DYNAMIC ISLET CULTURE PLATFORM FOR HIGH-THROUGHPUT DRUG SCREENING

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Currently, we are heading towards the period of nanotechnology which extends to many engineering disciplines. The necessity of its development is crucial to make life more convenient, to improve efficiency of each research field, and to integrate portable healthcare system. Thus, the next most important step is to develop a technology to meet the needs of both industry and research area [1]. Here, we developed a fully integrated microfluidic device to perform the dynamic islet culture used for multiple drug toxicity tests while simultaneously characterizing their functionality through fluorescence imaging of the mitochondrial membrane potential and intercellular calcium influx with enzyme linked immunosorbent assay for quantification of secreted insulin concentration. The dynamic islet culture platform made of triple layer is composed of a comb-patterned micromixer, a media distributor, four perfusion chambers, cell arrays and microfluidic channels for cell and drug injection and collection.

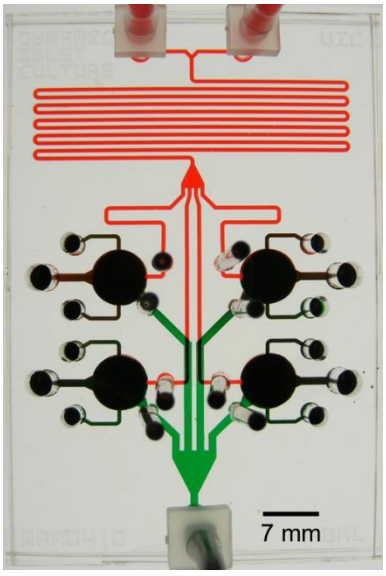

Figure 1 : Multi-perfusion microfluidic device for dynamic islet culture

The cells are subject to multiple cues that vary in time and space, including gradients of cytokines and secreted proteins from neighboring cells, biochemical and mechanical interactions with the extracellular matrix (ECM), and direct cell-cell contacts [2]. Microfabricated systems can present cells with these cues in a controllable and reproducible fashion that cannot easily be achieved by standard tissue culture, and can be used to link cell culture with integrated analytical devices that can probe the biochemical processes that govern cell behavior. These systems also provide optimal conditions for microscopic imaging of the subject in water. Some cell-based microsystems simply represent miniaturized versions of conventional laboratory techniques, whereas others exploit the advantages of small length scales. We believe these devices will become increasingly implemented in applied and basic biomedical research, mainly because soft lithography techniques have put microfluidics within the reach of biology-focused academic laboratories.

References;

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