Microfluidics: new vistas for systems biology and high-throughput chemogenomics

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Abstract:

Functional *cytomics* is slowly becoming an omnipotent part of the post-genomic drug discovery pipelines. The last decade, in particular, has brought many innovations to the field of *cytomics* and cytometry. Although, it is widely recognized in the drug discovery arena that the validation of therapeutic targets revealed by proteomic and genetic screens requires 4D (3-dimentional plus time) functional cell-based assays, their widespread clinical use is still underdeveloped. In this context, microfluidic technologies provide important technological advances that allow for fundamentally new capabilities in the spatiotemporal control of molecules and cells. The application of laminar fluid flow under low Reynolds numbers provides an appealing analytical avenue for a rapid delivery of reagents with unprecedented accuracy and real-time control. The confining dimensions of the microfluidic structures facilitate precise positioning of cells and sequential delivery of drugs and/or functional probes to the distinct cell microenvironment. Pioneering Lab-on-a-Chip (LOC) devices allow for a lucid integration of multiparameter data, obtained from functional cell-based assays, as well as from proteomic and genetic screening. As only low cell numbers and operational reagent volumes are required, high-throughput integrated *cytomics* on a single cell level finally appears within the reach of clinical diagnostics and drug screening routines. Lab-on-a-Chip microfluidic technologies provide therefore new opportunities for the development of content-rich personalized clinical diagnostics and cost effective drug discovery. It is largely anticipated that advances in microfluidic technologies should aid in tailoring of investigational therapies and support the current computational efforts in the systems biology.