We report the design and fabrication of robust fluidic platforms that are optimal for culturing and interrogating 3D organoid cultures. The optimized design of convective fluid flows, use of bio-inert and non-absorbent materials, reversible assembly of the platform, manual access for loading and unloading of cultures, and straightforward integration with commercial imaging and fluid handling systems are major improvements over conventional PDMS-based low volume microfluidics. The platform has been used for perfusion interrogation of human pancreatic islets, and engineered spheroid cultures that mimic the metastatic niche of the bone marrow. Human pancreatic islets were tested for dynamic secretion of hormones, concomitant live-cell imaging, and optogenetic stimulation of genetically engineered islets. The efforts to evaluate ex vivo function of islets are informing the clinical trials currently underway to transplant human islets in Type 1 Diabetic patients. The platform is also being tested for long term culture of spheroids composed of primary human cells of the bone marrow along with vascular cells and supporting pericytes. The efforts to recreate the metastatic niche are enabling in vitro maintenance and propagation of circulating tumor cells derived from the blood of breast and prostate cancer patients, as tools for enabling precision oncology.

Biography:
Ashutosh Agarwal is an Assistant Professor of Biomedical Engineering, and the Associate Director of Macdonald Foundation Biomedical Nanotechnology Institute at the University of Miami. His undergraduate degree from Indian Institute of Technology and his PhD from University of Florida are both in Materials Science and Engineering. He then gathered postdoctoral research experience in Biomedical Engineering at Columbia University, and at the Wyss Institute for Biologically Inspired Engineering at Harvard University. The research mission of his Physiomimetic Microsystems Laboratory is to develop human relevant organ mimic platforms for discovery of therapies and drugs, for modeling of disease states, for conducting mechanistic studies, and for differentiation, maturation and evaluation of stem cells. The lab is supported by NIH (1UC4DK104208, U01CA233363, 5U01DK104162), Early stage commercialization grants from Wallace H. Coulter Foundation, and a Sponsored research project from Mallinckrodt Pharmaceuticals.