



## Scheme for Transformational and Advanced Research in Sciences

Second Call for Proposal | December 2019

### Guidelines for Preproposal Submission



**MHRD**

Government of India  
Ministry of Human Resource Development



**Indian Institute of Science**  
**Bangalore - 560012**

<https://stars.iisc.ac.in/>

## Introduction

Scheme for Transformational and Advanced Research in Sciences (STARS) for promoting translational, interdisciplinary and India-centric research in sciences, supported by Ministry of Human Resource Development (MHRD), implemented and managed by Indian Institute of Science (IISc), Bangalore.

With the key objective of supporting socially relevant research, the following 6 basic thrust areas have been identified:

- ❖ Physical Sciences
- ❖ Chemical Sciences
- ❖ Biological Sciences
- ❖ Nano Sciences
- ❖ Data Science & Mathematics
- ❖ Earth Sciences

### **The Key Objectives of the Scheme:**

- ❖ To fund science projects which are translational, i.e. which have direct implications for the progress of the country, through a competitive process in an open and transparent manner.
- ❖ Basic thrust would be to take stock of an existing problem and work backwards towards conducting research for a solution.
- ❖ Promoting an inter-disciplinary & translational approach in research for synergy, de-duplication and greater comprehensiveness & relevance of research activity.
- ❖ Orient science towards addressing needs & issues of the country in key sectors like health, agriculture, energy, environment, security etc.

## Priority Research Areas



### Statement

Projects are sought on applications for any branch of PURE and applied Physical Science, with special emphasis on problems of societal relevance. Given the scope of the program, we expect the projects to be ambitious, collaborative and transformative. The quality of science should be of international standard, and should involve substantial theoretical/experimental components.

### Priority Areas

- ❖ Quantum Technologies : Quantum Information Sciences, Quantum Computing, Quantum Communication and Quantum Sensing.
- ❖ Photonics and Quantum Photonics.
- ❖ Designing Self Assembled Functional Materials / Robotics with Control and Adaptation, Reprogrammable Group/Collective Dynamics Soft Engineering, Reprogrammable Soft Materials, Physics of living systems.
- ❖ Advanced Hard Materials (smart / high strength / Energy storage and harvesting). Topological matter, novel superconductors.

## Priority Research Areas



### Statement

Proposals that involve probing fundamental aspects of chemical science, synthetic, computational and physical as well as analytical, that would lead to translational output, particularly on immediate relevance to the societal needs are welcome. The areas mentioned below are notional and are not restrictive. However, the projects are expected to lead to demonstrable outcome in terms of applications.

**Major Goal:** Ability to design and manipulate matter using principles of chemistry

### Energy conversion and Storage

- ❖ Understanding Electron / Ion Coupled Transport in various systems.
- ❖ Catalysis – Development of novel catalysts for dinitrogen and C=O bond activation.
- ❖ Chemical / photochemical and Electrochemical aspects of conversion and storage, role of electrolyzers and reformers / New approaches for heterogeneous catalysis, e.g., using porous organic polymers (POPs).

### Organic and Bio-catalysis – Catalysis on Demand

- ❖ Novel aspects of asymmetric synthesis / catalysts / enzymatic reactions / soft Matter / chemical biology / Sustainable chemistry and waste utilization, e.g., plastics and polymers.

**Capture, Utilization and Storage of Small Molecules such as CO<sub>2</sub> , Reversible Hydrogen Storage and conversion to useful products/ Scavenging of pollutants (from environments, water, air, etc.) by new mechanisms.**

**New functional molecules and functional materials, including supramolecular systems.**

- ❖ Application in the fields of health, environment, and safety and their translation to products/devices.
- ❖ Products for air and water purification, disease diagnosis and therapy.

## Priority Research Areas



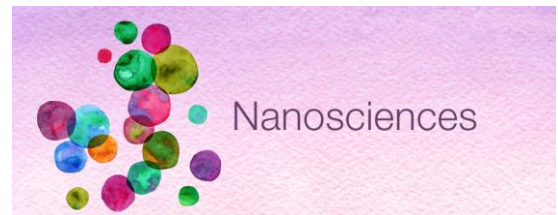
### Statement

Projects are sought towards addressing India-centric problems in the broad areas of (1) Nutrition and health, (2) Biodiversity, (3) Infectious diseases,(4) Human genetics and non-communicable diseases. The projects could address specific problems in any of these areas, or subdisciplines within these areas, through either an integrated approach or through approaches tackling a specific aspect of the problem. Potential approaches could include those involving either genetics, biochemistry, genomics, metabolomic, chemico-biological, biophysical or structural studies, ecological or evolutionary approaches, theoretical modelling, or engineering or systems-level approaches in organisms that are relevant for the above areas.

### Priority Areas

- ❖ Nutrition and health.
- ❖ Biodiversity.
- ❖ Infectious diseases.
- ❖ Human genetics and non-communicable diseases.
- ❖ Crop protection and value addition

## Priority Research Areas



### Statement

The research proposals in the domain of Nanoscience will be encouraged along the lines of application areas that are both cutting-edge globally, and relevant nationally – from the perspectives of Security, Healthcare, Agriculture, Pedagogy, Environment and Energy ('SHAPE'). The broad project objectives should concentrate on a set of clear, measurable and visible deliverables, based on the proof of concept already established by the PI. The proposal should focus on the research that can be translated into visible and commercially viable deliverables by indicating the current and projected Technology Readiness Level (TRL).

