BIOENGINEERING SEMINAR

SPRING 2024

Organ-on-a-chip and 3D Printing: Emerging paradigms in tissue engineering and regenerative medicine

Abstract

Research in Alimperti's laboratory at Georgetown University aims to integrate medicine and technology within a single framework for potential therapeutic purposes of craniofacial and musculoskeletal diseases. Approximately half of American adults are affected by them, with an estimated collective cost to the healthcare system of over $442 billion. The development of new therapeutics has been challenged due to conventional two-dimensional (2D) *in vitro* models, which lack the three-dimensional (3D) spatiotemporal and multicellular structure and functionality of those tissues. In addition, *in vivo* animal models are cost-demanding, laborious, and highly risky owing to the inherent deficiency in cross-species extrapolation. To overcome these limitations, in Alimperti's lab, we employ a multidisciplinary research program that encompasses 3D printing, organ-on-a-chip technologies, and molecular biology to build preclinical disease models, which recapitulate organ pathology and work as diagnostic platforms for therapeutic purposes. As a proof of concept, in the current presentation, we will demonstrate a novel 3D printed *in vitro* model named bone-on-a-chip. Also, we elucidate interepithelial adhesion mechanisms that maintain or disrupt barrier function in soft tissues by utilizing microfluidic technology. Finally, we demonstrate the development of novel 3D-printed bone grafts by developing novel additive manufacturing approaches and biomaterials that enhance tissue regeneration and host-graft integration. Overall, the microfluidics and 3D printing approaches may pave the way to develop new therapeutics and engineer 3D scaffolds with tunable pre-defined properties, which will enhance graft-host integration in various anatomic locations.

Biography

Dr. Alimperti received her B.S. in Chemical Engineering from the National Technical University of Athens (2006) and Ph.D. in Chemical and Biological Engineering from the State University of New York at Buffalo under Prof. Stelios Andreadis' supervision. Upon completing her Ph.D. in 2014, she joined the laboratory of Prof. Christopher Chen at Wyss Institute at Harvard University/Boston University as a postdoctoral associate. In 2018, she established her group at American Dental Association (ADA) and National Institute of Standard and Technology (NIST). Lately, she moved to Georgetown University as an Associate Professor. Her lab focuses on identifying the mechanisms involved in the development, maintenance, loss of function, and repair/regeneration by developing novel tissue engineering and regenerative strategies. She received multiple grants and has been the corresponding author in multiple manuscripts, U.S. and PCT patents. *Expertise terms: craniofacial, musculoskeletal, tissue engineering, cadherins, mechanobiology, inflammation, barrier function, vascularization.*

Stella Alimperti, PhD

Associate Professor
Tissue Engineering and Regenerative Medicine Laboratory
Department of Biochemistry, Molecular, and Cellular Biology
School of Medicine
Georgetown University

Thursday, February 8
12:00-1:00 pm

****In-person at SciTech Campus: KJH 258 ****

Live streaming to Fairfax Campus: Horizon Hall, Rm 1008