6-month internship at LMGP laboratory (Grenoble)

Design of proteins for the formation of beneficial marine biofilms

Context

Marine biofouling—that is, the accumulation of organisms on the hulls of ships and marine infrastructure—has major ecological and economic repercussions, as it increases fuel consumption, emissions, and maintenance costs, while promoting invasive species that disrupt ecosystems. This phenomenon begins with the adsorption of organic molecules, followed by microbial colonization that forms biofilms to which other species—such as algae, mussels, and barnacles—attach. Current antifouling solutions have numerous drawbacks. Toxic biocidal coatings have been banned, and the alternatives remain costly and only partially effective. A new ecological strategy aims to promote beneficial microorganisms that form "positive biofilms" which naturally inhibit harmful species. As part of this project, we aim to develop bioactive metal oxide surfaces that mimic marine infrastructure and attract protective bacteria.

Project description

To this end, thin films of metal oxides will be functionalized with marine adhesive proteins capable of strongly binding to various substrates. By precisely controlling the properties of the oxides and proteins, we aim to optimize protein adsorption and bacterial adhesion. Metal oxides are routinely synthesized in the laboratory. Preliminary experiments have allowed us to identify a protein capable of interacting with one of these oxides. This protein may promote bacterial adhesion. We aim to confirm these initial results by studying the interactions between other proteins derived from this initial model and other metal oxide surfaces using spectroscopic techniques and ELISA (Enzyme-Linked Immunosorbent Assays).
This internship project includes the following tasks:
- the production and purification of recombinant adhesive proteins derived from the protein produced in the laboratory;
- the study of interactions between different surfaces and these proteins.
The combination of materials science and protein engineering will enable a detailed study of the interactions between metal oxide surfaces and proteins, with the aim of better understanding these still poorly understood phenomena and inspiring innovative solutions to combat marine biofouling.

Scientific environment :

The Material and Physical Engineering laboratory (LMGP) (www.lmgp.grenoble-inp.fr/en) at Grenoble has an international reputation in the fields of nanomaterials and structured thin film materials and their applications in different fields, among which biology and biomedical engineering. The Engineering of NAnomaterials, BIOmolecules and Surfaces (NaBioS) team have a long-standing expertise in investigating protein adsorption and aggregation phenomena at interfaces using real-time surface-sensitive techniques (SPR, QCM, IR) and microscopy. The laboratory is fully equipped with all the necessary equipment for the production and purification of recombinant proteins (bacterial culture, chromatography systems).

Profil and requested skills:

The candidate is a student in the second year of a master's program or in the final year of an engineering school program. He/She must have a solid theoretical and practical background in biochemistry and/or biophysics. He/she should be keen on multidisciplinary approaches, able to work as part of a team and possess excellent writing and communication skills (reports, presentations, etc.). He/She must have a good knowledge of at least one of the languages used in the host laboratories: French or English.

Funding:

Allowance of ≈ 600 €/month.
Funding : Agence Nationale pour la Recherche – ANR BioMIFoul 2026.
Starting date : January or February 2027 – Duration : 6 months.

Contact:

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