



Bose Colloquium

S. N. Bose National Centre for Basic Sciences
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4.00 PM



Silver Jubilee
Hall



Webinar Link



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Innovations at the challenging interface of Engineering, Biology and Medicine

Bikramjit Basu*

CSIR-Central Glass and Ceramic Research Institute, Kolkata

*On deputation from, Indian Institute of Science, Bangalore 560012, India

Abstract

Biomaterials science and engineering is widely regarded as one among frontier and growing areas of research and innovation within the scientific community in the world; considering the number of scientific discoveries and their societal impact. In the field of bioelectronic medicine, electrical stimulation devices have been clinically used for a wide spectrum of applications, ranging from deep brain stimulation to drug and gene delivery. Despite such clinical relevance, the impact of electrical stimulation on the mechanistic insights into cellular biophysical processes has not been explored significantly, more so in the quantitative space. As a part of our research program on regenerative bioelectronics, I shall first present the experimental results to demonstrate the electric field stimulation on the modulation of stem cell fate processes. In rationalizing the experimental results, I shall further discuss the analytical results to develop quantitative biophysical insights into the influence of lateral electric field stimulation on bioelectric stresses in the intercellular/ extracellular region and the membrane tension, while solving Laplace equation with appropriate boundary conditions in an azimuthally asymmetric system with a single cell. The solution provides the spatial variation (radial and angular dependence) of the bioelectric stress tensor in both intracellular and extracellular microenvironment. The impact of the bioelectric stresses on the mechanotransduction induced cytoskeletal reorganization in the intracellular region as well as stress driven cellular signaling modulation in the cellular microenvironment will also be discussed. In the context of healthcare-related applications, I shall present our recent efforts towards translational research involving clinicians and industries towards indigenous manufacturing of biomaterial implants in India. I shall close my talk with key recommendations for the sustained growth of this field of research in India.

Short Biography of the Speaker

Dr. Bikramjit Basu is currently serving as Director, CSIR-Central Glass and Ceramic Research Institute, Kolkata, since November, 2024, on deputation from the Indian Institute of Science (IISc), Bangalore. After serving as a faculty at the Indian Institute of Technology, Kanpur (2001-2011), he joined IISc in May, 2011. After training in the field of Metallurgy and Materials Science, he has been pursuing research at the confluence of Ceramic Science, Biomaterials, Additive Manufacturing (laser/electron beam/extrusion-based 3D printing), Biological Science, and Medicine, to address many unanswered questions related to renewable energy and regenerative. His 250+ peer-reviewed research articles are cited more than 22,200 times with H-index of 75 (Google Scholar). He has co-authored 5 textbooks, two reference books and one research monograph related to policy on Biomaterials and Implants. A Chartered Engineer of the UK, he has the unique distinction of being the only ceramic scientist from India to get elected to all the major international ceramic societies and academies, including the World Academy of Ceramics (2024), the European Ceramic Society (2023), the American Ceramic Society (2019). In India, he is an elected Fellow of all the National Academies of Engineering, Science and Medicine, including the Indian National Science Academy (2021), Indian Academy of Sciences (2020), National Academy of Medical Sciences (2017), Indian National Academy of Engineering (2015), and National Academy of Sciences, India (2013). Internationally, he is an elected fellow of the International Union of Societies for Biomaterials Science and Engineering (2020), International Academy of Medical and Biological Engineering (2017) and the American Institute of Medical and Biological Engineering (2015). He is a recipient of India's most prestigious Science and Technology award, Shanti Swarup Bhatnagar Prize (2013) from the Prime Minister of India; and globally competent awards, like Humboldt Research Award from the Alexander von Humboldt foundation (2022), and International Richard Brook Award from the European Ceramic Society (2022). He is currently serving on many advisory panels of the national institutes, European universities and federal funding agencies as well as major multinational corporates.

