

# Development of bioinspired materials for cartilage regeneration

Period: 6 months from January/February to June/July 2024

Contact : [gilles.subra@umontpellier.fr](mailto:gilles.subra@umontpellier.fr)

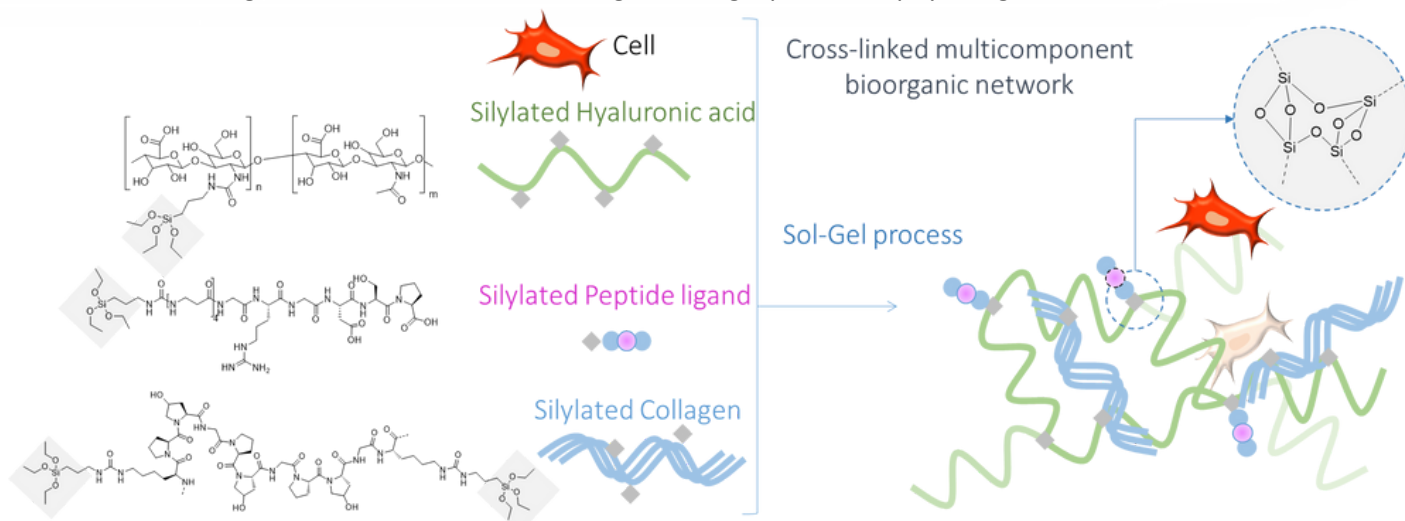
Internship locations: IBMM, Pole Chimie Balard, Montpellier, Peptides [www.ibmmpeptide.com](http://www.ibmmpeptide.com) and IRMB, university hospital saint Eloi

*The work will take place mainly at the IBMM in Montpellier, and IRMB for biomaterial evaluation.*

## Summary

Recapitulating the complexity and variety of extracellular matrixes (ECM) in terms of mechanical, physicochemical properties and biomolecular composition, is a challenge that still to be tackled to prepare both organ-on-chip and for tissue engineering applications. Extracellular extracts such as Geltrex™ or Gelmatrix™ are extensively used to produce organoids as cells may grow and differentiate inside these networks. However, as animal extracts they suffer severe limitations such as risk of immunogenicity, uncontrolled composition and non-adjustable mechanical properties.

This Master's research project at the interface of inorganic chemistry, organic chemistry and biology, aims to explore a generic methodology to synthesize novel bioinspired materials for regenerative medicine and in particular for cartilage and bone regeneration. This project relies on the synthesis of reactive biomolecular building blocks (e.g. hyaluronic acid, peptide ligands, collagen, growth factors...) that can be combined in desired ratio and composition and assembled using chemoselective and bioorthogonal sol-gel process in physiological conditions.



## Student work

The Master student will carry out the synthesis, analysis and purification of the different silylated biomolecules using state of the art bioconjugation techniques, LC/MS and NMR (1H 13C) analyses. He or she will perform the synthesis of biomaterial by sol-gel process and study the rheology, the mechanical properties and the three dimensional network structure at different scales. Depending on the composition, he or she will study the biocompatibility, degradability, cell adhesion and colonization of the materials as well as the one-pot synthesis and cell embedment during sol-gel process. Finally the 3D printability of selected materials will be assessed.

## Skills acquired:

1. Project management with several laboratories, work at the interfaces of disciplines.
2. Synthesis of peptides, synthesis on support, bioconjugation, biopolymer modification, sol-gel chemistry. Characterization of biomolecules (LC/MS, NMR) and biomaterials.
3. Basic biomaterials evaluation

## Required skills and soft skills

1. Scientific English, Organic Chemistry and Analytical Chemistry Master's level.
2. Knowledge of biology and biochemistry will be appreciated
3. Autonomy, scientific curiosity
4. Rigor, capacity for work
5. Good interpersonal skills, ability to report