Analytical Instrumentation, Methods & Materials

Method for Controlling Communication Between Multiple Access Ports in a Microfluidic Device

View U.S. Patent No. 8,211,709 in PDF format.

WARF: P07030US

Inventors: David Beebe, Ivar Meyvantsson, Jay Warrick, Michael Toepke

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a new method for controlling communication between components in a microfluidic system.

Overview

Microfluidic devices have been proven useful for exploring a variety of biological questions, such as how cell-derived soluble signaling affects cellular processes. Passive pumping is a common method used in microfluidics to provide fluid flow, requiring neither active components nor physical connections. Instead, fluid flow is driven solely through the fluid tension forces found at the microfluidic channel inlet and outlet ports. This approach allows fluid to be transferred to and from microfluidic channels in large arrays that can be addressed via generic liquid handling instruments.

Over the course of an experiment it can be beneficial to reconfigure a micro?uidic network at some stage or to connect different micro? uidic channels. However, current techniques and systems lack practical means for altering the fluid communication schemes of microfluidic networks on the fly. A more elegant method is needed for altering microfluidic systems so that modification of experimental parameters can take place within the duration of an experiment without the need for additional external equipment.

The Invention

UW-Madison researchers have developed a method and structure for controlling fluid communication between components in a passive pumping-based microfluidic system. The microfluidic network is designed so that a small drop of fluid can cover two nearby ports, promoting communication between the fluid-coupled channels.

In its simplest form, the communication device contains one input port and one output port, connected by a fluid-filled channel. If drops of fluid are pipetted onto the ports, the fluid will flow in the direction of the larger drop. The flexibility in the design provides a wide range of configurability and dynamic connectivity for executing changes to experimental setups on cue.

Furthermore, an intricate design can create a form of binary code in the presence or absence of drops on the ports. Microfluidic systems can have a complex network of channels and input/output ports that serve as logic gates, analogous to electronic circuit components. This multifaceted design allows limitless modifications throughout the duration of an experiment without adding external equipment.

Applications

- Cell-based assays, including cell-to-cell communication, cell migration and immunocytochemistry.

Key Benefits

- Can be operated automatically
- Cheap and easy to manufacture
- Enables delivery of soluble cell signals to multiple cell culture environments without cell contamination
- Reduces the amount of costly reagents and other chemical solutions needed for an experiment
- Provides a more portable system due to reduced need for additional external equipment
- Allows microfluidics to perform more complex functions
- Allows time-dependent control of systems due to adjustable resistance

Stage of Development

Various cellular studies have been carried out utilizing this tunable fluid communication technique amongst a network of microfluidic devices.

Additional Information

For More Information About the Inventors

- David Beebe
- Jay Warrick

Related Technologies

- For more information about passive pumping, see WARF reference numbers P02013US
- and P05284US.

Publications

- Toepke M.W., Abhyankar V.V. and Beebe D.J. 2007. Microfluidic Logic Gates and Timers. Lab on a Chip 7, 1449–1453.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Microfluidics

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