

Biomedical Microfluidic Devices for Clinical Use

Bor-Ran Li

Institute of Biomedical Engineering, National Yang Ming Chiao Tung University, Taiwan

Center for Emergent Functional Matter Science, National Yang Ming Chiao Tung University, Taiwan

liborran@nycu.edu.tw

The presence of circulating tumor cells (CTCs) in blood is associated with decreased progression-free survival and decreased overall survival in patients with metastatic breast, colorectal, prostate, or lung cancer. Thus, CTC monitoring might provide an opportunity for statistical diagnosis and therapy tracking. Although an efficient CTC monitoring approach is helpful in patients with cancers, most CTC isolation approaches are based on expensive antibodies that result in limited applications. Therefore, an antibody-free CTC enrichment approach is highly desired for clinical use. Herein, we designed a cascaded stair-spiral-microfluidic chip (SSMC) for label-free enrichment of CTCs from whole blood. The SSMC system contains stair channel heights, allowing the system to have different aspect ratios as the basis for adjusting the separation parameters. To optimize particle focusing conditions in the cascaded platform, two-stage spiral microchannels are designed with different heights. This allows the SSMC system to operate at high efficiency, removing 99.99% of red blood cells without antibody labeling. In addition, it can also collect over 80% of cancer cells effectively under a flow rate over 1 mL/min. In conclusion, this device provides a fast, high-throughput, low-cost and preconcentration platform for cancer cell detection technologies.



Associate Professor Bor-Ran Li

Institute of Biomedical Engineering, National Yang Ming Chiao Tung University, Hsinchu 30010, Taiwan

E-mail: liborran@nycu.edu.tw

Education/Career:

2020-now Associate Professor, Institute of Biomedical Engineering, NYCU

2015-2020 Assistant Professor, Institute of Biomedical Engineering, NCTU

2016-2017 Postdoctoral Fellow, Chemistry, NYU, Taiwan

2010-2016 Ph.D., Biochemistry, University of Edinburgh, UK

Research Interests

Microfluidic, Biosensor, Surface chemistry, Electrochemistry, Integrated Optical system