

**DEPARTMENT OF BIOTECHNOLOGY**  
**MINISTRY OF SCIENCE AND TECHNOLOGY**  
**Block-2, CGO Complex, Lodhi Road, New Delhi 110 003**

**CALL FOR PROPOSALS ON KNOWLEDGE-BASED NANOSCIENCE AND  
NANOTECHNOLOGY FOR APPLICATION IN BIOLOGY**

**THEME:** BASIC RESEARCH AND DEVELOPMENT OF NEW PRODUCTION PROCESSES AND DEVICES USING NANOSCIENCE AND NANOTECHNOLOGY DERIVED KNOWLEDGE-BASED MULTIFUNCTIONAL MATERIALS FOR USE IN AGRICULTURE, MEDICINE, FOOD PROCESSING INDUSTRY AND ENVIRONMENT MANAGEMENT AND THEIR TOXICOLOGICAL STUDIES

Nobel Prize in 1986 was awarded to Gerd Binnig from Germany and Heinrich Röher from Switzerland, for discovering the first Scanning Tunnel Microscope or STM. This invention realized the dream of Prof. Richard Feymann (Nobel Prize winner, Physics, 1965). Therefore, *nanosciences* and *nanotechnologies* made their first tentative appearance two decades ago. Soon it was realized by the researchers that physics and chemistry of life and molecules at the mesoscopic or nanoscopic level (i.e. one billionth of a metre or a nanometer, which is 80,000 times smaller than the width of a human hair) are not only novel but also excitingly new. This wonderful reunion has set the seal on a surprising rapprochement between fundamental research – working at the frontiers of the exploration of matter – and practical applications in a field which is growing all the time. Nanoscience has changed radically the way in which scientists – physicists, chemists and biologists – have studied the atomic and molecular world. Both '*top down*' and '*bottom-up*' approaches are adopted to 'artificially' create molecular nanosystems with very specific properties. Therefore, nanoscience poses a fundamentally new scientific challenge as it requires a command of interactions between atoms. What is more, such interactions are not governed by the principles of traditional physics but by the complex laws of quantum mechanics.

DBT HAS SET FORTH THE FOLLOWING AREAS OF NANOSCIENCE AND NANOTECHNOLOGY KEEPING IN VIEW OF THE PRESENT NATIONAL PRIORITIES AND FUTURE NEEDS OF OUR COUNTRY

- Basic research on nanoscience, nanotechnology and nanomaterials with future scope of application in biology, medicine, drugs, food, nutrition and alleviation of poverty
- Nanoscience and nanotechnology for improving soldiers' and emergency relief workers' lives, health, food and nutrition
- Biochip development
- Diagnostics and therapeutic tools
- Micro-nano technologies
- Applications in health, agriculture, food, environment and industry
- Nano-biotechnologies
- Applications in areas such as health, chemistry, energy and environment
- Nano-biotechnology related to genomics, proteomics
- Toxicological studies of materials developed

These broad areas could be further categorized as:

- Enhancing the protection and survival of soldiers and emergency relief worker's life using nanoscience and nanotechnology: threat detection, threat neutralization (such as bullet-proof and tsunami-proof clothing), concealment, enhanced human performance, real-time automated medical treatment, and reduced logistical footprint (i.e. lightening the considerable weight load of the fully equipped soldier), design lightweight food packaging material and food poison detection systems; Nano materials for guided bone regeneration or for wound healing based on biocompatible and biodegradable polymers, modification and optimization of implant surfaces, investigation of the influence of cell biology and growth behaviour by micro structuring of implant surfaces, preparation and characterization of composite coatings from nano-hydroxyl apatite collagen on titanium implants oxidized anodically; developing of new and effective protein-based nano-products in the area of local tissue regeneration, with the primary focus on bone and cartilage repair; nanoscaled immunotherapeutics, genetically engineered self-assembly systems, nanoarray coated virus-like particles, functional protein arrays,

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Biomimetic membranes, nanocapsules and glycosylated nanoarrays; nano-dimensional bioactive polymer systems for controlled drug release.

