

DBT-BIRAC Joint Call for Proposals on ‘Smart Proteins’

for Fostering High Performance Biomanufacturing under BioE3 Policy

1. Background

The **BioE3** (**B**io**E**chnology for **E**conomy, **E**nvironment & **E**mployment) **P**olicy for ‘*Fostering-High Performance Biomanufacturing*’ has been approved by the Union Cabinet in August 2024. The Policy lays down the framework for high-performance Biomanufacturing, to accelerate the development and scale up of Bio-based products in the country. Biomanufacturing can fundamentally transform the global economy from today’s consumptive manufacturing paradigm to the one based on regenerative principles and will play a pivotal role promoting in ‘*Green Growth*’ while driving country’s Bioeconomy.

2. Scope of the Call

Smart Proteins has been identified as one of the thematic subsectors under the BioE3 Policy for ‘*fostering high-performance biomanufacturing*’. Traditional food systems contribute significantly to carbon emissions, resource overuse, and challenges like food insecurity, climate change, and zoonotic diseases. As demand for food rises, scaling these systems threatens sustainability. Smart proteins offer efficient alternatives with reduced land, water, and energy requirements. These proteins address nutritional needs and widespread protein deficiencies while reducing environmental impact.

Hence, DBT and BIRAC aim to foster an innovative ecosystem for enabling the development of a sustainable biomanufacturing ecosystem that delivers high-quality, affordable ‘Smart Proteins’ to meet India’s nutritional and economic aspirations.

In view of this, DBT and BIRAC invite proposals for the development of ‘Smart Proteins’, including fermentation-derived, plant-based, and cell culture-based proteins. The emphasis is on transformative research to enhance smart protein production efficiency, safety, and affordability while addressing scalability

challenges. The proposals will be invited under two categories:

- (i) Discovery & Application-oriented Integrated Network Research; and
- (ii) Bridging the Gaps for scale up.

2.1 Discovery & Application-oriented Integrated Network Research: (Expected Outcome – TRL: 3-5)

Under this category, the proposals should focus on proof-of-concept development and applied research to validate the feasibility of innovative ideas and technologies for Smart Protein Biomanufacturing in the following sub-sectors:

2.1.1 Fermentation-derived Smart Proteins and Single Cell Proteins

- Design and development of recombinant microbial systems for Precision Fermentation of smart proteins.
- Building programmable microbial systems using synthetic biology to streamline metabolic pathways for higher protein yields.
- Utilizing genetic engineering/gene editing to enhance strain productivity and reduce by-products such as RNA.
- Optimising biotechnological approaches to remove allergens and toxins from microbial proteins, enhancing safety profiles.
- Development of alternative, renewable feedstocks such as agricultural by-products or low-cost carbon sources to reduce dependency on glucose.

2.1.2 Plant-Based Smart Proteins

- Utilizing untapped crops and agro-industrial by-products for sustainable protein extraction with high protein solubility and functionality.
- Development of co-extraction methods for balanced amino acid profiles.
- Designing and developing blended protein matrices combining plant-based and fermentation-derived proteins to optimize texture, flavour, and nutrition for hybrid products.
- Development of flavour-masking solutions to address off-flavours in plant protein formulations.
- Investigate the use of shear-cell or extrusion technologies to improve the

texture and taste of plant-based meat analogues.

- Addressing safety concerns including pesticide residues, anti-nutrients and allergenicity through enzymatic extraction and genetic engineering/gene editing.

2.1.3 Cell Culture-based Smart Proteins

- Formulating cost-effective, plant-based or recombinant serum-free growth media tailored to Indian conditions.
- Identification and validation of essential growth factors to optimize cell proliferation and differentiation.
- Developing functionalized edible scaffolds from natural materials like nanocellulose and alginate to improve texture and structural mimicry of meat.

2.2 Bridging the Gaps for Scale-up: (Expected Outcomes - TRL: 5-7)

Under this category, proposals should focus on scaling validated technologies from the laboratory to pilot-scale levels or pre-commercial, focusing on efficiency, techno-economic viability and sustainability of Smart Protein Biomanufacturing in the following sub-sectors:

2.2.1 Fermentation-derived Smart Proteins and Single Cell Proteins

- Integrating AI-driven optimization tools for real-time monitoring and predictive control of fermentation parameters such as pH, oxygen, and temperature for maximal protein yield.
- Advanced engineering to build modular bioreactors adaptable to various strains and multi-product outputs to enhance scalability and efficiency.
- Developing non-chromatographic techniques such as membrane filtration or precipitation for protein purification to reduce costs.

