Internship Proposal

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Project Title:
Development of a peptide/polymer injectable hydrogel for immune cell delivery to the intervertebral disc

Level:

Master Student

Project Summary:

Lumbar disc herniation (LDH) is one of the main causes of spinal surgery worldwide and a non invasive physiological therapy able to maintain tissue function is lacking. Previous work from our lab has identified a immune cell therapy with potential for physiologically resolution of LDH. The main goal of this internship is to develop an hydrogel delivery system based on hyaluronic acid and peptides for the in situ delivery of an immunotherapy for LDH. In this internship, the student will prepare an injectable hydrogel that mimetize the biochemical and biomechanical characteristics of the native herniated tissue, which may support cellular viability, serving as 3D in vitro testing platform for early identification of potential adverse effects in animal experimentarion and that may in the future be used in cellular immunotherapy for LDH resolution.

Work to be developed by the student:

Biocompatible hydrogels will be prepared based on hyaluronic acid (HA) and functionalized with self-assembling peptides that will act as HA crosslinkers while mimicking the collagen fibers present in the native tissue extracellular matrix. Macrophages will be cultured within the hydrogels. Physico-chemical, biomechanical and biological evaluation of the hydrogel will be carried out by rheometer and SEM analysis. Cell biocompatibility, injectability, cell/material interactions, encapsulated macrophage profile and their controlled release will also be tested by in vitro assays.

References:

Ribeiro-Machado C, Santos SG, Amaral IA, Caldeira J, Pereira P, Barbosa MA, Cunha C. Macrophage-based therapy for intervertebral disc herniation: preclinical proof-of-concept. NPJ Regen Med. 2023 Jul 10;8(1):34. DOI: 10.1038/s41536-023-00309-z.

Radvar E, Azevedo HS. Supramolecular Peptide/Polymer Hybrid Hydrogels for Biomedical Applications. Macromol Biosci. 2019 Jan;19(1):e1800221. DOI: 10.1002/mabi.201800221.

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