

# Indian Scientist

## Prof. Biman Bagchi

Shanti Swarup Bhatnagar Prize (1991)



(Born on 1 January 1954)

Professor Biman Bagchi, born in Kolkata, is one of India's most distinguished theoretical chemists. His groundbreaking work uses statistical physics to explain complex phenomena like chemical reactions, how proteins fold, and how glass forms. Currently a National Science Chair and Honorary Professor at the Indian Institute of Science (IISc), Bengaluru, his contributions continue to shape modern chemistry and biophysics worldwide.

### Scientific Contributions and Innovations

Dr. Bagchi is an acclaimed theorist known for pioneering work across several fields:

**1. Statistical Mechanics and Liquids:** He developed foundational theories in **statistical mechanics** to describe the rules governing large numbers of atoms and molecules. This includes theories on **phase transitions** (like liquid turning into solid), **nucleation**, and the **glass transition** (how a liquid slowly turns into glass).

**2. Reaction Dynamics:** Prof. Bagchi pioneered the first successful theory explaining barrierless chemical reactions. These are reactions where molecules combine or change without needing an initial activation energy barrier.

This reveals hidden dynamics in reaction speed. He also introduced translational modes into theories of dielectric relaxation, showing how solvent molecules move in response to an electric field.

**3. Biophysics and Biological Water:** His research has been crucial in biophysics, studying processes like protein folding how proteins correctly arrange themselves into 3D shapes. He coined the influential term "**biological water**" to describe the special dynamic layer of water molecules that surround biomolecules like proteins and DNA. His work also advanced theories in Fluorescence Resonance Energy Transfer (FRET), a powerful technique used to measure distances inside single molecules.

### Honors and Academic Legacy

For his outstanding contributions in Chemical Sciences, Dr. Bagchi has received top honors:

- **Shanti Swarup Bhatnagar Prize (1991):** India's most prestigious science award.
- **TWAS Prize in Chemistry (1998):** Awarded by The World Academy of Sciences.

His theoretical frameworks and concepts, such as "biological water," continue to be vital references for experimental and simulation studies globally.