ITI HiFunMat Master Internship Proposal

☐ M 1 ☒ M 2

Title: Exploration of the link between structure and properties of Elastin-like peptides

Internship supervisor

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Collaboration with a HiFunMat member (*please indicate their name*)	☒ No ☐ Yes :

Student profile looked for

Master program (*more than one box can be ticked)*	☒ Material science and engineering ☒ Chemistry ☐ Physics
Other indications if necessary	

Internship description

Context: Supramolecular materials arise from non-covalent interactions between molecular building blocks that self-assemble in a bottom-up approach into well-organized functional structures. Forming a network of fibers with a branched appearance, elastin provides elasticity to tissues, such as skin and arteries, ensuring that they remain in their original state after the application of an external force.[1] The elastic property of elastin is due to its high content of hydrophobic amino acids, which hide from the aqueous medium, leading to partially stretched conformations.[2] Studies carried out on tropoelastin have revealed the existence of a repeating sequence of amino acids, valine – proline – glycine – valine – glycine (VPGVG) pentapeptide. This sequence forms β-turn structures leading to the formation of a β-spiral, important for the elastic properties.[3]

The goal of the project: The amino acids and their order have tremendous importance on peptide/protein properties. The objective of the project is to deliver a library of elastin-like peptides and dig into the relationship between the peptide sequence (the order of the amino acids) and the secondary structure and rheological properties of the obtained hydrogels. To this aim, modified Fmoc-VPGpY peptides will be synthesized by combinatorial chemistry by changing the order of amino acids and their structural and rheological properties will be characterized.

Methodology: A combinatorial peptide library will be synthesized, and the selection assay will be optimized to obtain self-assembling peptides. Then, the best conditions of gelation will be determined as well as the robustness of the system. The gel characterization will be done by inverted tube test, rheology, fluorometry, fluorescent microscopy, UV-Vis spectrophotometry and infra-red spectroscopy.

References

(1) Wang, K., et al., Elastin Structure, Synthesis, Regulatory Mechanism and Relationship with Cardiovascular Diseases. Front Cell Dev Biol, 2021, 9, 596702.

(2) Alberts B., et al., Molecular Biology of the Cell. Garland Science. New York 2002.

(3) Chaffey, N., et al., Molecular biology of the cell. 4th edn. Annals of Botany, 2003, 91, 401.