



विद्यया ऽ मृतमश्नुते
Department of Biotechnology
Ministry of Science & Technology
Government of India



HIGH PERFORMANCE BIOMANUFACTURING PLATFORMS



Biomanufacturing Platforms – Building India's Bioeconomy through Strategic Hubs & Foundries

Bharat's Economic Growth

- Strong economic growth in the past decade
- Poised to be a global leader in the next industrial revolution
- Leveraging emerging technologies & innovative solutions

Challenges

- Climate change crisis
- Unsustainable material consumption
- Increasing waste generation
- Need for concerted sustainable interventions

Biomanufacturing has the immense potential to offer sustainable solutions to the above challenges



What is Biomanufacturing?

- Use of engineered microbial, plant, and animal (including human) cells
- Produces commercially important products at scale
- Enables efficient resource utilization, cost-effectiveness, scalability
- Reduces environmental impact



Potential of Biomanufacturing

- Harnesses regenerative and sustainable power of biology
- Enables bio-based alternatives to conventional products
- Supports low-carbon, circular economy models
- Aligns with global sustainability goals



Key Barrier – Scaling Up

- Limited domestic capacity for translation of research
- Lab-to-market transition hindered by lack of infrastructure
- Gaps in pilot to pre-commercial manufacturing support
- Urgent need for scale-up facilities & policy support

Way Forward...

**Enable
Bharat to
lead in the
bio-based
global
economy**

**Build
biomanufacturing
infrastructure**

**Strengthen
public-private
partnerships**

**Foster
innovation-to-mar
ket ecosystem**

BioE3 Policy: Driving High-Performance Biomanufacturing

Department of Biotechnology (DBT) Initiative

Biotechnology for Environment, Economy & Employment (BioE3)

BioE3 Policy

Foster high-performance biomanufacturing

Enable start-ups, SMEs, industries & academia with:

- Shared infrastructure
- Pilot & pre-commercial scale support
- Resources for viable bio-based product development

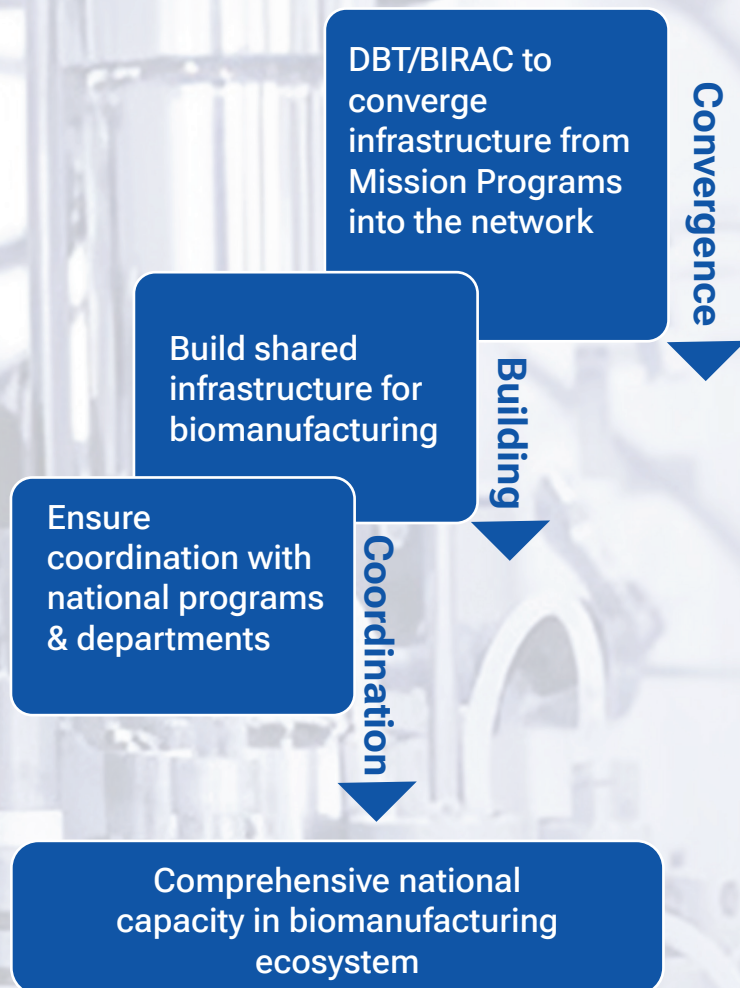
BioE3 Policy Verticals

1. Bio-based chemicals & enzymes
2. Functional foods & smart proteins
3. Precision biotherapeutics
4. Climate change & resilient agriculture
5. Carbon capture & utilization
6. Futuristic marine & space biomanufacturing
7. Bio-enablers (AI hubs & Bio-foundries/ Biomanufacturing hubs)

Bio-Enablers

- Sophisticated instrumentation & platforms
- Data acquisition & analysis with AI/ML
- Omics & biomaterial libraries
- Translate knowledge into scaled-up applications
- Support discovery & translational research across six verticals

Implementation...



