

**GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY**

**RAJYA SABHA
UNSTARRED QUESTION NO. 4455
ANSWERED ON 02/04/2026
“BioE3 Policy”**

4455: Shri Bhubaneswar Kalita:

Will the Minister of *Science and Technology* be pleased to state:

- (a) the key objectives and features of BioE3 Biotechnology Policy and how it supports India’s leadership in biotech research and innovation;
- (b) the details of experiments conducted on micro-algae and cyanobacteria like Spirulina and Synechococcus and their role in space nutrition, oxygen production and waste recycling;
- (c) the significance of newly inaugurated Department of Biotechnology-International Centre for Genetic Engineering and Biotechnology (DBT-ICGEB) Biofoundry in New Delhi and its role in supporting the Design-Build-Test-Learn (DBTL) cycle; and
- (d) The manner in which it contributes to the development of biotech products for sectors like food, agriculture, chemicals, pharmaceuticals and energy?

ANSWER

MINISTER OF STATE (INDEPENDENT CHARGE) FOR THE
MINISTRY OF SCIENCE AND TECHNOLOGY & EARTH SCIENCES
(DR. JITENDRA SINGH)

- (a) The BioE3 Policy sets forth a framework that ensures the adoption of cutting-edge advanced technologies (such as genome editing, synthetic biology, metabolic engineering, bioprocess engineering, data science and AI/ML tools etc.) and innovative research to revolutionise biomanufacturing processes for accelerating the development and scale-up of high-value bio-based products. Six thematic areas of national importance have been identified for implementation under the Policy. These include (i) Biobased chemicals, Biopolymers, Active Pharmaceutical Ingredients (APIs) and Enzymes; (ii) Smart Proteins and Functional foods; (iii) Precision biotherapeutics, (iv) Climate resilient agriculture, (v) Carbon Capture and utilization; and (vi) Marine and Space Research.

In order to augment research and scale up across the six thematic verticals, the Policy aims at setting up of state-of-the-art shared facilities, the “मूलभूत BioEnablers including Bio-Artificial intelligence Hubs, Biofoundries and Biomanufacturing Hubs” across the country in PPP. Bio-AI aim at building data-driven, cutting-edge, programmatic research support for the Biomanufacturing initiative. The outcomes are expected to provide critical and novel research leads impacting Health, Agriculture and Environment. The Biofoundries are designed to foster innovation while incorporating integrated facilities for early scaling-up of proof-of-concept developments established

by academia, SMEs, and industries. The Biomanufacturing Hubs focus on creating shared pilot-scale and pre-commercial-scale facilities designed to bridge the gap between laboratory research and full-scale manufacturing. These Hubs will serve as critical infrastructure for startups, academic institutions, and small and medium enterprises (SMEs), allowing them to access the necessary resources to scale up their innovations without the high upfront costs typically associated with building independent facilities. The Policy will thus support India's leadership in biotech research and innovation, and effectively steer India towards becoming a global biomanufacturing hub.

- (b) Three indigenous robust microalgal species namely, *Chlorella sorokiniana*-I, *Parachlorella kessleri*-I and *Dysmorphococcus globosus*-HI, were experimented on the International Space Station (ISS) to study the impact of microgravity, CO₂ and O₂ levels simultaneously in space and on the Earth (indoor lab). In the second experiment, two cyanobacteria strains i.e., an Indian isolate of *Spirulina*, and a very fast-growing *Synechococcus* strain were also experimented for their growth on two different nitrogen sources, nitrate and urea in the microgravity conditions provided by the ISS. These microalgae have the potential to function effectively in microgravity environments and grow fast on Earth to produce value-added products of industrial importance, while in space, capturing excess CO₂ from the ISS cabin and making vital nutrients and food supplements to support the astronauts' lives in space. On the other hand, the cyanobacteria experiment is expected to demonstrate the ability of cyanobacteria to recycle both C and N and will be an important progress towards developing cyanobacteria-based biological life support systems for futuristic space missions.
- (c) The newly inaugurated DBT-ICGEB Biofoundry in New Delhi serves as a transformative hub for interdisciplinary research. The facility bridges the gap between laboratory innovation and industrial-scale biomanufacturing. Its primary significance lies in its ability to provide high-end technology, fostering a collaborative ecosystem in which start-ups and established industries can accelerate the development of high-value microbial products. The Biofoundry contributes to the Design-Build-Test-Learn (DBTL) cycle by providing an integrated, high-throughput workflow that replaces slow, manual processes with bio-automation and Artificial Intelligence. Through specialised training workshops—such as the "Bench to Bioautomation" sessions held in March 2026—the Biofoundry ensures that the next generation of scientists can master these automated cycles, significantly shortening the timeline for microbial strain improvement and enhancing the precision of modern biomanufacturing.
- (d) The DBT-ICGEB Biofoundry in New Delhi significantly advances the development of biotechnology products across the food, agriculture, chemicals, pharmaceuticals, and energy sectors by bridging the critical gap between laboratory-scale research and commercial-scale production. It acts as a bridge between small laboratory experiments and large-scale factory production. The facility uses bacteria and yeast as "microbial platforms," and has the ability to scale up the production to 20 litres. This is important for the rigorous validation of bio-based solutions and ensures a seamless transfer of these technologies to industry partners for market entry. By providing high-tech tools and expert training, the Biofoundry helps startups and researchers speed up their work, bringing better and more sustainable products to the market faster.