MICROFLUIDIC TOOLS TO MODEL AND ANALYZE THE BODY

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ABSTRACT

Many biological studies and pharmacological assays require culture of living cells outside of their natural environment in the body. The gap between the cellular microenvironment in vivo and in vitro, however, poses challenges for obtaining physiologically relevant responses from cellular drug screens and for drawing out the maximum functional potential from cells used therapeutically. This "physiology gap" exists, at least in part, because the fluidic environment of mammalian cells *in vivo* is microscale, 3D, and dynamic whereas typical in vitro cultures are macroscopic, 2D, and static. This presentation will give an overview of efforts in our laboratory to develop microfluidic systems that enable spatio-temporal control of chemical, cellular and fluid mechanical environment of cells using microchannel systems [1-3], aqueous two phase systems [4, 5], and hanging drop arrays [6]. The development of such microfluidic models of the body presents new challenges of developing meaningful readouts to enable interpretation of the microfluidic cell culture systems and relating the readouts to human physiology. Some of our efforts in development of useful biomarker readouts will also be described [4, 7]. Specific biomedical topics that will be discussed include in vitro fertilization on a chip, lung-on-a-chip, microfluidic models of cancer, bacterial communities, and nanofluidic chromatin analysis.

KEY WORDS

Aqueous Two Phase Systems, Oscillator, Biomarker, Fracture Fabrication, Spheroids

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