

# CARNEGIE MELLON UNIVERSITY BME 2022 FALL SEMINAR SERIES

## Tissue Engineering for the Creation of Functional Tissues and Microphysiologic Systems



### PRESENTED BY

#### **Bruce Bunnell**

Professor and Chair  
Department of Microbiology,  
Immunology and Genetics  
University of North Texas

### SCHEDULE

**Porter Hall (PH) 100**

**Thursday,  
November 10, 2022  
(10:15AM-11:15AM)**

With the advent of whole organ decellularization, extracellular matrix scaffolds that were potentially suitable for organ engineering were generated from multiple tissue types, including the heart, lung, liver, kidney, and pancreas. The generation of functional lungs is important due to an insufficient number of donor organs that are available to meet the transplantation demands. This issue could be addressed by regenerating functional tissue from diseased or damaged lungs that would otherwise be deemed unsuitable for transplant. Dr. Bunnell will present research from his group on decellularization efficiency, characterization of the decellularized tissue, and efforts to recellularize lung scaffolds. Detergent-mediated whole-lung decellularization produces a three-dimensional natural scaffold that can be repopulated with various cell types. The cell types, delivery methods, and bioreactors employed for decellularization/recellularization will be presented.

Disorders of the synovial joint, such as osteoarthritis (OA) and rheumatoid arthritis (RA), afflict a substantial proportion of the global population. Moreover, osteoarthritis in the knee joint is known to impact all tissue components within the joint. Therefore, developing a human cell-derived microphysiological system (MPS, often called organ-on-a-chip) composed of all knee tissues that effectively permits crosstalk or tissue interactions under physiologic conditions is highly desirable for studying etiologies/pathogenesis of joint diseases and testing novel therapeutics. As part of a collaborative team, a human mesenchymal stem cell-derived miniature common system (miniJoint) has been generated, in which an engineered osteochondral complex composed of synovial-like fibrous tissue and adipose tissue is integrated into a microfluidics-enabled bioreactor. This novel design facilitates communication between the tissues while maintaining their respective phenotypes. Progress on the development of this system will be presented.

