

Internship proposition 2026-2027
Master 2 GP Medicine 4R (Repair, Replace, Regenerate, Reprogram)



Lab: UMR1229 RMeS (<https://rmes.univ-nantes.fr>)

Team: REJOINT

Name and position of the supervisor: Fabien NATIVEL

Email of the supervisor: fabien.nativel@univ-nantes.fr

Candidate (if internship filled):

Title of the internship: REMI – Remote Electrochemical interactions between Metallic Implants

Summary of the internship proposal:

Implantable medical devices are often manufactured from metals or metallic alloys. Once implanted, these materials interact continuously with their biological environment. In contact with physiological fluids (serum, lymph, saliva), they can generate electrochemical potentials and small electrical currents, similar to those observed in a battery. This phenomenon, known as galvanic corrosion (or galvanic coupling), occurs when different metals are present in the same environment and can lead to the accelerated degradation of the more electrochemically active material. This corrosion process results in the release of metallic ions and particles into the body, which may induce local or systemic adverse effects, including hypersensitivity reactions and potential distant toxic effects. These mechanisms are complex and highly patient-dependent, and could contribute to clinical complications such as implant loosening or failure. These issues may be particularly relevant in patients with multiple implants. Although such corrosion is likely to develop when two or more different metals are in close contact in a physiological environment inter-implant distances and configurations could also influence electrochemical interactions. As a result, the behaviour of different metals or alloys in such settings remains difficult to anticipate and largely unpredictable. In this context, predicting the lifespan and safety of metallic implants remains a major challenge. Corrosion processes are influenced by multiple physiological parameters (tissue impedance, composition of biological fluids) and non-physiological factors (material composition, inter-implant distance, duration of exposure). To address this challenge, this project proposes the development of an innovative experimental platform designed to model electrochemical interactions between multiple metallic implants under controlled and physiologically relevant conditions. This platform will enable precise control of key parameters such as electrolyte composition, pH, geometry, and dynamic conditions, allowing the study of corrosion mechanisms in configurations representative of clinical situations involving multiple implants.

The intern will contribute to the design and implementation of experimental protocols simulating the physiological environment. They will perform electrochemical measurements to monitor corrosion phenomena and analyze metallic degradation products. In addition, they will participate in the evaluation of the biological effects associated with these products using relevant in vitro cellular models, including assays of cell viability, cytotoxicity, and inflammatory response. This project offers the opportunity to gain hands-on experience in cell culture, electrochemical techniques, and physicochemical characterization, while developing strong skills in experimental design, data analysis, and interpretation.

Profile(s) linked to the project:

Experimental Biology (*Recherche expérimentale*)

Clinical Research (*Recherche clinique*)

Research in data analysis (*Recherche en analyse de données*)