DÉPARTEMENT BIOPOLYMÈRES ARTIFICIELS

POLYMÈRES POUR LA SANTE

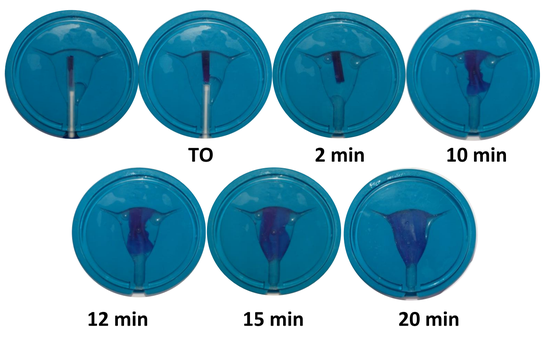
IBMM
UNIVERSITÉ DE MONTPELLIER, FRANCE.

TOPIC 4 : PROCESSING & EVALUATION OF DEGRADABLE POLYMERS

IMPLANTABLE MEDICAL DEVICES AND SCAFFOLDS

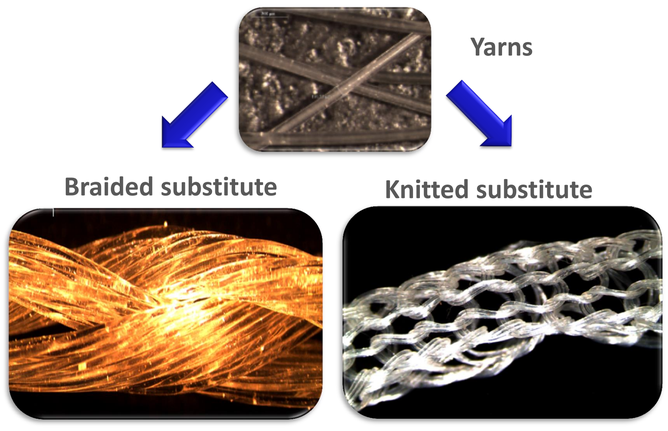
Aim : to design new scaffolds and implantable medical devices based on degradable polyesters for biomedical applications and tissue engineering

Bioresorbable, self deployable and intra-uterine device for the management of uterine adhesions



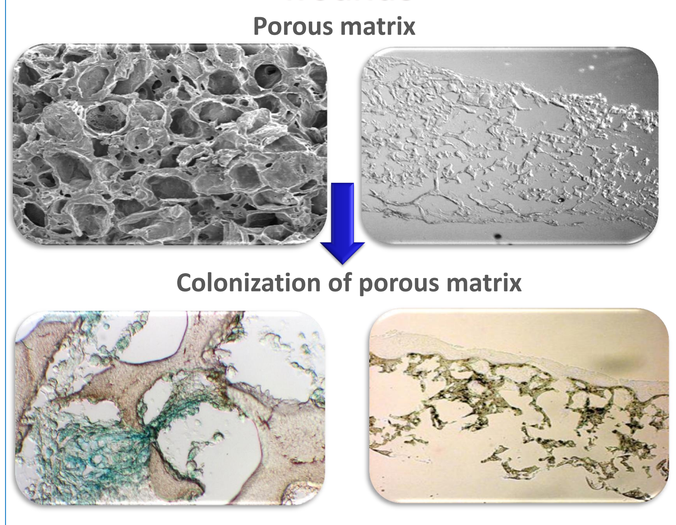
The objective of the project PREVISYN is to design a self-deployable, bioresorbable and anti-adhesion medical device to prevent the appearance of intrauterine adhesions. PREVISYN has the ambition of improving the spontaneous fertility through the design of a temporary intrauterine device. This medical device must be perfectly adapted to the clinical practice of gynecologic surgeons.

Bioresorbable and elastomeric ligament substitute for the treatment of anterior cruciate ligament failures



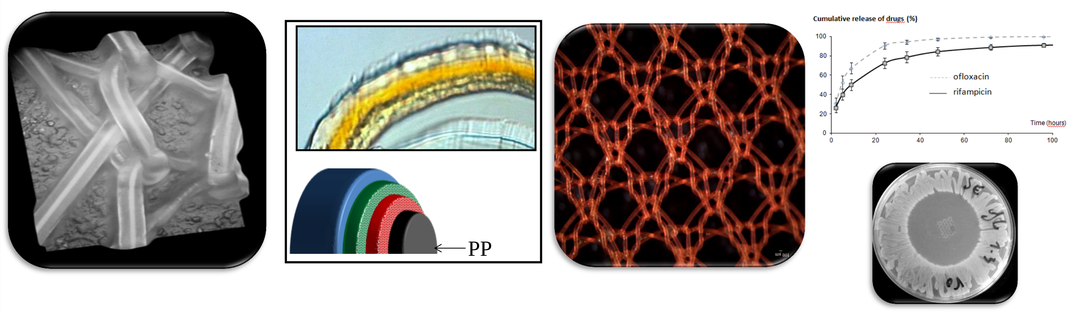
The aim of this project is to develop a scaffold whose composition and design fit to ligament regeneration. We hypothesize that the combination of PLA-Pluronic based copolymers and adequate shapes can allow the conception of ligament substitute that meet specific requirements of the ligament reconstruction in terms of mechanical properties[1].

