Induced-pluripotent stem cell into glomerular cells within microfluidic devices

Internship location: CoRaKiD, UMRS1155, Hôpital Tenon

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Context:

Induced-pluripotent stem cells (iPSC), that we are usually reprogrammed human fibroblasts, have a unique potential to generate various specific cell types without facing the major ethical issue of embryonic stem cells. Their principal application is in regenerative medicine where major advances are highly expected to face the lack of organ transplants. Another major application is to improve the physiological relevance of human cell used in *in vitro* assay, who often derived from cancer cells or immortalized cells with genomic modifications. Two main approaches have been developed to generate physiological human cells. The first one consists in the differentiation of iPSC into various cell types specific to an organ. If this approach is powerful as it produces the whole complexity of organs, it cannot be use to study a particular physiological function of an organs. The second approach consists in the differentiation of iPSC directly into a specific cell type using different cytokines at different time points.

Team:

In the framework of the project AWACS, the multi-disciplinary team composed of engineers, biologists, chemists and clinicians, aims to develop a physiologically relevant *in vitro* model of the renal glomerulus, which plays a major role in blood filtration. The project is composed of three major developments: (i) stem cell differentiation into glomerular cells, (ii) basement membrane mimicking biomaterials and (iii) design of a microfluidic chip integrating sensors (Dembele, Delafosse *et al*., *Med Sci (Paris)*, 2021). Once the development will be achieved, the *in vitro* model will be used in translational medicine to help the clinicians.

Internship objective:

The aim of this internship is to differentiate iPSCs into podocytes and glomerular endothelial cells using published protocols within a microfluidic device. As the microfluidic device is composed of a single microchannel, the effect of the shear stress-induced by the flow rate on the differentiation will be study at the mRNA and protein levels thanks to RT-qPCR and Immunofluorescence. Gold standard glomerular cells will be also cultured for benchmarking.

Candidate profile:

We are looking for a M2 student interested in microfluidics and *in vitro* model with a background in Chemistry/Biochemistry and Life Sciences. Interest in undertaking a PhD in a wider project to contribute to the development of kidney-on-chip will be appreciated.

Expected contributions:

- Acquire technical skills in cell culture and molecular biology (RT-qPCR, Immunofluorescence)
- Collect and analyze the obtained data
- Present during the bimonthly team meeting
- Read scientific literature