Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

C o u l t e r S e m i n a r S e r i e s P r e s e n t s

"At the intersection of Immune engineering and precision health"

Lonnie Shea, PhD

William and Valerie Hall Chair

Steven A. Goldstein Collegiate Professor

Department of Biomedical Engineering

University of Michigan

Lonnie Shea is the Chair of the Department of Biomedical Engineering at the University of Michigan (U-M), which is joint between the College of Engineering and the School of Medicine. He received his PhD in chemical engineering and scientific computing from U-M in 1997, working with Professor Jennifer Linderman. He then served as a postdoctoral fellow with then ChE Professor David Mooney in the Department of Biologic and Materials Science at the U-M Dental School. Shea was recruited to Northwestern University's Department of Chemical and Biological Engineering and was on the faculty from 1999 to 2014. In 2014, Shea was recruited back to the University of Michigan as chair of the Department of Biomedical Engineering, with his recruitment coinciding with the endowment of the chair position by William and Valerie Hall. He is the Steven A. Goldstein Collegiate Professor of Biomedical Engineering and is an internationally recognized researcher at the interface of regenerative medicine, drug and gene delivery, and immune-engineering, whose focus is on preventing tissue degeneration or promoting tissue regeneration. His projects include islet transplantation for diabetes therapies, nerve regeneration for treating paralysis, autoimmune diseases and allogeneic cell transplantation, and diagnostics for immune dysfunction in cancer and autoimmunity. He is currently PI or co-PI on 5 NIH grants (4R01's, 1 R21). Shea has published more than 240 manuscripts, and has numerous inventions to his credit. He is the PI for the Coulter Foundation Translational Research grants committee at the University of Michigan. He served as director of Northwestern's NIH Biotechnology Training Grant. He has received the Clemson Award from the Society for Biomaterials, is a fellow of the American Institute of Medical and Biological Engineering (AIMBE) and the Biomedical Engineering Society (BMES), a member of the editorial boards for multiple journals such as Molecular Therapy, Biotechnology and Bioengineering, and the Journal of Immunology and Regenerative Medicine.

ABSTRACT

The promise of precision health is typically associated with the early detection of disease, and the identification of an individually tailored therapy to extend health span while also reducing costs. I will discuss our work on immune engineering, as the immune system is essential to health, and consequently immune dysregulation can lead to disease. Autoimmune disease has been increasing in prevalence for the past few decades, and results from the immune system attacking healthy tissues, such as in Type 1 Diabetes or Multiple Sclerosis. Current treatments typically involve suppressing the entire immune system, despite the immune system attacking specific proteins. Based on the function of the immune system, we have developed nanoparticles that re-program immune responses to specific antigens leading to tolerance to those antigens and leaving the remainder of the immune system intact. The nanoparticles maintain the antigen until internalization by immune cells, with subsequent presentation of the antigen coincident with down-regulation of the co-stimulatory factors and up-regulation of negative co-stimulators. In addition to reprogramming specific immune responses, a need exists for technologies that can detect autoimmune disease initiation prior to substantial destruction of healthy tissues. We have applied tissue engineering principles to generate tissues subcutaneously that function as an immunological niche, which can be accessed easily to avoids risks associated with biopsy of native tissues (e.g., brain,) and thereby report on immune status within tissues. Technologies for detecting disease at the earliest stages combined with reprogramming specific cellular responses represent major opportunities for Precision Health to improve health while containing costs.

Friday, October 9th

12:00 Noon

Seminar will be presented virtually via Zoom: https://go.unc.edu/f3QHx