Internship proposition 2026-2027

Master 2 GP Medicine 4R (Repair, Replace, Regenerate, Reprogram)

Lab: Inserm U1229
Team: REJOINT, Group HEAL

Name and position of the supervisor: Catherine LE VISAGE, Group Leader

Email of the supervisor: Catherine.levisage@inserm.fr

Candidate (if internship filled):

Title of the internship: A 3D model of an intervertebral disc for the evaluation of regenerative therapies

Summary of the internship proposal:
Low back pain, which affects more than 80% of adults in their lifetime worldwide, leading to considerable disability and socio-economic burden, is often associated with degeneration of the intervertebral discs. regenerative medicine seeks to reverse the degenerative process and restore the integrity and function of the intervertebral discs.
The main therapeutic strategies under development include biomolecules, biomaterials, cells, or their secretome. However, evaluating these new strategies relies on in vitro models, which do not reproduce the complex structure of a disc, and on pre-clinical models in large animals such as sheep, which have physiological, anatomical, and biomechanical similarities with humans.
Therefore, this project aims to develop a clinically relevant in vitro model using biomanufacturing techniques to reproduce the macro and microarchitecture of the intervertebral disc while limiting the need for animal experimentation.
We have previously designed an in vitro intervertebral disc model that recapitulates the native cellular organization and phenotype of disc cells (Carrot et al., Int. J. Bioprint., 2025; Carrot et al., Biofabrication, 2025). In this 3D model, we will evaluate the ability of human mesenchymal stromal cells and their extracellular vesicles to promote extracellular matrix synthesis and slow the degenerative process.
The main objectives of the internship will be to i/ induce degenerative changes in the model using pro-inflammatory cytokines, ii/ evaluate the relevance of this model to determine the efficacy of a biotherapy by carrying out experiments in parallel on ovine discs. To address their functionality and regenerative potential, human MSCs and MSC-derived EVs will be injected into the NP compartment of the 3D bioprinted model via a transannular pathway. This evaluation will be carried out in parallel on ovine discs to validate the relevance and robustness of this new 3D model.

Techniques used in the project: Primary cell culture (bovine NP cells, Human mesenchymal stromal cells, ovine disc cells), Bioprinting, ex vivo organ culture of ovine IVD cells / extracellular matrix evaluation (Histology, RT-qPCR, Elisa).

Profile(s) linked to the project:

X Experimental Biology *(Recherche expérimentale)*
☐ Clinical Research *(Recherche clinique)*
☐ Research in data analysis (Recherche en analyse de données)