
Hydrogels based on peptides and polysaccharides to manage chronic wounds

DIRECTEUR DE THESE : PHILIPPE LAVALLE

INSERM / CNRS / UNIVERSITE DE STRASBOURG, UMR_S 1121, BIOMATERIALS AND BIOENGINEERING, CENTRE DE RECHERCHE EN BIOMEDECINE DE STRASBOURG,
1 RUE BOECKEL, 67000 STRASBOURG

TEL : 03 68 85 30 61 ; E-MAIL : philippe.lavalle@inserm.fr

Postoperative infections are the most common complications faced by surgeons after implant surgery. Moreover chronic wounds, and more specifically diabetic wounds, are prone to infections and lead to major complications.

Our recent work on polypeptide-based coatings, including polyarginine (1-3), has shown the effectiveness of these molecules. In this project, we will design hydrogels based on biopolymers like polysaccharides with antibacterial activities and also with healing properties to regenerate damaged tissue on chronic wounds. These hydrogels will be able to release antimicrobial peptides in a controlled manner but also specific ions and drugs promoting tissue regeneration. In particular, some physiological metals will be released to stimulate, fibroblasts keratinocytes and macrophages in a pro-regenerative direction. We will focus not only on the design of the hydrogel but also on the applicators able to allow its delivery on the wound as a liquid bandage.

The final objective of the project will be to design a high performance hydrogel with an applicator system that can be evaluated through an ex vivo and in vivo study. The hydrogels will be used in many applications and could be incorporated in bandages or directly brought in contact with chronic wounds in a injectable form.

This project will involve experiments in chemistry and physical chemistry of materials, in biology (cell biology and molecular biology) but also, artificial intelligence studies will be performed through close collaborations with partners to optimize the design of the hydrogels.

The work will be performed at the Biomaterials and Bioengineering lab (<https://www.biomaterials-bioengineering.com>) in close collaboration with well known laboratories from other Universities and with medical device companies.

[1] Lebaudy E., Petit L., Nominé Y., Heurtault B., Ben Hadj Kaddour I., Senger B., Rodon Fores J., Vrana N. E., Barbault F., Lavalley P., *Eur. J. Med. Chem.*, 2024, 268, 116224.

[2] Kocgozlu L., Mutschler A., Tallet L., Calligaro C., Knopf-Marques H., Lebaudy E., Mathieu E., Rabineau M., Gribova V., Senger B., Vrana N. E., Lavalley P., *Mater. Today Bio.*, 2024, 28, 101168.

[3] Gribova V., Boulmedais F., Dupret-Bories A., Calligaro C. Senger B., Vrana N. E., Lavalley P., *ACS Appl. Mat. Int.*, 2020, 12, 19258-19267.