Department of Biotechnology, Government of India
and
Biotechnology Industry Research Assistance Council
(A Government of India Enterprise)

JOINTLY INVITE PROPOSALS

for setting up of
मूलांकुर Bio-Enablers: Biofoundries and Biomanufacturing Hubs

focussing on

Biofuels and Carbon capture | Functional Foods and Smart Proteins | Futuristic marine and space research | Climate resilient agriculture (agribiologics) | Bio-based chemicals, Bioplastics, Active Pharmaceutical Ingredients (APIs), and Enzymes | Precision Biotherapeutics (monoclonal antibodies, mRNA therapeutics, cell & gene therapy)

under following categories

A. Using existing facilities	B. Augmenting existing facilities	C. Setting up new facilities
For online application, implementation plan and specific guidelines, please visit BIRAC website (www.birac.nic.in) Academic proposals will be processed and implemented by DBT, while BIRAC will provide support to Start-ups, SMEs, and industries.	Last date for submission of proposals 14th November, 2024 (till 5:30 pm)*	For queries, please contact: Dr. Katalvani Ganesan, Scientist 'F', DBT (Email: k.ganesan@nic.in), Dr. Shilpi Gupta, Deputy General Manager, Technical, BIRAC (Email: sgupta@birac.nic.in), Dr. Prachi Kaushik, Senior Manager, Investment, BIRAC (Email: pkaushik@birac.nic.in)

* Those who have already submitted the proposal need to align it with the Implementation Plan and the revised proposal format

Network of 21 Bio-enablers: 8 Bio-foundries and 13 Biomanufacturing Hubs has been created across the country catering to different thematic areas of biomanufacturing

Contents

Emerging Technologies

- Dedicated facility for large scale manufacturing of marine biotech products (KIIT TBI, Bhubaneswar)
- Nation's first animal stem cell repository (NIAB with HiMedia, Hyderabad)
- Biomanufacturing hub for mRNA-based precision medicine (Genova Biopharmaceuticals, Pune)
- Bio-foundry for the development and production of high-quality precision biotherapeutics (TSHTI, Faridabad)
- State-of-the-art Cell Therapy Manufacturing Hub (ACTREC, Mumbai)

Healthcare

- Biofoundry for the development of indigenous monoclonal chassis for bioproduction (NCCS, Pune)
- Pilot scale facility at 100 L, to scale up specialty chemicals and enzymes and to provide scale up services (FSID with TATA Chemicals, Bangalore)
- GMP Grade Facility for Gene Delivery Vector (Immunoadoptive Cell Therapy Pvt Ltd, Mumbai)
- Fermentation facility (at a scale of 10 KL) and to produce drug intermediates and bio-energy starter cultures at commercial scale (HiTech Biosciences, Pune)
- Facility with pilot scale and large scale fermenters for the precommercial production of APIs (Embio Ltd, Mumbai)
- Fermentation Facility for Functional Foods, Smart Proteins, Bio-based Chemicals, Enzymes and Precision Biotherapeutics (Laurus Bio Pvt Ltd, Vishakhapatnam)
- State of the art facility for commercial production of monoclonal antibodies and biosimilars (Virchow Biotech Pvt Ltd)

Agri-Food

- State of the art biofoundry for the process development and optimization for pilot scale production of biopesticides from plant and microbial sources (IPFT, Gurugram)
- Biofoundry in the area of agri-food, nutrition, and biomanufacturing (NABI, Punjab)
- Plant to scale up the production of Gluconates (Agilent Bioplus, Ahmedabad)
- QMS compliant facility for commercial production of Fructo- oligosaccharides (FOS) (Revelations Biotech Pvt Ltd, Hyderabad)
- Fermentation facility at 1 KL scale for food based products, food additives, probiotics and cell growth stimulators (Himedia Laboratories, Mumbai)
- QMS compliant facility for commercial production of probiotics and smart proteins (Sundyota Numadis Probioceticals Pvt Ltd, Ahmedabad)

Energy/Green Chemistry

- Biofoundry for Microbial Biomanufacturing (ICGEB, New Delhi)
- Facility to support development and scale-up of products used in cosmetics, food, pharma and bioplastic industry (IIT Madras with TICEL Bio Park, Chennai)
- Sequestration of CO₂ and its utilization for growing engineered microalgal strains (Jindal Steel & Power Ltd, Angul)

EMERGING TECHNOLOGIES

Dedicated Facility for Large Scale Manufacturing of Marine Biotech Products

KIIT Technology Business Incubator- BioFoundry

Deliverables:

- Production of natural bio-sunscreen formulations, cattle feed additives, pharma-grade collagen, seaweed-based biostimulants, recombinant spider silk fibers and silk fibroin
- Development of antiviral solution

Applications and current status:

