Analytical Instrumentation, Methods & Materials

Achieving Precision Laminar Flow for Biological Microfluidics

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Inventors: David Beebe, Jay Warrick, Erwin Berthier

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method and device for controlled laminar flow patterning within a network of channels utilizing asynchronous pumping.

Overview

Despite the growing interest in the natural interactions between different cellular compartments— and the increasing need to model these phenomena *in vitro*—no method currently in practice in biological laboratories reproducibly controls the laminar, i.e., not turbulent, flow of cells or particles.

An ideal method to pattern or diffuse side-by-side cell streams within a channel would employ the smooth, controlled flow of material. Such laminar techniques, however, remain underutilized due to traditional limitations like tubing connectivity, dead volumes and air bubbles. Devices recently developed to alleviate these issues, including surface tension or gravity pumping micropipettes and syringe pumps, are susceptible to flow variation over time and require precise synchronization.

A new design, simple to implement and removing intense timing requirements, is sought.

The Invention

UW–Madison researchers have developed a microfluidic method and device to provide controlled laminar flow patterning of samples in one or multiple channels with asynchronous pumping.

The network comprises multiple fluid loading ports leading to respective buffering reservoirs. Flow synchronization is achieved by linking the reservoirs to a common pool acting as a capacitor that, when charged by the presence of a sample, triggers flow. In this way fluid can be added asynchronously through any input port without varying the relative flow rates through the network, converging in the cell culture channel where patterning occurs.

Varying the resistances of the separate branches serves to control the ratio by which the shared culture channel is divided into the multiple flows. This design therefore eliminates the need for synchronized pipetting by utilizing passive components for controlled, reproducible laminar patterning.

Applications

- Biological research assays
- Studying cellular co-culture, wound healing and cell migration

Key Benefits

- Simple, inexpensive to implement

- Eliminates synchronized pipetting
- Achieves laminar flow with controlled and repeatable method

Stage of Development

The researchers have prototyped and tested the new device and method.

Additional Information

For More Information About the Inventors

- David Beebe
- Jay Warrick

Publications

- Berthier E., Warrick J., Casavant B. and Beebe D.J. 2011. Pipette-Friendly Laminar Flow Patterning for Cell-Based Assays. Lab Chip 11, 2060-2065.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Microfluidics

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846