Degradable skin scaffold for the treatment of severe and chronic skin wounds



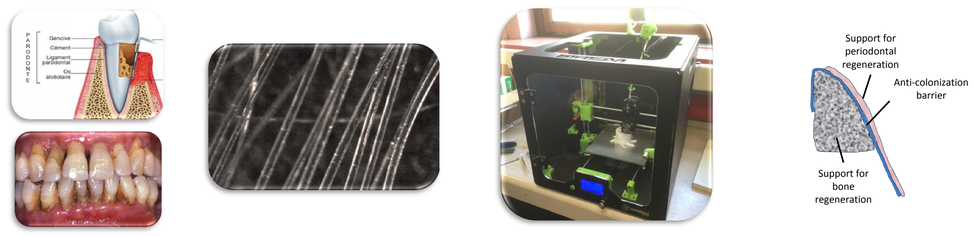
The aim of this project is to produce a scaffold that can stimulate skin wound healing and promote neovascularization. The porosity, the type of polymers and the degradation rate are key parameters to obtain the most suitable skin healing support[2].

Multilayer, degradable coating as a carrier for the sustained release of antibiotics from implantable medical devices



The objectives of the project are the design, the optimization and the in vitro biological evaluation of a new degradable multilayer coating intended to prevent the bacterial contamination of Polypropylene surgical mesh. We have developed a biocompatible and biodegradable PCL- and PLA-based polymeric coating that serves as a reservoir for two antibiotics[3].

Multi-tissue guide for periodontal regeneration by 3D printing

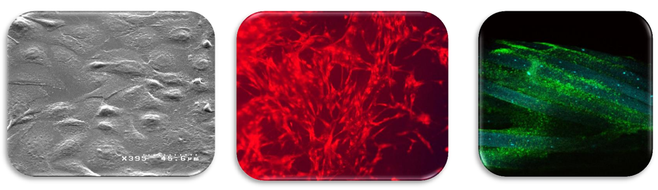


The objective of this project is to design a multi-tissue guide for periodontal regeneration. We want to develop an implantable medical device by 3D printing, which would consist of three parts: a bone regeneration support calcium phosphate cement, a degradable membrane to limit gingival colonization of bone support (the main cause of bone regeneration failure) and a porous, degradable and elastomeric support for gingival regeneration.

BIOLOGICAL EVALUATIONS OF DEGRADABLE POLYMERS

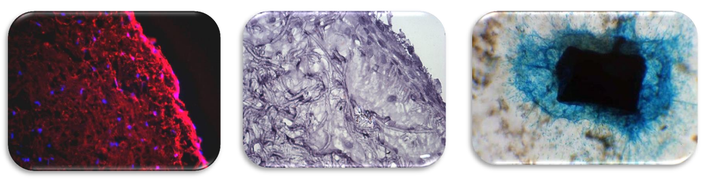
Aim : To evaluate the biocompatibility of degradable polyesters and implantable medical devices

Cytocompatibility



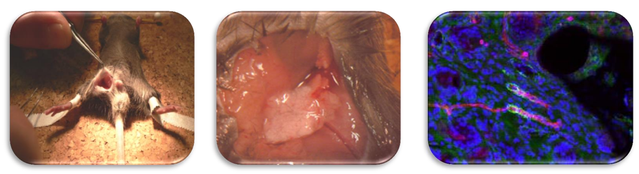
Evaluation of cell adhesion, proliferation and migration.
Quantification of scaffold cell colonization

Production of extra-cellular matrix



Identification and quantification of synthesized proteins by histological staining, immunofluorescent staining and RT-PCR

In vivo evaluation



Evaluation of tissue integration, inflammation and neovascularization .
Study of polymer degradation

1. Leroy A., Pinese C., Bony C., Garric X., Noël D., Nottelet B., Coudane J. *Investigation on the properties of linear PLA-poloxamer and star PLA-poloxamine copolymers for temporary biomedical applications.* Materials Science and Engineering: C 2013 Oct;33(7):4133-9.
2. Garric, X.; Guillaume, O.; Dabboue, H.; Vert, M. and Molès JP. *Potential of a PLA-PEO-PLA-Based Scaffold for Skin Tissue Engineering: In Vitro Evaluation.* Journal of Biomaterial Science, Polymer edition 2012;23(13):1687-700.
3. Guillaume O, Garric X, Lavigne JP, Van Den Berghe H, Coudane J. *Multilayer, degradable coating as a carrier for the sustained release of antibiotics: preparation and antimicrobial efficacy in vitro.* Journal of Controlled Release. 2012 Sep 28;162(3):492-501.

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