- 90% of sunscreen market is still dominated by synthetic, chemical-based products. All-natural bio-sunscreen products (lotions and creams), offer sustainable, chemical-free UV protection.
- Collagen Serves as a key ingredient in anti-aging creams, moisturizers, and skin-repair formulations. It is used in supplements for joint, bone, and skin health. Also used in wound dressings, tissue engineering, and drug delivery systems. It holds potential in food and beverage as a functional ingredient in protein-enriched products
- Nano-formulated seaweed-based biostimulant can be used across diverse crops (cereals, pulses, vegetables, and fruits) to enhance nutrient uptake, improve soil health, and increase crop resilience to abiotic stress.
- Nutri-g [nutrients gelatinizer] is an innovative feed additive aims to replace chemical binders, mold inhibitors, and colorants, improving feed quality and reducing production costs.
- High-performance recombinant spider silk fibers find use in protective clothing, bullet-resistant gear, and lightweight tactical fabrics for defense applications.
- Antiviral solution is designed for direct application in shrimp hatcheries and aquaculture farms to prevent and manage white spot syndrome virus (WSSVs).

Impact on Indian economy:

By reducing dependence on imported products, India could advance self-reliance in biotech innovation, capturing a larger share of the global market and reinforcing its status as a competitive player in the field

Services to be offered:

Scale up services, IP support, regulatory guidance, and business mentoring.

Diving Deep into Marine Biotechnology Innovations:

Tapping into the rich marine diversity of the country for bio-based alternatives of harmful chemicals.



NATIONS'S First Animal Stem Cell Repository

National Institute of Animal Biotechnology (NIAB)
with HiMedia Laboratories Pvt Ltd, Hyderabad -

Deliverables:

- National biobank (initially with 4 cell lines) at a scale of operation of 50L
- Production of serum free media and food grade media at 50 L

Applications and current status:

- Biobank will house hydrogel assisted cryopreservation systems for the long term storage and transportation of cells
- Serum free culture media will facilitate growth and long term maintenance of MSCs.
- Food grade media is primarily used for growing muscle and fat stem cells from animals to produce meat without slaughter

Impact on Indian economy:

The animal stem cell lines will boost up the pet health care industry and cultured meat industry impacting Indian economy

Services to be offered:

- Bio-banking services for veterinary clinics, hospitals, research institutions, and other stakeholders
- Hydrogel Development Services for functionalization of polymers and development of hydrogels for encapsulation of stem cells and assisted cryopreservation.
- Collaboration with industrial partners for the development and distribution of domestically produced, cost-effective, and highly efficient serum-free culture and food grade media.

Accelerating innovation and reducing import dependency:

Steady supply of stem cells and high grade media for meat without slaughter



Biomanufacturing hub for mRNA-based Precision Medicine

Gennova Biopharmaceuticals Limited, Pune

Deliverables:

- Completion of Phase I trial for TB vaccine
- Phase II/III for CAR-T precision medicine for oncology indication

Applications and current status:

- mRNA-based vaccine development for tuberculosis (TB) represents a breakthrough in combating this enduring infectious disease.
- mRNA-based CAR-T therapy marks a significant advancement in personalized cancer immunotherapy, offering a safer and more flexible alternative to conventional viral vector-based methods
- Demand for these innovative mRNA-based products is largely unmet by existing solutions due to technological and manufacturing limitations

Impact on Indian economy:

- Significantly impact the Indian economy by strengthening healthcare infrastructure
- Promoting biotech entrepreneurship, driving sustained growth in both public health and biotechnology sectors

Services to be offered:

Design and development of mRNA vaccines and therapeutics targeting infectious diseases, cancer, and genetic disorders, using diverse RNA platforms including self-amplifying, trans- amplifying, non-amplifying, and circular RNA.

Advancing mRNA based therapies:

Strengthening nascent mRNA therapeutics industry with advanced manufacturing facility



Bio-foundry for the development and production of high-quality precision Bio-therapeutics

BRIC: Translational Health Science and Technology Institute (THSTI), Faridabad

Deliverables:

- Anti-Nipah therapeutic monoclonal antibodies
- Live Bio-therapeutics from wild type bacterial strains *Lactobacillus*, *Bifidobacterium*, and *Parabacteroides*

Strengths:

Platforms established for mAb generation, bio assays etc and utilised by industries for covid-19 vaccines and diagnostics.

Impact on Indian economy:

- Global Monoclonal Antibodies (mAb) market, valued at over \$180 billion in 2024, reflects strong demand driven by increasing incidence of infectious diseases and expanding access to biologics.
- Live Biotherapeutics have the potential to transform India's healthcare system and boost its biotech sector.

