Node-Pore Sensing: A Label-Free Method for Cell Screening

L. L. Sohn
Dept. of Mechanical Engineering, University of California, Berkeley, CA 94720
sohn@me.berkeley.edu

We have developed a unique, label-free, multi-parametric method to screen single cells for size, multiple cell-surface markers, and deformability[1-3]. This method, which we refer to as Node-Pore Sensing, is based on measuring the current pulse caused by a cell transiting a microchannel that has been segmented by a series of inserted nodes. Like resistive-pulse sensing (RPS), i.e. the Coulter-counter principle, the pulse magnitude corresponds to cell size. Unlike RPS, however, the current pulse in NPS is modulated, reflecting both the number and spacing of the nodes in the channel. When the individual segments between the nodes are functionalized with different antibodies corresponding to distinct cell-surface antigens, cells whose antigens can interact specifically with the functionalized antibodies in a particular segment will travel more slowly through that section of the channel than through the isotype-control segment. Surface-marker identification, and ultimately phenotypic profiles can thus be determined. When a constricted segment (such that a cell must deform or "squeeze" through in order to transit) is included between the nodes, we can determine the stress relaxation of the cell. In so doing, we can potentially evaluate the "invasive" potential of different types of cancer cells. In this talk, I will discuss the versatility of NPS. I will also discuss the "next-generation" NPS[4], which involves using analysis techniques borrowed from radar and telecommunications theory.

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[1] K. Balakrishnan, G. Anwar, T. Ngyuen, A. Kesavaraju, and L. L. Sohn, *Node-Pore Sensing: A Robust, High-Dynamic Range Method for Detecting Biological Species,* Lab Chip, 2013, 13, 1302-1307.

[2] K. Balakrishnan, J. Whang, R. Hwang, J. Hack, L. Godley, and L. L. Sohn, *Node-pore sensing enables label-free surface-marker profiling of single cells*, Anal Chem. 2015 March3;87(5):2988-95. Doi 10.1021/ac504613b. Epub 2015 Feb 12.

[3] J. Kim, A. Lei, M. LaBarge, and L. L. Sohn, in preparation (2015).

[4] F. Rivest, A. Pechacek, R. Park, K. Goodman, N. Cho, M. Lustig, and L. L. Sohn, in preparation (2015).