UMR 5244 Université de Montpellier-CNRS-IFREMER- Université de Perpignan via Domitia
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PhD Project Proposal

Microbiota, Epigenetics and Anti-Vibriosis Strategies: A Sustainable Prophylactic Approach for Shellfish Farming

Where: Host-Pathogen-Environment Interactions Laboratory (IHPE), UMR5244, University of Perpignan Via Domitia (https://ihpe.fr/)

Keywords: Epigenetics, Microbiota, *Magallana gigas*, *Vibrio aestuarianus*, innate immunity, microbial education, aquaculture.

Duration: 3 years, from 01/10/2026 to 30/09/2029

Application period: From 25/04/2026 to 31/08/2026

Context:

French oyster farming ranks first in Europe and accounts for 80% of the total European oyster stock. Its intensification has led to the emergence of health crises, and as a result, the sector is seeking environmentally responsible anti-infective strategies (as alternatives to antibiotics). In particular, vibriosis represents a major risk for professionals, as it can massively affect marketable oysters. High mortality rates were recorded in 2023 and 2024 in the Thau lagoon, placing the causative pathogen, *Vibrio aestuarianus*, as a top priority for managing oyster farming crises in the Mediterranean.

In this context, our research aims to harness the natural properties of the oyster microbiota and apply them to biological control strategies. Key findings from our unit have shown that it is possible to "educate" the oyster immune system by modifying larval rearing conditions and exposing larvae to a diverse microflora at this stage (microbial education). Larvae exposed during the development of their immune system retain a memory of this exposure (epigenetic memory), and once they reach juvenile or adult stages, oysters are better able to defend themselves against vibriosis. These studies have significant impact because, when applied in hatcheries, microbial education could be used as a prophylactic strategy to combat infectious diseases currently affecting oyster farming. Additionally, our previous work led to the creation of a bacterial strain collection isolated from wild oysters sampled in natural environments. The identification

of antimicrobial and quorum-quenching properties in some of these bacteria suggests another promising avenue for anti-infective strategies.

Objectives

The aim of this PhD project is to further exploit the microbiota of *M. gigas* within an applied anti-infective strategy. The doctoral candidate will:

- Optimize microbial education (in collaboration with Hugo Koechlin).
- Engage in a co-construction process with stakeholders in the oyster farming sector to better understand the acceptability of microbiota-based approaches. This will involve semi-structured interviews with professionals and the development of shared and realistic application scenarios (collaboration with Céline Jacob).
- Deepen molecular knowledge of long-term host-microbiota interactions, including:
    - Characterizing microbiota impact on epigenetic information carriers in *M. gigas*
    - Exploring microbiota effects on telomere stability (collaboration with A. Dupoué)
    - Expanding in vitro screening of bacterial activities for biological control (collaboration with R. Lami)

Methods et Activities

The candidate will be involved in zootechnical implementation with support from an expert at the Ifremer Argenton hatchery. Microbial education will be refined by testing different exposure windows (larval stages), durations, and rearing conditions. The candidate will participate in sampling and experimental infection assays.

The co-construction approach will be conducted through collaboration with a researcher specialized in blue economy, environmental governance, and marine conservation. The candidate will interact directly with oyster farming professionals via semi-structured interviews and participatory workshops.

The molecular basis of host-microbiota interactions will form the core of the PhD project. The candidate will generate and analyze molecular ("omics") data to characterize chromatin structure and telomere length. Techniques such as ATAC-seq, Cut&Tag, and telomere assays will be used. The candidate may also contribute to screening bacterial activities for valorization (antibacterial and quorum-quenching activities).

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Details on the thesis supervision

The PhD will be conducted at IHPE under the supervision of:

- Marie-Agnès Travers (expert in microbial diseases of marine shellfish), (ORCID : 0000-0001-5340-7435)
- Céline Cosseau (expert in environmental epigenetics) (ORCID : 0000-0002-0780-8980)

Co-supervision:

- Eve Toulza (expert in microbiota analysis) (ORCID : 0000-0003-2049-2279)

The candidate will have weekly meetings, attend relevant training, join the TReV team (Transmission, Resistance and Virulence), and regularly present results in team meetings and annual doctoral days.

Scientific, Material, and Financial Conditions

IHPE will provide all necessary experimental facilities. The project is linked to the European project **SPREAD** (Study on oyster pathogen *Vibrio aestuarianus* transmission and dissemination dynamics in French oyster populations), funded by FEAMPA.
The candidate will contribute to tasks focused on future solutions to limit epizootics, collaborate with project partners, participate in meetings, and supervise Master's students. Main collaborators include : Andreaz Dupoué, Ifremer, Laboratoire des sciences de l'Environnement MARin, Hugo Koechlin, Ifremer, Laboratoire des sciences de l'Environnement MARin; Céline Jacob, Ifremer, Aménagement des Usages des Ressources et des Espaces marins littoraux), Raphaël Lami, Sorbonne Université, Laboratoire de Biodiversité et Biotechnologie Microbienne.

International dimension

The project is part of the IRP EcoHealthSea program, in collaboration with Chilean and Brazilian teams, focusing on marine health ecology in aquaculture environments.
The candidate will have opportunities for international exchanges and will attend at least one international conference.

Dissemination and Valorization

Results will be published in peer-reviewed international journals. The candidate will also engage in science outreach (Science Festival, "My Thesis in 180 Seconds").
Discussions are underway regarding potential intellectual property protection and industrial applications.

Contacts:

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How to apply :

Applications must be submitted via the ADUM platform (https://adum.fr/). Applicants are encouraged to contact supervisors beforehand.