Paving the path for Precision therapeutics:

Indigenous development of monoclonal antibodies and live biotherapeutics for affordable but advanced healthcare



State-of-the-art Cell Therapy Manufacturing Hub

Advanced Centre for Treatment, Research and Education in Cancer, Tata Memorial Centre, Mumbai

Deliverables:

- Early pre-clinical development through clinical manufacturing for early- phase, first in human cell therapies.
- 5-8 products with 120-150 batches annually.
- Oncolytic Virotherapy, CAR-T for bladder cancer, GD2 CAR-T, CD22 CAR-T etc.

Strengths:

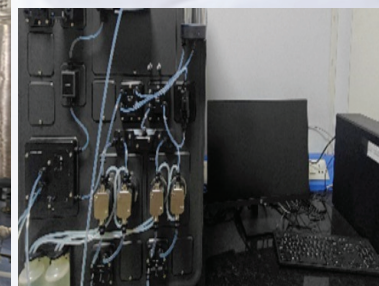
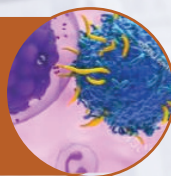
NexCAR 19 (commercialised by ImmunoACT) is the first Indian cancer cellular therapy for the treatment of B-cell malignancies, CD19 CAR T Therapy.

Impact on Indian Economy:

- Global cell and Gene Therapy (CGT) market is projected to surpass USD 50 billion by 2030.
- Indigenous CAR-T and VST CAR-NK therapies developed will significantly reduce reliance on imported treatments, currently costing ₹3-4 crore to ₹30-40 Lakhs.

End to end Solutions for novel Cancer therapies:

Facility for supporting research, development cGMP manufacturing and clinical trials of CAR-T therapies



HEALTHCARE

Bio-Foundry for the Development of Indigenous Monoclonal Chassis for Bioproduction

National Centre for Cell Science (NCCS), Pune

Deliverables:

- Strain engineering and scaling up of bioproduction from indigenous microbial systems
- Potential of the chassis organism for the following:
 - ▶ Early Scale-up of Rose aroma (2-Phenylethanol) production (Current market demand is around \$300 million).
 - ▶ Production of Oxalate metabolizing bacteria *Lactobacillus plantarum* (Current market demand is around Rs 300 Crore and has wide applicability in health care sector).
 - ▶ Gluten Degrading enzymes from bacteria, for Celiac Disease (Globally, Celiac Disease care is costing \$690 Million).

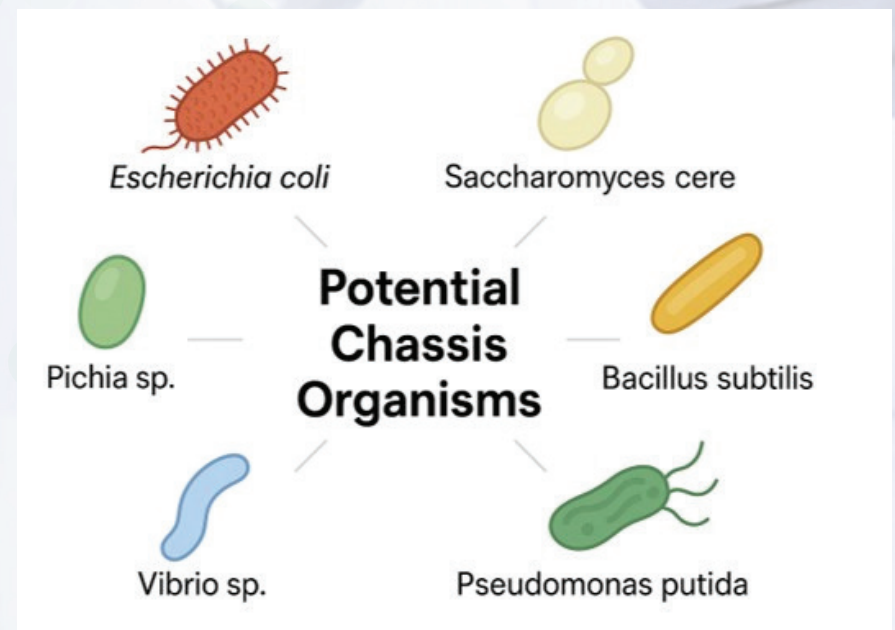
Strengths:

The NCMR (National Centre for Microbial Resource) at BRIC-NCCS (National Centre for Cell Science) houses 2 Lakhs+ collection of microorganisms, including bacteria and fungi.