2.2.2 Plant-Based Smart Proteins

- Optimize extrusion and texturization methods tailored to regional and cultural food preferences.
- Developing methods to scale-up protein isolation and texturization processes while reducing energy consumption.

- Developing bio-based preservatives and packaging solutions to enhance the shelf life of plant-based protein products.
- Exploration of residual biomass utilization and life cycle assessment analysis.

2.2.3 Cell Culture-based Smart Proteins

- Addressing sensory, nutritional, and textural differences between lab-scale and bioreactor-scale production of cell-culture-derived meat.
- Development of high cell density and fed-batch fermentation techniques for optimal yield of cultivated meat.
- Develop scalable 3D printing technologies to produce food-safe, customizable scaffolds for large-scale cultivated meat production.

3. Key requirements for the proposed projects

- a. Developed technology (if applicable) should be sustainable from an economic and environmental point of view and the technology should be scalable.
- b. Gap in the technology to be addressed and strategies proposed to address the gap should be outlined clearly.
- c. Proposals must mention the present TRL level of the technology and the TRL proposed to be attained at the end of project duration
- d. The proposal should strictly adhere to the prescribed proforma.
- e. The proposals with clear focus and likely execution of deliverables within timelines will be preferred.
- f. All proposals must adhere to statutory regulatory requirements.

4. Mode of Submission

Proposals may be submitted by both Academia and Industry applicants, either independently or as a collaborative project.

- a. **For proposals from Academia/Research Institutions:** Interested applicants should submit the proposals in the prescribed format duly forwarded by the executive head of the institution through the Department's e-ProMIS portal (www.dbtepromis.nic.in).

b. For proposals from Industry and Industry-Academia collaboration:

Interested applicants should submit the proposals in the requisite format duly forwarded by the executive head of the Company/LLP/Institution by logging to the BIRAC website (www.birac.nic.in).

5. Eligible Organizations

5.1 Academic Organisations

- a. Proposals may be submitted by interested applicants engaged in research activities at various Institutions/Universities/Societies/Trusts/NGOs/Foundations/ Voluntary Organizations, recognized as a Scientific and Industrial Research Organization (SIRO).
- b. The Principal investigator must have at least four years of the employment remaining in the institution at the time of proposal submission.

5.2 Industry

- a. Eligibility criteria for the industries will be as per “*Implementation Plan for the Biomanufacturing and Biofoundry Initiative*” attached at ANNEXURE I.
- b. Pre-requisite documents required to be submitted by the Industry as per the BIRAC norms are as follows:

5.2.1 Companies/Startups

- a. Incorporation certificate.
- b. CA/CS certified share holding pattern as per BIRAC format (Companies having a minimum of 51% Indian shareholding / individuals holding Indian passports are only eligible) mentioning UDIN number.
- c. Details regarding in-house R&D facility, if any; or Incubation Agreement with recognized Incubator.
- d. Audited financial details of latest last three financial years,
- e. Copy of passports of the shareholders if required (in support of 51% eligibility criteria).

5.2.2 Limited Liability Partnership

- a. Incorporation/Registration Certificate.
- b. Partnership deed: CA/CS certified certificate which states that minimum half of the partners are Indian citizens mentioning UDIN number.

- c. Copy of passports of Indian partners/subscribers
- d. Research mandate/ details regarding in-house R&D facility, if any/ Incubation agreement
- e. Audited financial details for the last three financial years

Companies/LLP if recommended have to provide a declaration stating that Company/LLP is not in default of BIRAC OR any other organization. Further there are no Legal Proceedings going against the applicant.

6. Evaluation Criteria

The proposals will be evaluated as per existing norms of DBT and BIRAC.

7. Funding Modalities

- a. Projects that have academic partners only will be funded by DBT. Projects involving Academia and Industry or only Industry will be supported by BIRAC.
- b. Extent of funding will depend on the proposed activities and will be in alignment with the “*Implementation Plan for the Biomanufacturing and Biofoundry Initiative*” attached at ANNEXURE-1.
- c. Project duration will be up to 2 years, extendable up to 5 years based on the performance.

8. Scope of Intellectual Property Generated During the Duration of the Project

The Intellectual Property (IP) generated during the duration of the project will be in accordance with the IP Policy of DBT and BIRAC.

9. Discretion

DBT/ BIRAC shall reserve the discretion on determination of sanction of funding and processes as per its standard norms and such determination shall be final. The selection process is not open to review.

10. Contact Information

Any queries may be addressed to the e-mail: BioE3-smart-proteins@dbt.nic.in

Last date for submission of proposals has been extended till 5th April 2025.