

Recapitulating human biology, disease states, and therapeutic responses in vitro

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Failure of animal models to predict therapeutic responses in humans is a major problem that also brings into question their use for basic research. In this presentation, I will describe Organ-on-a-chip (Organ Chip) microfluidic devices lined with living human tissues that form tissue-tissue interfaces, reconstitute vascular perfusion and organotypic mechanical cues, integrate immune cells, contain living microbiome, and recapitulate organ-level physiology and pathophysiology with high fidelity. Work will be presented describing how single human Organ Chips and multi-organ human Body-on-Chips systems have been used to model complex diseases and rare genetic disorders, study host-microbiome interactions, quantitatively predict drug pharmacokinetic and pharmacodynamic parameters, recapitulate whole body inter-organ physiology, and reproduce human clinical responses to drugs, radiation, toxins, and infectious pathogens. My message is that the possibility that human Organ Chips can be used in lieu of animal models for drug development and as living avatars for personalized medicine is coming ever closer to becoming a reality.