Impact on Indian Economy:

Development of microbial chassis will significantly reduce the development cost as well as reduce the licensing costs for the Indian industries

Indigenous microbial strains for Bioproduction:
Reducing the cost of domestic high value compound production



Pilot Scale Facility (100 L) to Scale up Specialty Chemicals and Enzymes and to Provide Scale up Services

Foundation for Science Innovation and Development (FSID) with Tata Chemicals Limited, Bengaluru

Deliverables:

- Scale-up of (up to 100 L) one specialty chemical such as Astragalin and 3 enzymes such as UndB, Ulp1, Bt-CYP450
- Provide scale up (up to 100 L) services to two external users

Applications and current status:

- Astragalin is a nutraceutical and cosmetic ingredient with anti-inflammatory, antioxidant, and antiviral properties. Imported for R&D; no Indian producer; produced synthetically in labs
- Ulp1 SUMO protease is an enzyme for recombinant protein purification in biomanufacturing/CDMOs. Currently imported.
- UndB enzyme is used in bio-based surfactants, green solvents, lubricants (for use in bio-refineries). Need is currently unmet.
- Bt-CYP450 is a biocatalyst for synthesizing pharmaceutical intermediates. Lab expression from cloned genes; no suppliers; research- stage only

Impact on Indian economy:

Reduction in import dependency, create jobs, support MSMEs, and localize strategic enzyme and bioactive production.

Services to be offered:

Technical consultancy and support for scaling enzymes and specialty chemicals production.

Strengthening Domestic Enzymes and Specialty Chemicals manufacturing:
Boosting a greener chemical industry



GMP Grade Facility for Gene Delivery Vector

Immunoadoptive Cell Therapy Private Limited, Mumbai

Deliverables:

- GMP plasmid manufacturing facility at 20 L
- GMP lentiviral vector manufacturing facility at 200 L

Applications and current status:

- GMP grade plasmids and lentiviral vectors act as critical raw material in manufacturing of cell and gene therapy
- Import of lentiviral vectors faces several challenges, related to scaling up manufacturing and ensuring quality control

Impact on Indian economy:

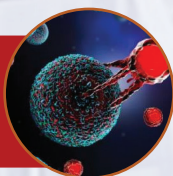
- Indigenous lentiviral manufacturing marks a significant step towards self-reliance
- Lowers production costs for gene therapies and research tools

Services to be offered:

Provide services to external users working in the same sector.

Affordable Futuristic Therapies:

Indigenous development of delivery vectors for CAR-T Cell Therapy to increase access to cancer care.



Fermentation facility (at a scale of 10 KL) to Produce drug Intermediates and Bio-energy Starter Cultures at Commercial Scale

Hi Tech Biosciences India Ltd, Pune

Deliverables:

- Production of R- and S- Mandelic acid, Phenylacetaldehyde at 2000 L scale
- Bio-energy starter cultures for Anaerobic Fungus at 10000 L scale

Applications and current status:

- Mandelic acid is considered an essential precursor in several drugs. R-Mandelic acid enhances skin appearance by promoting collagen production and regulates unclog pores, sebum production, and reduces inflammation owing to which reduction in acne breakouts is visible.
- S-Mandelic acid helps to exfoliate the skin gently compared to other Alpha Hydroxy Acids (AHAs) and reduces epidermal penetration and provides more exfoliation with less irritation. Used as an active ingredient in cleansers and also used as an anti-aging ingredient in cosmetics.
- Phenylacetaldehyde is Used in Fragrances and flavors, Polymers and as Natural Medicine.
- Bio-energy Starter Cultures can be used for Biogas Production, Biofuel Production and for Bio-based Chemicals

India is the largest importer of Mandelic acid derivatives and Phenylacetaldehyde

Impact on Indian economy:

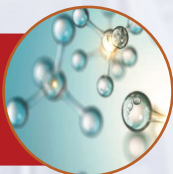
Significant positive impact on the Indian economy, particularly as import substitution & foreign exchange savings, boost to indigenous manufacturing.

Services to be offered:

Early-Stage Technology Support, Process Development, Large-Scale Validation, Contract Manufacturing and Commercialization

Biomanufacturing for Cosmetic Industry:

Production of drug intermediates and bio- energy starter cultures



Facility with Pilot Scale and large Scale Fermenters for Precommercial Production of APIs

Embio Limited, Mumbai

Deliverables:

- Production of Nor-Ephedrine at 1 KL scale
- Levodopa - 20 KL for Levodopa biomass, 10 KL for Pyruvate and 10 KL for biotransformation reaction

Applications and current status:

- Levodopa has use in Parkinsons disease, currently imported from China.
- Nor-ephedrine is Used to make API's with end use applications in Hypotension, HIV, Anti- obesity and ADHD, currently produced via a semi-synthetic route

Impact on Indian economy:

- Indigenous production of levodopa will reduce the import dependency
- Nor-ephedrine produced via complete bioprocess route in this facility represents a shift towards greener technologies

Services to be offered:

- End to end services in Concept R&D, scale-up, commercial manufacturing and regulatory support
- In-house analytical method development, Biosafety approvals, environmental risk management
- Effluent treatment strategy and Marketing support through existing clientele and distribution channelst

Transforming Pharmaceutical Industry:

Indigenous Bio-based manufacturing of Active Pharmaceutical Ingredients (APIs) to shift towards greener alternatives



Fermentation Facility for Functional Foods, Smart Proteins, Bio-based Chemicals, Enzymes and Precision Biotherapeutics

