POST-DOCTORAL POSITION

Endothelial dynamics in 3D chiral fiber microenvironments

Hosting structures

This project will be carried out at **Institut Curie**, a leading French cancer center combining a multidisciplinary research center and hospital, and at **Chimie ParisTech**, a chemistry engineering school and active research center with expertise ranging from synthetic and physical to material chemistry. It will be performed in the frame of a dynamic collaborative project between **Sylvie Coscoy** (team Biology-inspired Physics at Mesoscales, Curie) and **Vincent Semetey** (team Materials, Interface and Soft Matter). The post-doc will take place in the context of this global **project** developing innovative approaches to build reconstituted 3D fiber architectures perfectly controlled in a geometrical, chemical and mechanical point of views, in order to study fundamental mechanisms of cell-fiber dynamic interactions. This project benefits from a **strong collaborative network**, with important interactions for this post-doc with Catherine Monnot (Centre de Recherche des Cordeliers), expert in angiogenesis and endothelial cell behavior. Institut Curie and Chimie ParisTech are both located in the center of Paris, in close proximity, and the project benefits from the **rich infrastructure** of both institutes (state-of-the-art imaging platform, cell culture, microfluidics and microfabrication, modeling of biophysical phenomena; chemical surface analysis equipments and wide expertise in chemistry), with a **two-photon polymerization set-up** specifically dedicated to the project.

Project

This project aims to decipher fundamental aspects involved in **endothelial cell behavior** in relation to the geometric and mechanical characteristics of the 3D microenvironment. Cell dynamics in a matrix with **3D chiral micron-scale properties** remains largely unexplored, despite growing evidence of the influence of chirality on cell migration and differentiation. We propose to use a two-photon polymerization-based microfabrication system[1], in which we have previously observed geometry-triggered phenotypes evocative of angiogenesis initiation [2], to build tube networks with 3D spiral chiral fibers, with tunable geometrical, chemical and mechanical characteristics. In these microstructures, we will study **3D cell polarity**, the **dynamics of filopodia** and the **forces** at play, as well as **migration and multicellular dynamics** including early steps of endothelial multicellular engagement. This project is based on ongoing **innovative developments** for the generation of **controlled 3D fiber arrays**, and will involve image analysis developments to capture dynamic properties of endothelial cell-fiber interactions at subcellular and multicellular scales.

[1] Coscoy S, Baiz S, Octon J, Rhoné B, Perquis L, Tseng Q, Amblard F, Semetey V. (2018) Microtopographies control the development of basal protrusions in epithelial sheets. *Biointerphases***.** 13(4):041003. doi: 10.1116/1.5024601.

[2] Ucla P, Ju X, Demircioglu M, Baiz S, Muller L, Germain S, Monnot C, Semetey V & Coscoy S (2022) Dynamics of Endothelial Engagement and Filopodia Formation in Complex 3D Microscaffolds. *Int J Mol Sci* 23: 2415

Candidate profile

A variety of profiles and PhD backgrounds will be considered for the position: applicants with **PhD either in physics, biomechanics, cell biology or image analysis** could be a good match for the project. An **interdisciplinary motivation** is recommended. Technologies used in the project will include chemistry and microfabrication by two-photon polymerization for the creation of new 3D microstructures promoting multicellular engagement and collective migration, cell culture, live imaging by spinning disk or Lattice Light Sheet microscopy, forces measurements, and image and data analysis. The initial training will be adapted according to the post-doc background in biology, chemistry or physics. The subject may involve developments in image analysis for the detection of subcellular and cellular features in 3D fiber networks, and a strong motivation or previous experience in using and developing AI-based methods for image analysis would be a good asset for the project.

Postdoctoral funding is available for one year. After this period, selected applicants will be encouraged and supported to apply for external postdoctoral grants/fellowships on this project, with an alternative possibility to join other related funded projects in the “3D fibers” consortium.

Contacts

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