A NOVEL CELL BIOMEMES PROTOTYPE FOR SURFACE MARKER DETECTION[1)]

Yang Fan Zhang Yan Long Mian [2)]

(National Microgravity Laboratory, Institute of Mechanics, Chinese Academy of Sciences, Beijing 100080,China)

In recent years, biochip has been used widely for the detection of marker pr oteins in such biomedical analyses as disease diagnosis and phenotyping of cells [1,2]. But conventional microarray biochips, which are generally designed for measuring the binding of soluble proteins to immobilized probes, require the time-consuming pretreatments to purify marker proteins from cells. *In vivo* protein-protein interactions, however, are tightly related to the cellular environment. Direct measurements of cell surface proteins provide the more important information in physiological and pathological processes.

A novel cell BioMEMS prototype was developed in this study to directly detect cell surface marker(s). This microsystem mainly consists of a PDMS-made microfluidic chip, which was fabricated by rapid prototyoping[3], and a pocket detection device. Cells without time-consuming pretreatments are pumped into the microchannel of the chip. Only those cells expressing the marker protein(s) are captured by the counterpart protein(s immobilized onto the microchannel substrate, while others are flushe d out by the buffer. Binding of marker protein(s) onto cell surfaces to immobilized proteins is a two-dimensional kinetic process that is distinct from adhering of soluble marker protein(s) in conventiona biochips. Adherent cells are visualized using a li ght microscope, and capture efficiency, defined as the percentage of adhering cells, are then calculated.

To test the reliability of the cell BioMEMS, bovine serum albumin (BSA), served as a marker protein, was coupled onto the surface of human RBCs. Anti -BSA antibodies were immobilized onto the microchannel substrate to capture BSA-coated RBCs. Binding is specifically mediated by BSA-anti-BSA antibody interactions (capture efficiency = 86%), since plain RBCs do not adhere to the substrate (<1%), and bindin g were abolished by soluble anti-BSA antibodies (against BSA-coated RBCs) or soluble BSA (against antibody-immobilized substrate) (<1%). This imparted the confidences that the binding of surface -expressing marker protein(s) to counterpart protein -immobilized substrate can be measured quantitatively using the cell BioMEMS. Dependences of capture efficiency on site density and flow rate were further tested by systematically -varying BSA densities and flow rates. Data indicated that the efficiency increased with site densities and decreased with flow rates, suggesting that binding affinities might be predicted from the measured capture efficiency using the well-developed probabilistic kinetic model of small system[4]. This work provides a new methodology to quantify the two-dimensional binding and to test the cell surface marker in clinic.

References

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[2)] E-mail: mlong@imech.ac.cn