

## Third Laureate Fundamental Research

26<sup>th</sup> Khwarizmi International Award (KIA)



- **Project Title:** Study of improvement and increasing biological macromolecules stability and function
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- **Researcher:** Dr. Bijan Ranjbar
- **Collaborator Organizations:** Ministry of Science, Research & Technology, Vice-Presidency for Science & Technology, Management & Planning Organization.

### ● Abstract:

Study of the stability-function relationships of proteins and nucleic acids is of great interest for researchers of biophysics, biochemistry and biotechnology, which leads to understanding of the molecular dynamics and kinetic-thermodynamic fundamentals of folding process, for design and engineering of novel peptides, proteins and nucleic acid structures. This research has been conducted on determination of functions based on structure, gene identification/discovery and their protein products for development of novel drugs, prevention of incurable diseases, production of microorganisms with new capabilities and biological products such as peptides, recombinant proteins, design and fabrication of nucleic acid structures with specific characteristics, and development of protein/ nucleic acid based biosensors. In these investigations, stability and function of various spherical and non spherical proteins such as lysozyme, peroxidase, luciferase (two types), lipase (mesophile, psychrophile),  $\alpha$ -amylase (BAA, BLA), savinase, metaloprotease, lacase, human and cow serum albumin, Interleukin2-, peptides from long-chain snake neurotoxin Naja naja oxiana, nucleic acid nanostructures (cauliflower-like DNA and DNazymes) and complexes of protein-gold nanorod systems have been studied via different spectroscopic, calorimetric and microscopic techniques, theoretical calculations and site-directed mutagenesis methods. Each designed/fabricated system has its own specific application. Complexes of lysozyme-gold nanorods for targeted drug delivery systems and detection purposes, identification of physicochemical properties of luciferase for biosensors, different lipases esp. HR59 strain extracted from burn infections (pseudomonas aeruginosa) and other peptides/proteins in pharmaceuticals and biotechnology, cauliflower-like DNA with new characteristics for nanoelectronics and other DNA nanostructures, are a number of examples that have been studied so far. The most important outcomes of such efforts with promising applications in pharmaceutical, food and biotechnology industries, detection of cancer, infectious diseases and environmental pollutions, could be summarized as publication of international and national full scientific papers, 2 registered patents, registration of 9 sequenced local genes.

