Knowledge Transfer Office
香港城市大學
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Microfluidic Chip, System, and Method for Determining Cell Deformability

Health & Wellness

Biomedical and Genetic Engineering

Opportunity

Cell deformability, or cells' ability to change their shape in response to external forces, is an emerging biomarker in the medical industry. For example, it can be used to detect sepsis and bacterial infection and evaluate the differentiation of stem cells, the pathological status of cardiac cells, and the metastatic potential of cancer cells. However, actual clinical applications have so far failed to take advantage of this valuable mechanical property due to difficulties encountered in measuring cell deformability. Standard methods, including atomic force microscopy, cannot swiftly handle large numbers of cells. Other means of measuring deformability require costly imaging equipment and sophisticated flow control, making them unsuitable for widespread application. The industrial applications of such methods are also limited by low sensitivity, low accuracy and complicated operations. New devices, systems and methods that can overcome these limitations and advance the real-world measurement of cell deformability, an important biomarker, are needed.

IP Status
Patent filed

Technology Readiness Level (TRL) ?
4

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Technology

Researchers have developed a novel microfluidic chip, system and method to more efficiently and accurately measure cell deformability. The chip has an inlet where cells enter, an outlet from which they exit, several main channels, and one or more bypass channels. The main channels, located between the inlet and outlet, contain small constrictions that cause the cells to deform as they pass through. These microconstrictions are arranged so that multiple cells passing through can be imaged simultaneously. The bypass channels, which are separate from the main channels, help maintain a stable pressure across the chip. The system includes a camera to capture images or videos of the cells as they pass through the chip, providing data on their shape and movement. A connected computer processes these data using a computational framework that includes an artificial neural network with machine learning tools, which detect, track, segment and classify the cells.

Advantages

- Multiple cells passing through the microconstrictions in the novel microfluidic chip can be imaged simultaneously, thus significantly improving efficiency and throughput relative to existing methods/systems.
- The invention does not require costly equipment and its fabrication and operation costs are much lower than those of many existing technologies.

- The system is more sensitive and accurate in evaluating cell migration and retention than many existing systems and methods.
- Compared with existing systems and methods, the invention has a wider range of application: it can be applied in contexts of scientific discovery and/or clinical detection and it is portable, enabling it to be easily installed in various sites, such as hospitals.

Applications

- Detection of infections, such as malaria, sepsis and bacterial infections.
- Evaluation of stem cell development.
- Evaluation of spread of cancer cells.
- Evaluation of pathology of cardiac cells.