Laurus Bio Pvt. Ltd, Visakhapatnam

Deliverables:

- Production of two of recombinant Albumin, recombinant intermediate for S-MOIPA (methoxy propylamine), Serratiopeptidase at 100 KL scale
- Production of Single cell protein at 100 KL fermentation capacity

Applications and current status:

- Recombinant albumin is a protein produced through genetic engineering, has various applications in medicine and biotechnology, including stabilizing vaccines, enhancing cell therapy, and serving as a carrier for drug delivery. It can also be used as an excipient in pharmaceutical formulations and for stabilizing biological material : In India the market demand for albumin is around 140 tons per annum.
- Serratiopeptidase is a proteolytic enzyme having immense applications in therapeutic areas. The global serratiopeptidase market, valued at \$144 million in 2025 is projected to reach \$291 million by 2033.
- Enzyme for S-MOIPA (Methoxy propylamine) is primarily used in research labs for synthesizing new molecules, including pharmaceuticals and agrochemicals. The demand for S-MOIPA is primarily driven by the ongoing research and development efforts in pharmaceuticals, agrochemicals
- Single cell protein (SCP) offers a sustainable solution for low-cost and high-quality protein supplements. The global SCP market is projected to reach \$18.5 billion by 2030

Impact on Indian economy:

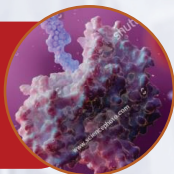
Indian as well as global market demand will be met sustainably and at competitive price.

Services to be offered:

Biomanufacturing facility for recombinant proteins, enzymes, functional foods, smart proteins, bio-based chemicals, biopolymers etc.

Bio-based production of recombinant proteins:

Facility for recombinant proteins as therapeutics, functional foods and supplements



State of the art Facility for Commercial Production of Monoclonal Antibodies and Biosimilars

Virchow Biotech Private Limited, Hyderabad

Deliverables:

- Commercialization of Rituximab, Glargine and Liraglutide and Scale-up of Rituximab to 2000L
- Completion of Phase I clinical trials for new Insulin formulation and Semaglutide

Applications and current status:

- Rituximab is used for the treatment of Non-Hodgkin's Lymphoma (NHL), Chronic Lymphocytic Leukemia (CLL), Rheumatoid Arthritis (RA). 32.7 million USD worth of Rituximab currently imported
- Insulin & Glargine are used in Diabetes treatment. In 2023, India imported \$32.08 million worth of insulin and its salts with a total quantity of 2,033 kg.
- Liraglutide and Semaglutide are used in Diabetes treatment and Obesity control. 115 million USD worth of these products were imported.

Impact on Indian economy:

Calculations indicate the cost reduction of 20% enabling to achieve significant market share.

Services to be offered:

Clinical material generation and commercialization of mAbs and biosimilars.

Indigenous Affordable Treatments:
Production of therapies to meet market demand



AGRI-FOOD

State of the art Bio-Foundry for Pilot Scale Production of Biopesticides from Plant and Microbial Sources

Institute of Pesticide Formulation Technology (IPFT), Gurugram

Deliverables:

- Pilot scale process design and development for production of microbial and plants-based pesticides
- Suitable formulations with 100Kg/L per batch.
- Scale up for microbial and plant based biopesticide formulations.

Strengths:

- 8 Biopesticides formulated and transferred to industry

Impact on Indian economy:

- The global market demand for biopesticides is projected to increase upto USD 20 billion by 2030 and Indian market upto Rs. 3500 crores by 2030.
- Promotes self-reliance (Atma Nirbhar) through indigenous manufacturing by reducing dependency

Biopesticides for sustainable Agriculture:
Bio-manufacturing of pesticides for improving soil health



Bio-Foundry in the area of Agri-food, Nutrition & Biomanufacturing

BRIC-National Agri-Food and Biomanufacturing Institute (NABI), Mohali

Deliverables:

- Natural colourants and pigments from anthocyanin, betalain, Canthaxanthin, Prodigiosin (100g).
- Low calorie sweeteners xylitol (50g scale to Multi Kilo Scale).
- Smart protein from corn starch industry waste (10-50g Scale to Industrial Kilo Scale).
- Production of Levulinic acid and its derivatives as bioplasticizers for food packaging (5 Litre to Several Kg).

Strengths:

- First Biomanufacturing institute in the country.
- Platform for scale-up of Agri-Food products (smart protein & bio-based chemicals and enzymes).

Impact on Indian economy:

- Global xylitol market is projected to reach USD 1,475.87 million by 2030, growing at a CAGR of 6%.
- Global food colorants/ pigment market is expected to reach USD 6.0 billion by 2028.
- Plant-based protein market is forecast to reach USD 17.4 billion by 2027.
- Levulinic Acid (LevuA) market size is projected to reach USD 83.83 billion by 2030.

