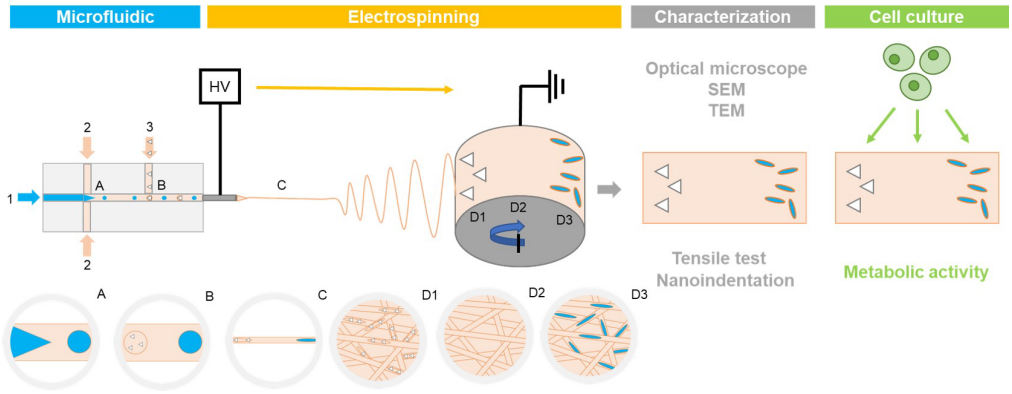
Internship offer

Combination of microfluidic and electrospinning techniques to produce scaffolds for tissue engineering of the osteotendinous junction.



Description

Tendon is a complex fibrous tissue whose spontaneous healing after an injury is very slow. Recovery could be enhanced by providing cells with an adequate scaffold promoting their differentiation and integration in the native tissues. Such scaffolds should present adapted biochemical and biomechanical properties to favor cell fate but also anchorage with adjacent tissues, as bone. Electrospun polymers such as polycaprolactone (PCL) are popular biomaterials used as scaffolds in this field. However, classical extrusion methods or even more advanced ones such as 3D-Bioprinting do not allow meeting the above requirements since the polymer solution is prepared in advance.

We propose here to use a coupled microfluidic/electrospinning approach to produce fibers with finely tuned shape, mechanical, chemical and biological properties that can evolve during the process itself. In particular, we aim at creating gradients in the scaffolds in order to better mimick the interfaces with bone. The structure of fibers will be observed by optical, SEM and TEM microscopy while the mechanical properties will be characterized thanks to tensile tests and nanoindentation. Cell culture will be performed on the final materials to compare the metabolic activities of stem cells with classical PCL scaffolds.

The recruited student will work in close collaboration with a PhD candidate from the team Cells, Biomaterials and Bioreactors, as well as with the researchers in charge of the Microfluidics platform. The internship is part of a joined research project with a German laboratory (Institut für Mehrphasenprozesse, Leibniz Universität Hannover) and may be the start of a PhD project.

References

1. M. Beldjilali-Labro, A. Garcia Garcia, F. Farhat, F. Bedoui, J-F. Grosset, M. Dufresne, C. Legallais Biomaterials in Tendon and Skeletal Muscle Tissue Engineering: Current Trends and Challenges. Materials (2018), 11, 1116 – 1165.
2. I. Bihi, D. Vesperini, B. Kaoui, A. Le Goff Pressure-driven flow focusing of two miscible liquids. Physics of Fluids 31, 062001 (2019)

Conditions

6-month position; starting in February 2023.
Students with a background in bioengineering, fluid mechanics of biomaterials are encouraged to apply.

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