Internship Proposal

Proposal By: Sara Silva | scsilva@i3s.up.pt

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Contact: scsilva@i3s.up.pt

Project Title:
Applying principles of supramolecular chemistry to develop 3D-printed perfusable microvessels

Level:

Master Student

Project Summary:

The project aims to establish 3D printing technology in the lab to fabricate microvascular structures similar to those found in the blood-brain barrier (BBB) for the development of in vitro BBB models. It will apply principles of supramolecular self-assembly and 3D printing to recreate the biochemical and architectural environment necessary for cells to form a functional barrier model, enabling their reproducible use in studies of drug permeability and delivery to the brain.

Work to be developed by the student:

Establishing bioprinting capacity and optimising printing materials: The first step will focus on setting up the 3D-printing module. Then preparation of the bioinks and support bath. Host-guest HA hydrogels will be prepared [5] and characterised for viscosity, gelation kinetics and mechanical properties for optimisation of printing fidelity. Bioactive PAs containing functional sequences from laminin, collagen type IV and VEGF will be used. The printing parameters, such as pressure, speed, and nozzle diameter, will be optimised to ensure structural fidelity, material flow and self-assembly interactions to enable the formation of stable tubular structures.

References:

[1] N. Weiss, et al. Biochimica et Biophysica Acta Biomembranes 2009, 842-857

[2] R.M. Capito et al. 2008, Science. 2008 28;319(5871):1812-6.

[3] D.S. Ferreira, et al. 2015 Adv Health Mater, 602-12

[4] J.W. Tashman et al. 2022 Sci Rep 12, 22652 [5] Loebel, C. et al. 2017 Nature Protocols, 12(8), pp. 1521–1541

INSTITUTO
DE INVESTIGAÇÃO
E INOVAÇÃO
EM SAÚDE
UNIVERSIDADE
DO PORTO

Rua Alfredo Allen, 208
4200-135 Porto
Portugal
+351 220 408 800
info@i3s.up.pt
www.i3s.up.pt