DBT- BIRAC Joint Call for Proposals on 'Enzymes' for

Fostering High Performance Biomanufacturing under BioE3 Policy

1. Background

The **BioE3** (**Bio**technology for **E**conomy, **E**nvironment & **E**mployment) **Policy** 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

Enzymes hold immense potential to unlock new opportunities for innovative technologies due to their specificity, efficiency and wide range of applications across various sectors, including industrial processes and biocatalysis. Although India possesses adequate infrastructure for lab scale enzyme research, it requires a prioritized and focused attention for scaling up. Further, with the push for net-zero targets, industrial enzymes global demand will continue to grow in coming decades because of the inherent benefits that enzymes bring across various sectors.

Hence, DBT and BIRAC aim to foster an innovative ecosystem to establish enzyme biomanufacturing as an economically viable and environmentally sustainable solution, by addressing the key challenges of high production costs, efficiency & scalability.

In view of this, DBT and BIRAC, invite proposals on 'Biomanufacturing of Enzymes' with the objective of building capabilities and infrastructure in advance enzyme technology, to develop a pipeline of indigenous and affordable enzymes for the following set of Enzymes:

a) **Enzymes for the biotransformation of low-cost feedstock into high value functional biomolecules** like D-allulose 3-epimerase, Trehalose Synthase, Amylosucrase, Glutamate decarboxylase, Cellobiose 2-epimerase, β-galactosidase etc**.**

b) **Biomass hydrolyzing enzymes focusing on the efficient conversion of lignocellulosic biomass into fermentable sugars** like endoglucanases, exoglucanases, beta-glucosidases, monooxygenases, esterases and xylanases, etc.

c) Enzymes for biotransformation towards production of Specialty Chemicals / APIs for the pharma industry like ammonia lyase, peroxygenases, nitrilases, lipases, ketoreductases omega-transaminases etc.

The proposals will be invited under the two categories:

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

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

Proposals under this category should focus on proof-of-concept development and applied research to validate the feasibility of innovative ideas and technologies so as to reach Technology Readiness Level (TRL) 3-5 for the class of enzymes mentioned above. The proposals should focus on:

- Discovery, design and characterization of novel enzymes with high catalytic efficiency, enhanced stability, specificity, activity, or newer applications
- Development of enzyme platform for producing Active Pharmaceutical Ingredients (APIs)
- Development of advanced enzyme engineering techniques for production of valuable chemicals, biofuels, and pharmaceuticals for industrial use in biomanufacturing
- Demonstrating the bioproduction of enzymes in a bioreactor (at less than 100 Litre)
- Outlining the minimal bench mark (titre/productivity/scale) for the product.

2.2 Bridging the Gap for Scale up (Expected Outcomes- TRL: 5-7 or above)

Proposals under this category should focus on scaling validated technologies (ready for late stage validation/scale-up) where the proof-of-concept is established for advancing the

Technology Readiness Level (TRL) to 5-7 or above for the class of enzymes mentioned above. The proposals should focus on:

- Optimization, upscaling and down-streaming (recovery & purification) of existing technologies
- Extensive strain engineering in the established strains for further yield/titer improvement
- Outlining the minimal bench mark (titre/productivity/scale) for the product.

3. Key requirements for the Proposed Projects

a. Name of the background strain, procurement source, IP associated with the strain or tools used, if the strains are genetically modified
b. Present TRL level of the technology and the TRL proposed to be attained at the end of project duration
c. Outline the minimal benchmark (titer/productivity/scale) proposed to be attained for the selected enzyme.
d. Gap in the technology to be addressed and strategies proposed to address the gap
e. Sustainability of the process from an economic and environment point of view
f. Scalability of the technology and its commercialization potential
g. All proposals must adhere to statutory regulatory requirements.

4. Mode of Submission

Proposals maybe 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 shareholding 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 of 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 having 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 upto 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-enzymes@dbt.nic.in

Last date for submission of proposals is 30th April, 2025

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