Scale up boost for Agri-Industry:

New facility for a seamless scale up of high value, high demand agri-products



Plant to Scale up the Production of Gluconates

Agilent Bioplus LLP, Ahmedabad

Deliverables:

Production of 8 tons/day of Gluconates (Calcium Gluconate or Sodium Gluconate) at 20,000 L scale.

Applications and current status:

- Calcium gluconate is used in the pharmaceutical, food, and industrial sectors. It serves as a calcium supplement in pharmaceuticals, is used in food fortification, and also has applications in industrial processes like cement production.
- Sodium gluconate is used as a chelating agent in food-grade cleaning solutions, in food preservation, and as a retarding agent in cement production
- Calcium Gluconate and Sodium Gluconate are not manufactured in India, with nearly 100% of the demand met through imports from China

Impact on Indian economy:

- Contributes significantly to saving over 40 crore INR in foreign exchange
- Local production will help reduce dependency on imports

Services to be offered:

Provide scale-up services to external users working on similar products.

A Step towards self reliance:

Strengthening domestic production of gluconates for the Pharmaceutical and Food Industry



QMS Compliant facility for commercial Production of Fructo- Oligosaccharides (FOS)

Revelations Biotech Pvt Ltd, Hyderabad

Deliverables:

- Commercial scale Production of Fructo-oligosaccharides of L-65, L-95 and P-95 grades
- Scale up of Brazzein to precommercial scale

Applications and current status:

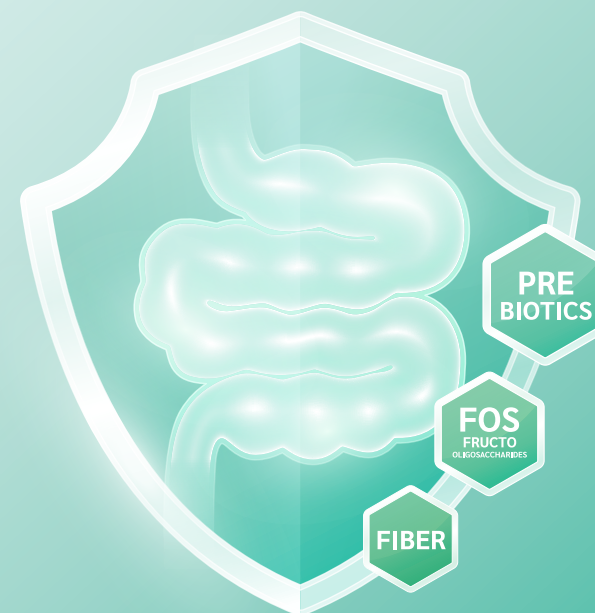
- Fructo- oligosaccharides are prebiotics with applications in food industry, used as supplements, low calorie sweeteners and improve digestive health
- Demand for FOS is huge and India imports more than 16000 MT of FOS annually
- Global demand for FOS is about 500000 MT year

Impact on Indian economy:

- Technology to be developed will make India self-sufficient as well as the leader in FOS manufacturing.
- Project helps to support sugarcane farmers and sugar mills in India since the primary raw material for FOS production is Sugar

Services to be offered:

Scale up services shall be offered for the companies relevant to the facility created.



Biomanufacturing for Gut Health:

Indigenous production of Fructo- oligosaccharide (FOS) as prebiotics for digestive health



Fermentation Facility at 1 KL Scale for Food based Products, food Additives, Probiotics and Cell Growth Stimulators

HiMedia Laboratories Pvt Ltd, Mumbai

Deliverables:

- Production of Gellan gum and Probiotic products at 1 KL scale
- Growth factors at 100 L scale

Applications and current status:

- Gellan Gum is widely used as a gelling agent, stabilizer, and thickener, especially in dairy beverages, desserts, jams, and pet foods
- Probiotic Cultures are utilized for managing Irritable Bowel Syndrome (IBS) and Inflammatory Bowel Disease (IBD), antibiotic-associated and traveler's diarrhea; enhances gut microbiota and immunity, promotes digestion and nutrient absorption in livestock and can be applied as plant growth-promoting agents, improving crop yield and soil fertility
- Growth Factors (e.g., EGF, PDGF-BB, IGF-1, FGF) are essential in regenerative medicine, cell proliferation, wound healing, and as critical components of eukaryotic cell media for research and therapeutic applications

Impact on Indian economy:

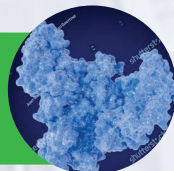
- Substantial reduction in import dependency
- Supports the objectives of Atmanirbhar Bharat and Viksit Bharat 2047 through indigenous bio- manufacturing capabilities
- Enable foreign exchange savings and opens avenues for exports, enhancing India's presence in global biotech market

Services to be offered:

Affordable access to fermenters, clean rooms, and analytical tools for academic and early-stage start-ups.

