

Pa-098

**MICRO-/NANOFLUIDIC COMPUTING AND ITS
APPLICATIONS TO BLOOD VESSEL THROMBUS
FORMATION CONTROL**

Toshinori Munakata,^{1*} David W.M. Marr² and Michael Kalafatis³

¹ *Department of Computer and Information Science, Cleveland State University, Cleveland, OH 44115, USA.*

² *Department of Chemical Engineering, Colorado School of Mines, Golden, CO 80401, USA.*

³ *Department of Chemistry, Cleveland State University, Cleveland, OH 44115, USA.*

Micro-/nanofluidics control liquids on a scale in the order of microns and nanometers [1]. Because of its very small scale, micro-/nanofluidics have many advantages and potential applications. Micro-/nanofluidic computing incorporates computing operations such as logic and arithmetic gates and memory on the platform of micro-/nanofluidics [2]. This new computing paradigm further enhances micro-/nanofluidics by inheriting its advantages and adding the computing functionality. Because of these characteristics, micro-/nanofluidic computing is envisioned to have significant application potential in many areas including biomedicine, space and engineering. In this paper we first introduce the current state and our recent work in the micro-/nanofluidic computing field, discussing implementation schemes and their advantages.

We then consider the possibility of applying this technique to a specific chemistry-biomedicine problem called thrombus formation control [3]. Thrombus formation is the abnormal development of a clot inside blood vessel walls that can lead to serious problems, such as heart disease and stroke, which are the leading causes of death worldwide. A thrombus can be dissolved by injecting drugs into the blood flow nearby, upstream of the thrombus. We can apply nanofluidic computing elements such as the NOT gate to study the control of drug injection. Such techniques may be further extended for many other applications such as diagnosis and treatment of cancers.

KEY WORDS

Nanoscale processes, Nanolithography, Nanomaterials for chemo- and biosensors, Nanobiomaterials and nanomedicine, and Micro-/nanofluidic computing.

References

- [1] A. Terray, J. Oakey, and D.W.M. Marr, Microfluidic control using colloidal devices, *Science*, 296, 2002, 1841-1844.
- [2] T. Vestad, D.W.M. Marr and T. Munakata, Flow resistance for microfluidic logic operations, *Applied Physics Letters*, 84(25), June 21, 2004, 5074-5075.
- [3] B. Furie and B.C. Furie, Thrombus formation in vivo, *Journal of Clinical Investigation*, 115(12), 2005, 3355-3362.

* Corresponding author, Phone: +1-440-526-1499, E-mail: t.munakata@csuohio.edu