APPEL A PROJETS CONTRATS DOCTORAUX 2019
INSTITUT CARNOT CHIMIE BALARD CIRIMAT

PROJECT : APAPTIDE –Organic / inorganic particles for the treatment of complex wounds with high risk of infection

Key words: apatide, peptide, wound-healing, antibacterial, hybrid materials, particles

CONTEXT :

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Summary:

This PhD project focuses on the design and the study of apatide-based organic/inorganic particles which will be stabilized by biomolecules and in particular bioactive peptides. The antibacterial and wound healing effect of the particles will be evaluated.

Challenges:

Open wounds are common in all health services, from emergencies to dermatology, maxillofacial, orthopedic and plastic surgery. In the case of deep wounds, infection is a major threat to the health of the patient, especially for the most fragile subjects such as the elderly, diabetic patients, immuno-depressed or burn victims. Innovative solutions need to be developed for the most complex wounds where coordinated (antibacterial and pro-healing) effects are required to achieve optimal healing. In addition, current solutions are generally based on general antibiotic therapy, but microbial resistance is becoming a major public health problem, and alternative solutions are needed.

Scientific approach:

In this context, APAPTIDE aims to design an alternative solution to conventional dressings and systemic antibiotic treatments through the development of sub-micron peptide-apatite hybrid particles for the controlled release of active agents. Such anti-inflammatory or antibacterial agents will be (i) associated with apatitic particles by ion doping (ex: ions Cu^{2+}, Zn^{2+}), and (ii) placed on the organic corona stabilizing apatite particles in colloidal solution. In this project and for the first time, this organic corona will be constituted by bio active peptides displaying antimicrobial, pro-angiogenic (promoting neovascularization) and wound healing properties.

The innovative aspect of the project is based on the very nature of the hybrid objects. Indeed, the submicron particles of apatite (HA) will not be stabilized by primary stabilizing agents (phosphonated PEG, polar head of phospholipids, etc.) but by peptides which themselves have intrinsic bioactive properties.

Models studied:

Thesis project will demonstrate this concept by delivering: (i)-a method of synthesis of hybrid particles HA / peptides eventually applicable to any type of bioactive peptide, (ii)-the first particles peptide- HA characterized, and (iii)- a preliminary evaluation of the antibacterial efficacy of the particles in vitro. The formulation of these hybrid particles in the form of a medical device of the dressing and / or ointment type will also be explored.

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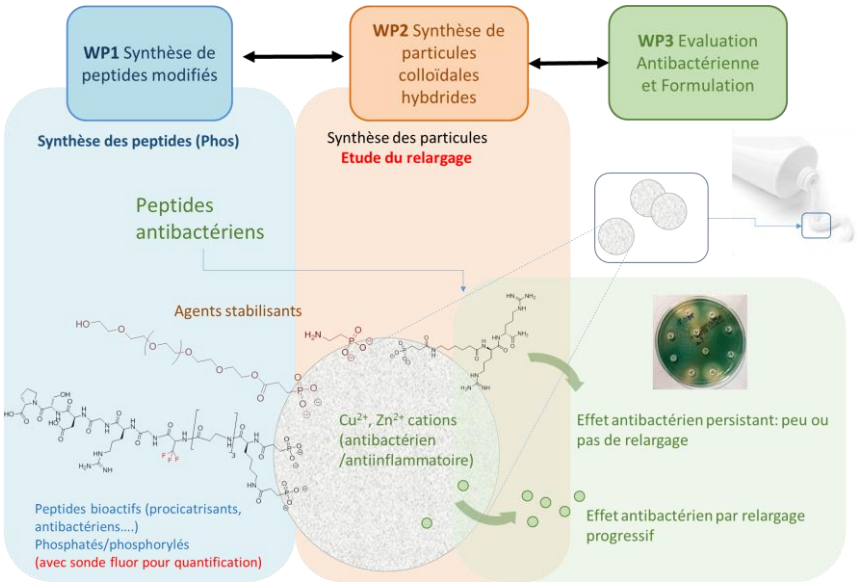

Candidate Profile:

Student having validated an Master in (bio)organic chemistry and / or graduated from chemistry engineering school.
Autonomy, creativity and rigor, very hard-working capacity and motivation
Good level in organic chemistry
Experience in biology, physicochemistry or nanomedicine will be appreciated.
Good level of English
Interested by Chemistry / biology interface and the will to work in different laboratories (Montpellier/Toulouse)