### Priority Areas

- ❖ Nanoscience and technology for emerging electronics, photonics and heterogenous nano systems.
- ❖ Nanoscience and technology for Security, Healthcare, Energy and Environment.

## Priority Research Areas



### Priority Areas

- ❖ Use of techniques from differential equations (ordinary or partial), random processes, etc. to model phenomena in meteorology, oceanography, environmental sciences, epidemiology, geophysics, etc. with accompanying analysis and/or numerical or simulation techniques.
- ❖ Application of statistical methodologies to medicine, weather prediction, disaster prediction (e.g., earthquakes), environment, and so on.
- ❖ Application of algebra, algebraic geometry, number theory, etc. to problems relevant to national security such as coding theory and cryptography.
- ❖ Application of statistical methodologies and optimization in logistics applied to areas such as defence, disaster management, etc.
- ❖ Development of provably effective algorithms for analysis of large data sets of social relevance such as in problems of resource allocation.
- ❖ Application of dynamical systems and control theory to robotics, aerospace engineering, etc.
- ❖ Applications to medicine (medical image analysis, tomography, dosage optimization)
- ❖ Modelling and analysis for meteorology, oceanography etc., (monsoon modelling, disaster prediction)

This list is suggestive and not exhaustive. The projects are required to be translational, in the sense that the research should demonstrably lead to concrete results in the domain for which the application is intended and not merely be an 'in principle' or 'proof of concept' result. At the same time, it should not be a routine application of existing techniques.

## Priority Research Areas



### Statement

Projects are to focus on the interacting earth system processes and their feedback mechanisms that are critical to the sustainability of our planet through (a) exploration and sustainable exploitation of natural resources; (b) quantifying impacts of anthropogenic forcing on climate change and its environmental, social and economic impacts; (c) risk assessment from natural hazards like earthquakes, tsunamis, cyclones, landslides, avalanches, floods etc. and (d) development of models of interactions between lithosphere-atmosphere-hydrosphere-cryosphere and biosphere.

### Priority Areas

- ❖ Assessment of groundwater reserves, quality assessment and projections for future leading to conservation and longevity of quality and quantity.
- ❖ Climate change through time and impacts on cultural and economic development – focus on rivers (migration of civilizations, influence of river systems, impacts on environment and projections to future); evolve strategies for management of the river basins.
- ❖ Accounting for the Himalayan glaciers and their vulnerability; avalanche hazard zonation; retreat of glaciers and long-term impact on river water budgets, potential remedial measures.
- ❖ Landslide risk zonation, construction and development- roadmaps to development of vulnerable regions.
- ❖ Protection of coastal zones- mapping the limits of coastal inundation from sea surges (cyclones and tsunamis) considering sea level changes in the past and projections to future based on climate change models, surface water-aquifer interactions, submarine groundwater discharge, and salt water intrusion into coastal aquifers in response to sea level dynamics.
- ❖ Environmental impacts of resource exploitation (mining, quarrying, land reclamation, soil degradation etc), remedial measures.
- ❖ Earthquake and tsunami hazards-mapping the vulnerability zones and impact assessment, increasing preparedness through outreach programs and policy options.
- ❖ Geology and our cultural evolution-river systems and ancient civilizations; development of our heritage structures, building stones, our geological heritages (potential contributions to the natural history museum in plan).
- ❖ Interactions among surface processes, climate and tectonics with focus on human sustainability- coupled surface process-tectonic models, mechanics of erosion, fluvial terrace systems, sedimentary basins and their architecture.
- ❖ Develop a unifying theoretical framework of Critical Zone evolution that integrates physical, chemical and biological processes. Develop coupled system models to explore how CZ services respond anthropogenic, climatic and tectonic forcings and to develop extensive integrated datasets to document a wide range of CZ settings, including geology and climate.



## Guidelines for Preproposal Submission

All the proposals would be received online through STARS website (<https://stars.iisc.ac.in/>)

The procedure adopted in the current funding cycle will be as follows:

1. Submission of pre-proposal: This will include an executive summary, key objectives and optionally schematics of the research idea
2. Blind review: Because we will perform blind review of the pre-proposal, the PI and co-PI(s) must ensure that their identities are not revealed anywhere in this part of the submission. For example, do not use phrases like “As shown in our earlier work” or similar phrases that will reveal the identity of the team. You may refer to publications relevant to the proposed research, but do not mention if these publications are from your group, failing which the proposal can be disqualified. This is critical and mandated by the parent funding agency.
3. Co-PI addition: If co-PI(s) are involved, before starting a new pre-proposal, the applicant should add them using the co-PI menu. Co-PI(s) need(s) to accept the invitation email. Please remember, change of the PI and co-PI(s) team will not be possible later.
4. Invitation for the full proposal: The committee will perform blind review of all proposals and will be inviting selected PIs for full proposal submission.
5. The review of the full proposal will be as per standard procedures, where the identity of the PI and co-PI(s) will be revealed to the reviewers.

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