IDIL master 1 project

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Title: Bioprinting of a vascularized scaffolds for nerve tissue engineering

Spinal cord injuries generate very incapacitating paralysis with limited therapeutic solutions due to difficulties in guiding the growth and reconnection of axons to their targets. Indeed, at the chronic stage, the formation of a glial and fibrotic scar hampers axonal growth. These conditions require the development of therapeutic solutions promoting efficient regeneration. Cell therapy combined to support biomaterials represent a promising approach. The team strategy consists in developing a multi-channel nerve guide with supporting cells to favor neuronal cells survival and axonal growth. The scaffold will present an anisotropic structure and is composed of natural polymers to allow cell adhesion and alignment. In the perspective of scaffold implantation, an important feature is to provide a quick vascularization of the graft. The specific aim of this master's project will be to produce a pre-vascularized scaffold using bioprinting of endothelial cells. The challenges will be to obtain self-organization of the cells within the bioink in the scaffold while controlling architecture with a high resolution. The first objectives of this internship project will be the optimization of the bioink composition and 3D printing of the scaffolds described above using a cutting-edge bioprinter recently purchased in the lab. Further investigations will involve characterization of the scaffold properties and overtime analysis of the cells viability, migration and organization using specific staining and observations by confocal microscopy.

The experimental work will be mainly carried out at the Charles Gerhardt Institute - UMR 5253 in the department "Macromolecular Chemistry and Materials". The laboratory's research in the field of regenerative medicine relies on complementary expertise in materials chemistry (natural or synthetic polymers, advanced processing techniques) and in cell biology within the institute as well as on several national and international collaborations.

Candidates should ideally have a training in both material formulation and cell biology and must be motivated by the development of tissue engineering solutions for regenerative medicine.