Facility for food- based products:

Scale up of bio- based chemicals for food, pharmaceutical and therapeutic industry



QMS Compliant Facility for Commercial Production of Probiotics and Smart Proteins

Sundyota Numandis Probiocentials Private Limited,
Ahmedabad

Deliverables:

- Production of Probiotics based ingredients such as lactobacilli
- Algal based smart proteins at a scale of 5000L

Applications and current status:

- Lactobacillus strains and algal proteins have varied applications as Probiotics, postbiotics, nutraceuticals and functional foods
- India is largely importing strain specific probiotics

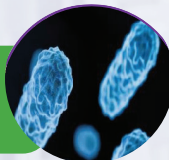
Impact on Indian economy:

- Boosts national bio-economy by producing high-demand probiotics, algal proteins, and fermented bioactive nutraceuticals
- Reduces dependency on major producer markets
- Reduction in imports and increase in exports from India

Services to be offered:

- Support to scale-up relevant indigenous technologies at a commercial scale
- Act as a Contract Development Manufacturing Organization (CDMO)

Strengthening Domestic Probiotics Production:
Boosting domestic production of probiotics and smart proteins



ENERGY/GREEN CHEMISTRY

Biofoundry for Microbial Biomanufacturing

International Center of Genetic Engineering and Biotechnology (ICGEB), New Delhi

Deliverables:

- Production of Cetaryl alcohol, a cosmetic ingredient, and Paraffin in engineered E. Coli. Strains
- 2G ethanol production from biomass hydrolysate by genetically engineered yeast
- Grain-based ethanol production by thermotolerant yeast *S. cerevisiae* NGY10

Strengths:

Cellulolytic enzyme technology using recombinant fungal platform scaled up to 15,000-liter scale.

Impact on Indian Economy:

The technology to be developed by ICGEB is expected to provide import-substitute for yeast to be used in ethanol fermentation.

Sustainable Biofuel Production:

Platforms for ethanolic compounds to boost cosmetic and energy Industry



Facility to Support Development and Scale-up of Products used in Cosmetics, food, Pharma and Bioplastic Industry

IIT Madras with TICEL Bio Park Ltd., Chennai

Deliverables:

Production of Hyaluronic Acid, Pure Isomers of D & L- Lactic Acid, Acetoin, Muconic acid, Protocatechuic acid and Therapeutic products.

Applications and current status:

- Hyaluronic Acid (HA) for Cosmetics and pharmaceutical industry.
- Lactic acid serves as a building block for poly lactic acid (PLA) which has applications in bioplastics and have applications in Pharmaceutical, Food and Chemical Industries.
- Acetoin i.e. (3-hydroxybutanone) is a natural flavor and fragrance compound, widely used in food, cosmetics, pharmaceuticals, and as a platform chemical in bio-based solvents and polymers. Nearly 90–95% of industrial-grade acetoin is imported.
- Muconic acid is a bio-based platform chemical used to produce nylon (adipic acid), Poly ethylene terephthalate (PET) alternatives, plasticizers, and coatings. 100% of current demand is met through imports, as India has no commercial producers of Muconic acid at present.
- Protocatechuic acid has a wide range of applications, primarily in pharmaceuticals and cosmetics

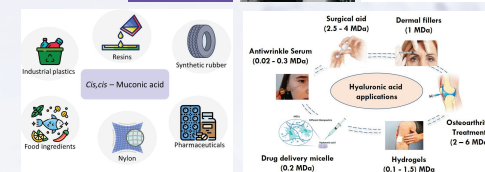
Impact on Indian economy:

Provides an indigenous technology for the production of value-added products and reduces the import cost of raw materials.

Services to be offered:

Modular services for upstream and downstream analytics, characterization, and data handling

A step towards greener chemistry:
Boosting biomanufacturing of bioplastics, cosmetics and pharmaceuticals



Facility for Sequestration of CO₂ and its Utilization for Growing Engineered Microalgal Strains

Jindal Steel And Power Limited, Angul

Deliverables:

Production of Phycocyanin, Astaxanthin, Bio-oil, Biocarbon at the scale of 2-3kg/day.

Applications and current status:

- Phycocyanin is a blue pigment-protein complex (E-18) and a natural food colorant, Dietary supplement, and a potential pharmaceutical agent.
- Astaxanthin is a food colorant and functional ingredient in the food industry, component in nutraceuticals and dietary supplements, and has applications in cosmetics for its anti-aging and UV- protective effects.
- Bio-oil is a source of affordable energy used in boilers and heavy duty engines. Serves as a source for high value chemicals, binders and functional carbon materials.
- Biocarbon is used in energy production, soil improvement, environmental remediation, and material science

Most of the requirement of these pigments is met through import currently

Impact on Indian economy:

- New sector contributing to the bioeconomy and green GDP reduced
- Petrochemical imports and increased exports

Services to be offered:

Contract biomanufacturing services.

Carbon capture for Biofuel and pigment manufacturing:

Achieving lower emissions and clean Energy





सत्यमेव जयते

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