsh Nagar, Dharavi at Mumbai and IIT Bombay were held on August 28-29, 2017 where teachers and students of government schools from across India were trained so that they can use the Foldscope as a teaching tool. Foldscopes will also be distributed to teachers. About 500 Foldscopes were distributed to students and teachers during these workshops.

In response to a call for proposals for the use of Foldscope; a total 525 applications have been received – 112 from schools, 357 from colleges and 56 from citizen scientists. In the first phase, 10,000 foldscopes have been received, which will be distributed to 117 government schools and 328 government colleges.

## Nobel Prize Series India 2017

The Department of Biotechnology has signed an MoU with the Nobel Media AB of the Nobel Foundation to bring the Nobel Prize Series to India from **2017 to 2022**. The first Nobel Prize Series India 2017 was a trilateral partnership between DBT, the State Government of Gujarat and Nobel Media AB.

The first edition of Nobel Prize Series was inaugurated by **Hon'ble Prime Minister of India Shri Narendra Modi** on **January 9, 2017** at the Science City in Ahmadabad, Gujarat as a prelude to Vibrant Gujarat 2017. **Nine Nobel Laureates** participated in the event whose theme was **"Science Impacts Lives"**. By bringing together Nobel Laureates, other experts, researchers and students, the programme aimed to stimulate innovation and creative thinking.



The programme also included a unique science exhibition with exhibits brought from the Nobel Museum Sweden and showcases the achievement of Alfred Nobel, his will, and the achievements of Nobel Laureates of how their ideas have impacted / changed human life.

The Nobel Prize Series India 2017 was the biggest event organised by Nobel Media AB outside of Scandinavia and has been a trendsetter for both within the country and outside.

The second edition, Nobel Prize Series - India 2018, will be held in Goa in partnership with the Goa government during February 2018.

## Human Resources Development

### DBT's skill development initiative will speed up India's Development

The skill development program launched in partnership with Indian Institutions will provide high quality hands on training for 10+2 students, fresh graduates, and faculty in the areas of biotechnology.

DBT's support will include

- Study of demand and supply of trained skilled manpower and identification of gaps for initiating new programmes.
- Study of available skill development programmes in the country and overseas, and adaption and adoption of suitable model.
- Planning for training of teachers, students and entrepreneurs, framing course curriculum with duration.
- Identification of experts and partner institutes for conducting specific technique based skill development programmes, entrepreneurship development programmes and faculty improvement programmes.
- Conduct skill development programmes for school pass outs and undergraduate students.
- Conduct entrepreneurship development programmes in collaboration with industry associations.

### DBT participated in Smart India Hackathon 2017

The Department of Biotechnology along with 28 other departments participated in the Smart India Hackathon 2017 organized by the Government of India under Digital India initiative. DBT was a 'Premier Partner' for the Smart India Hackathon event. About 17 problems were proposed for students to provide digital based solutions. The Grand Finale of Smart India Hackathon 2017 was held simultaneously at 26 different nodal centres across the country. The Grand Finale for DBT and DST was organised at C V Raman College of Engineering, Bhubhaneshwar, Odisha. DBT has also projected 26 problem statement for Smart India Hackathon 2018.

### Partnering with Heidelberg University on Big Data Research

The Department of Biotechnology has signed a Memorandum of Understanding (MoU) with Heidelberg University, Germany for starting Joint DBT-Heidelberg University Graduate Programme on Big Data Research. There are six Indian partner institutes like IIT Madras, IIT Kanpur, IIT Guwahati, Jawaharlal Nehru University, Allahabad University and Delhi University. Under this programme, the first batch of 15-20 students will be sent for 2-3 months training during their Masters phase to Heidelberg University, Germany. It is also proposed to include about 10 doctoral students per year. The programme envisages sending Indian students for 5 consecutive years.

## Societal Development

### DBT recognizes HESCO for "Biotechnology Social Development Award"

Biotechnology, as an emerging area, has immense potential to improve the lives of people - specially the socially and economically disadvantaged sections of the society. The Department of Biotechnology has recognized its importance and has dedicated organizations working at grass-root levels in various resource based, village based

and rural based activities. These organizations have made substantial contribution to the community in various aspects of healthcare and hygiene, providing avenues for livelihoods and empowering people.

This year (2017), the Department has recognized the **Himalayan Environmental Studies and Conservation Organization (HESCO)**, Dehradun, Uttarakhand, for their pioneering work on creating livelihood options for rural community in the Himalayan region.

