Light patterning of hydrogels and peptides in microfluidic devices

Benoit G.C. Maisonneuve, Ernst Wolvetang, Justin Cooper-White*

StemCARE,
Australian Institute for Bioengineering and Nanotechnology (AIBN)
Corner College and Cooper Rds (Bldg 75)
The University of Queensland
Brisbane, Qld 4072, Australia

The cellular crosstalk and the influences of systemic circulating factors on the functions of organs is central to unravel the mechanisms of ageing and diseases. Assessing the crosstalk between specific cell types and the influence of specific circulating factors can be extremely challenging *in vivo*. Indeed, the limited control on the circulating factors in the blood stream, the complexity of a complete organism and the difficulty to assess the region of interest in real time prevent the full deciphering of these adjacent, paracrine and endocrine interactions. Microfluidic devices as *in vitro* platforms offer an unparalleled degree of control on the circulating media, but the use of PDMS walls and pillars to structure the tissue mimic severely limits their physiological relevance.

Here, we will present a method to control the spatiotemporal organization of different cell types and create complex structures without using PDMS pillars and walls within microfluidic devices. We use photosensitive hydrogels, constituted of hyaluronic acid and polyethylene glycol, to structure and organize layers of cells with various geometries. The cells are free to migrate within their hydrogels, without constraints from walls, and communicate with other cell types. The hydrogels can be precisely patterned with cells, but also secondarily photo-patterned with peptides to provide control onto cell migration and organization. This method can be used to produce platforms with multiple cell types, proteins and specific peptides, and with any geometry producible by light patterning technologies. To exemplify the process, vascular systems, made with endothelial cells and pericytes were fabricated.

The presented method allows for the fabrication of minimalistic but physiologically relevant *in vitro* platforms, which enable the investigation of complex interactions between multiple cell types and any circulating factor of interest.

Biographic Details

Benoit G.C. Maisonneuve
Title: Postdoctoral researcher
Affiliation, Country: StemCARE, Australia
Phone: +61 7 334 63835 E-mail: b.maisonneuve@uq.edu.au
Research interests: microtechnology, material science, rheology, bioengineering