- Nano in tracer and bioanalysis, protein analysis via nano-coupling methods, and clinical diagnosis of extremely small sample volumes for future human research, high-resolution imaging and bio-sensing of proteins and membranes on the single molecule level, Nanoscale reactive chip and biosensor surfaces, functional hydrogels, hyperbranched architectures and photosensitive polymers, Polymer matrices on gold-coated chips (nanofilms or self-assembled layers) and gold particles in porous materials as fluorescence enhancers, Imaging dynamic interactions between single biomolecules in real-time with the atomic force microscope, Biosensors, neurons on a chip, functional surfaces, etc.
- Nanoscale systems for studies of gene expression, stress regulation and signal transduction, investigations of structure–function relationships in proteins, protein engineering, development of biosensors for different processes, and studies of organelle biogenesis.
- Development of nanoscale system based DNA microarray to follow-up the gene expression in adipose tissue in murine models of diseases, Development of biochips for the GMO detection, Microarray to monitor gene expression in breast tumours. Side effects detection of drug candidate on microarray, controlled synthesis of short DNA chains on metallic nanostructures with plasmon resonance (SPR).
- Development of nanoscale system based biochip for the identification of pathogenic bacteria in food, Development of a biochip for the identification of nosocomial pneumonia, Development of a biochip for the selection of diseases resistant animals for veterinary, poultry and fisheries industry, Nanoparticles applicable in medicine, and ecology, Nanoparticles for applications in foodstuffs and food ingredients, nutraceuticals, diagnostics, biosensors, enzyme catalysts, etc.
- Controlled metallization of protein-made nanostructures, Enzyme-binding proteins for functional nanostructures, Self-assembly of protein ‘building-blocks’ into nano protein crystals, Protein based nanoparticles, Screening of the protein databank for ‘building blocks’ to be used in self-assembled nano-structures.

Concept papers (Maximum: 10 pages; single space typed in A4 size; *Verdana* style; 10 point font size) including a brief biodata of PI and all Co-PIs demonstrating experience and expertise in the proposed area and proposed budget (see Annexure, which is available on website: [www.dbtindia.nic.in](http://www.dbtindia.nic.in)), may be submitted positively by **30 March 2007** by post to: **Dr R. R. Sinha, Adviser, Department of Biotechnology, Block-2, 6th Floor, CGO Complex, Lodhi Road, New Delhi 110 003**, and also by email: [rrsinhadbt@gmail.com](mailto:rrsinhadbt@gmail.com) mentioning ‘**KNOWLEDGE BASED NANOSCIENCE NANOTECHNOLOGY**’ in the subject area. Scientists who submitted their proposal in response to DBT’s earlier advertisement need not apply again.

#### ANNEXURE-I

#### DEADLINES

Date of Advertisement:

Concept Note Submission deadline: **30 March 2007**

Brainstorming meeting (selected concept notes) (Tentatively): After **15 May 2007**

#### ANNEXURE-II

#### PROJECT ESSENTIALS

- **Eligible Principal Investigators (PIs):** Individuals with the skills, knowledge, and resources necessary to carry out the proposed research are invited to work with their institution to develop an application for support.
- **Applicants** may submit more than one application, provided each application is scientifically distinct and PI has expertise in the area.
- **Essential requirement:** Concept papers must demonstrate proof of high degree of interdisciplinary collaborations among investigators with expertise in a range of disciplines, including but not limited to engineering, physics, chemistry, cellular and molecular biology, materials and computer science. Concept paper submitted in response to this advertisement may propose hypothesis-driven, discovery-driven, developmental, or design-directed research.
- **Budget and project period:** PIs may request a project period of up to 3 years with two year extension subject to evaluation and extension on case to basis. Budget should be reasonable and as per the requirement.
- **Eligible organizations:** Public or Private institutions, such as universities, colleges, hospitals, and laboratories; units of state and local governments; NGOs and private-funded research organizations India.
- **AWARD CRITERIA:** The following points will be considered while shortlisting the concept papers by the reviewers:
  1. Scientific merit of the proposed project as determined by peer review team from India and abroad.
  2. Relevance to program priorities.