Quantitatively Study the Dynamic Behavior of Cells through Microfluidic Devices at Single Cell Resolution

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We designed and constructed several types of microfluidic devices to culture, stimulate, and record cell's dynamic behavior with accurately controlled microenvironment. These devices were made of polydimethylsiloxane (PDMS), an elastic material through which the integrated pneumatic valves can be easily embedded into the chip. Combined with the automatic control of the device and advanced microscopic imaging technologies, we have employed these devices to perform studies on many biological systems including nanoliter reactions, high throughput cell migration screening, automatic nanoliter cell culture, single cell culture, cell imaging analysis, cell coculture, single cell sequencing and gene digital counting, cell migration dynamics, as well as the label-free dynamic imaging. Microfluidic devices have brought many advantages into the cell culture, especially the dynamic and quantitative measurement of the single cell's behaviors.