

# **‘Cardiovascular Immunology, Drug Discovery & Drug Development’**

**Invited Talk by**

**Prof Shyam S. Bansal**

Vice Chair for Basic Science Research & Associate Professor (with tenure)  
Heart and Vascular Institute, Department of Medicine, Pennsylvania State University  
Hershy Medical Centre, Hershy, PA, USA

Students Council, Department of Chemistry, organized on October 11, 2025, an Invited Talk ‘*Cardiovascular Immunology, drug discovery and drug development*’ by Prof Shyam S. Bansal, Associate Professor, Pennsylvania State University, Hershey Medical Centre, Hershey, PA, USA. The session began with Institute prayer. Amalgamating the immune system with cardiac dysfunction, in the early part of his talk, Prof. Bansal explained how immune cells, especially T lymphocytes, help tissue repair immediately after injury and play role in maintaining heart health. He further explained their contribution to chronic inflammation and heart failure. He then elaborated on his team’s research that focuses on deciphering how activated T cells infiltrate the myocardium and drive adverse left ventricular remodeling, fibrosis, and contractile dysfunction. He highlighted that over the past two decades, accumulating evidence implicates both the innate and adaptive immune arms in the initiation, progression, and remodeling phases of cardiovascular injury (after myocardial infarction) — such as, through macrophage activation, dendritic cell signaling, T-cell polarization, and cytokine networks. He described his research work on the synthesis of a novel small-molecule drug designed to inhibit pathogenic T-cell activation, particularly those subtypes which are responsible for chronic cardiac inflammation.



Prof. Bansal elaborated on the molecular targets and signaling pathways involved, noting the importance of estrogen receptor- $\beta$  (ER- $\beta$ ) signaling and TNF receptor-1 (TNFR1) in modulating T-cell activity. He further discussed how the subsets of T helper cells (Th1, Th2, Th17), regulatory T cells (Tregs), and macrophage phenotypes (M1, M2) dynamically shift over time and help to overcome the injury. He pointed out that simple blockade of single cytokines (neutralizing IL-1, TNF) has in many cases failed to show expected benefit in CVD — highlighting the complexity and redundancy in immune networks. Moving into drug discovery, Prof. Bansal outlined strategies to translate immunological insights into therapeutic leads. He also stressed on challenges and pitfalls unique to immunomodulation in the heart, highlighting that immune suppression may lead to increased infection risk; off-target effects in noncardiac tissues; the time windows for intervention (too early or too late may be ineffective or detrimental); and the inherent heterogeneity of patient immune states (co-morbidities, age, genetic variation). His work serves as a strong example of bench-to-bedside research, illustrating how a clear understanding of immune mechanisms can guide the design of next-generation therapies that precisely target the root inflammatory causes of cardiovascular disease. His talk also provided broader insights into the translational pipeline of drug discovery, from identifying molecular targets, validating them in animal models, optimizing the chemical structure of candidate molecules, and navigating through preclinical safety assessments toward potential clinical applications.



The talk by Prof Bansal emphasized that the intersection of immunology and cardiovascular research offers promising but challenging frontiers. Through his presentation, he left the audience with an appreciation of the elegant complexity of immune-cardiac interactions and the rigorous path needed to convert mechanistic insights into safe and effective therapies. The talk ended with Institute song followed by National anthem. On this occasion, Prof Bansal was presented a memento also by the Department of Chemistry.

