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Internship period * : 1 février – 30 juin 2018

Title

Compartmentalized microfluidics for cell co-culturing

Projet scientifique (1 page maximum) / *Scientific Project (maximum 1 page):*

1. *Project*

Cells function in interaction with multiple macromolecular complexes in defined environments. The extracellular matrix (ECM) and cell adhesion components, the vascular network, surrounding cells and soluble factors all play a role in this dynamic interplay. Microfabrication strategies and microfluidics are perfectly suited to meet the appropriate tissue microarchitecture, complex biochemical milieu and dynamic mechanical microenvironment because they provide precise dynamic control of structure, mechanics and chemical delivery at the cellular size scale.[1-3] We use microfluidics to provide cells with a multiplexed dynamic environment, which integrates cell-matrix interactions and the delivery of signaling molecules in a controlled fashion. **This project aims at fabricating a two-chamber microdevice to allow the co-culturing of epithelial cells in two different ECM-like environments.**

2. *Specific techniques or methods*

We fabricate patches that are coated with biopolymer fibers obtained by electrospinning (Figure 1A) and that are further cellularized. Our group has shown that these patches are efficient matrices for stem cell culture with maintenance of their pluripotency over months,[4] as well as for stem cell differentiation.[5,6] The fabricated frames will be characterized by scanning electron microscopy (SEM) and force measurement to determine their morphological and mechanical properties. Then, patches will be inserted into a 2-chamber microfluidic device (Figure 1B). The sandwich type device is produced by PDMS casting with lithography defined templates, resulting in chambers for the patch integration, injection channels, and fluidic connectors.

* 5 mois à partir du 21 janv 2019 / *5 months not earlier than January, 21st 2019.*

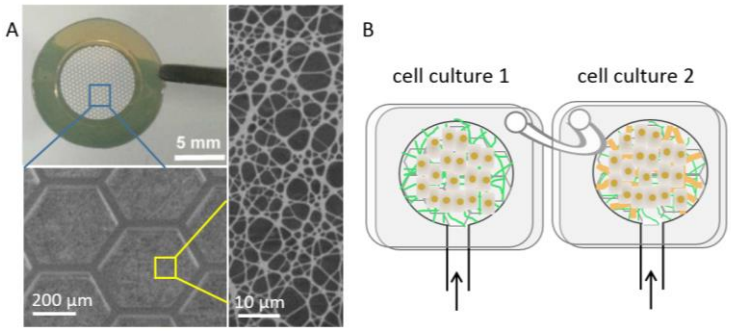

Figure 1. (A) Photograph and SEM images of a culture patch after electrospinning. (B) Scheme of the 2-chamber microsystem to be developed.

3. Résultats attendus

(1) Fabrication of patches coated with different biopolymer networks: gelatin nanofibers and "fiber-on-fiber" matrix obtained by electrospinning of two different polymers (gelatin and polyglycolic acid).
(2) Fabrication of devices that will ensure easy insertion of the patch without leakage, and enable reproduction of physiological flow conditions.
(3) The proper functioning of the culture patch microfluidic device will be settled with the culture of epithelial cells.

4. Références / *References*

[1] Tibbitt, et al. Proc. Natl. Acad. Sci. USA. 2015, 112, 14444.
[2] Takayama, et al. Nature 2001, 411, 1016.
[3] Huh, et al. Trends Cell Biol. 2011, 21, 745.
[4] Liu, et al. Biomaterials. 2017, 124, 47.
[5] Tang, et al. J. Mater. Chem. B 2016, 4, 3305.
[6] Tang, et al. Nanoscale 2016, 8, 14530.