

Microfluidic Technologies for Advanced Disease Modeling and Drug Testing

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Abstract

Microfluidic-based organ-on-a-chip platforms, also known as microphysiological systems, provide a powerful approach for recapitulating physiological and pathological microenvironments in vitro. These systems leverage precisely controlled fluid dynamics to model vascular function, tissue interactions, and drug responses with high fidelity. In this talk, I will discuss recent work on an acoustofluidic-based dynamic flow generator that enables the study of helical flow effects in blood vessels, a critical factor in vascular physiology and pathology. Additionally, I will present a vascularized microphysiological system designed to investigate tumor-endothelial crosstalk in anti-cancer drug resistance, highlighting the impact of flow conditions on endothelial function. Lastly, I will discuss the development of a microphysiological artery model used to study vascular dysfunction induced by high glucose, advanced glycation end products, and inflammatory cytokines, as well as its application in evaluating therapeutic interventions. By integrating fluidic principles into microphysiological system design, these platforms provide a more biomimetic representation of the in vivo microenvironment and improve the predictive power of preclinical studies. This talk will explore how fluid mechanics-driven innovations in microfluidic systems can lead to more physiologically relevant and translational in vitro models.

Keywords: microfluidic system, organ-on-a-chip, microphysiological system (MPS), disease modeling, drug testing

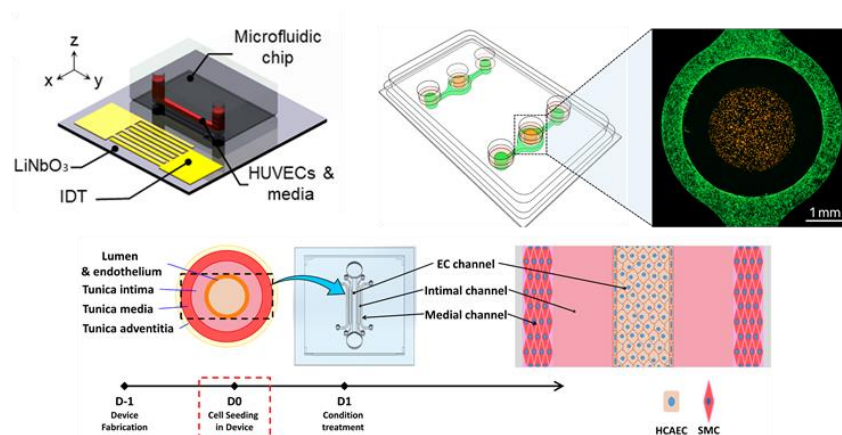


Figure 1. Microfluidic-based organ-on-a-chip platforms developed for disease modeling and drug testing

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