

Human Immune Organoids and Complex Organ-on-Chip Technologies

Ankur Singh

Designing vaccines, immunomodulatory drugs, and cell therapies against infections, cancer, inflammatory conditions, and age-related disorders requires a detailed understanding of how immune cells form and activate in primary, secondary, and ectopic tertiary immune organs. Traditionally, research on the immune system has been restricted to in vivo approaches, which do not allow for the detailed control of intracellular and extracellular processes, and to 2D in vitro models, which lack physiological relevance. These models are being investigated to understand immune function and dysfunction at the cellular, tissue, and organ levels. In this talk, I will discuss my laboratory's effort in developing synthetic, human ex vivo immune organoids to replicate the structure and function of immune tissues. I will discuss strategies to combine engineered materials and immune cells from individuals to generate antibody-secreting cells in a dish or as organ-on-chip against viral and bacterial infections and describe immunogenicity testing efforts. I will further describe the use of human immune organoids in oncology and drug development space, and subsequently describe the integration of immune organoids with complex mucosal organ-on-chip technologies.