Himalayan Environmental Studies and Conservation Organization, i.e., HESCO is based out of Shuklapur village near Dehradun in Uttarakhand. It is an NGO working since 1979 and focusing on economic and developmental needs of the community. It is working towards encouraging society to tap local bio-resources for self-reliance. For the last 37 years, HESCO has been applying knowledge of the environmental and bio-sciences and propagating simple technologies to bring consistent development to the rural villages of the Himalayas. The mission of HESCO is to promote innovative and ecologically-sound solutions in the Himalayan region for sustainable utilization of local bio-resources and ultimately help the community development through their sustainable livelihood.

### **North-Eastern Region**

The Department of Biotechnology has taken many steps to bring about a paradigm shift in biotechnology in the country's North-East Region (NER). Eyeing an inclusive growth, DBT has announced a series of new programs and missions for NER. DBT has established a dedicated 'North Eastern Region Biotechnology Programme Management Cell (NER-BPMC)', with an annual investment of ₹ 180 crores to evolve, implement and foster biotechnology research in the North-Eastern states.

DBT has many major ongoing projects in the North-eastern states. Some of the major highlights of DBT's ongoing efforts in NER are as follows.

#### **Phyto-Pharma Plant Mission announced:**

DBT has announced a ₹ 50 crore mission aiming at conservation and cultivation of endangered and threatened endemic medicinal plants of North East India and discovery of new botanical drugs for unmet medical needs using the rich traditional ethno-botanical knowledge and biodiversity of these states. This mission would also help to improve the availability of authentic and quality botanical raw material on sustainable basis for a boom in the phyto-pharmaceutical industry.

It is expected that this mission would enable farmers and phytopharmaceutical industries from NE states to become global leaders in production and export of some quality botanical drugs DBT would be the nodal coordinating and implementing department for this mission and work closely with Ministry of DONER and other identified institutions.

#### **Brahmaputra Biodiversity and Biology Boat (B4)**

DBT has announced a unique mission to construct a laboratory on a boat for doing research at different laboratories in NER. Named **Brahmaputra Biodiversity and Biology Boat (B4)**, this well-equipped laboratory would contain facilities for analysis of all components of the entire ecosystem of the river and surroundings. This lab will link all the local research institutions as well as national and international laboratories along the Brahmaputra.

B4 will have capability to analyse soil, water, environment, plant and animal life, human health and agriculture and an equal component that involves local citizens in the experimental process of science in data generation and management. B4 will also have a teaching laboratory for school/college children. It is also proposed to have mobile satellite boat labs, which will run along the tributaries of Brahmaputra to feed in data to the main B4.

#### **Twinning R&D Programme**

Twinning R&D Programme has been implemented, which made a huge impact in NE states for implementing hard core biotechnology in association with rest of India institutions. Till now, more than 480 twinning projects have been implemented as collaborative projects between North East institutions and the rest of India Institutions.

The concerted efforts of DBT have resulted in publication of 252 research papers in the peer reviewed journals. This programme has also resulted in capacity building of NER researchers and employs more than 600 students as JRF/SRF. In last three years, DBT has been able to invest an amount of ₹ 90 crores in last three years.

#### **NER-Scented Rice**

North Eastern Region of India possesses a rich diversity of Aromatic Rice (AR). An important programme emerged out of a brain storming meeting in twinning collaborative mode on "NER-Scented Rice" has been implemented in NER. Aromatic rice varieties are of high value both in terms of their unique and delicious edible medicinal properties. The aromatic rice of NER especially Joha and Black rice are of premium value because of their aroma and high medicinal characteristics. But these are also poor yielders and susceptible to pest attacks. Hence, innovative approach was adopted using biotechnological intervention to ameliorate the agronomic



characteristics of this aromatic rice and other scientific properties besides yield enhancement. A similar kind of project in NER Banana on twinning mode has also been implemented recently in the regions. An amount of ₹16.67 crores has been sanctioned by DBT in the last year.

### **Human Resources**

Support to 11 medical colleges in NER to create an environment of training and research in Medical Biotechnology

DBT has invested an amount of ₹ 40.00 crores during a period of 5 years. The medical diagnostic facilities at these institutions are open to the patients and these facilities conducted 4.79 lakhs pathology/haematological and microbiological tests in different types of diseases. More than 110 papers published in peer-reviewed journals. Hundred and ten personnel trained in the project.

### **Support to Star Colleges**

Fifteen colleges have been recognized so far as Star Colleges in NER. DBT invested more than ₹ 2.50 crores in last three years. Under this programme, colleges get enhanced lab infrastructure and mentoring by leading scientists and Fellows of various National Academies.

### **Biotechnology Labs in Senior Secondary schools (BliSS) programme**

DBT has established Biotechnology Labs at 88 Senior Secondary Schools from NER under BliSS programme. An amount of Rs 2.20 crores has been spent to create laboratory infrastructure at senior secondary school level. This programme is first of its kind in India.

\*\*\*\*\*

RDS/sk

(Release ID: 1513856) Visitor Counter : 9483

