



## Proposition de stage

### Parcours Master 2 « Microbiologie, Environnement, Santé »

#### 1. Laboratoire / Entreprise d'accueil :

Intitulé : Génomique des Vibrio-Laboratoire de biologie intégrative des modèle marins, SU-CNRS 8227 Station biologique de Roscoff  
Adresse : Place Georges Tessier, 29680 Roscoff  
Responsable du Laboratoire / Entreprise : Stéphane Egée (unité), Frédérique Le Roux (équipe)  
Responsable de l'encadrement : Frédérique Le Roux  
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Co-encadrant éventuel :

#### 2. Titre, description du sujet, approches utilisées, références (1 page maximum) :

#### **Mechanisms responsible for resistance to antibiotics and heavy metals in vibrio**

The One Health concept recognizes that human health is connected to the health of animals and plants, as well as the quality of their environment. It is thus crucial to break down interdisciplinary barriers separating human and veterinary medicine from ecological, evolutionary, and environmental sciences. In this context, exploring the origins, spread and evolution of antibiotic resistance genes (ARG) in the environment is critical to understand and control the processes leading to the emergence and dissemination of antibiotic resistance in pathogens.

*Vibrionaceae* are marine bacteria that are ecologically diverse members of planktonic- and animal-associated microbial communities. It encompasses the well-studied human pathogen, *Vibrio cholerae*, as well as some very important albeit less thoroughly characterized animal pathogens. For example, *V. crassostreae*, is a *Vibrio* species particularly abundant in oysters affected by the Pacific Oyster Mortality Syndrome. Although members of this species are genetically diverse, most of them can cause disease. Our preliminary data suggest that resistance to multiple antibiotics is common in *Vibrio crassostreae*, strains isolated from the environment. In many cases the resistance phenotype could not be linked with the presence of these known ARG. Our hypothesis is that environmental vibrios are reservoirs of ARGs, because these genes tend to be genetically linked with those involved in survival against toxic molecules present in the environment. For example, oysters naturally bio-accumulate heavy metals and selection for genes allowing bacteria to cope with them favor the acquisition of antibiotic resistance.

This project aim to discover novel mechanisms responsible for resistance to antibiotics and heavy metals by functional genomic.

An PhD position (ANR submitted in May 2020, fellow submitted at Ifremer 2021 or ED515), starting in September 2021 will then aim at exploring understand the diversity, mechanisms and evolution of resistance to antimicrobials in vibrio and to determine if the oyster acts as a hotspot of HGT (collaboration Eduardo Rocha, Pasteur Institute).

**The Le Roux team** (Department of Integrative Biology of Marine Models, Marine station of Sorbonne University, Roscoff, France) seeks to understand **the evolution of microbial populations in the wild** and their adaptation to the environment. To this aim they develop an integrated approach (from ecology to the gene, from mathematical modeling to genetic) to understand the evolution and adaptation of bacterial pathogens (the *Vibrionaceae*) threatening animal species (e.g. the oyster *Crassostreae gigas*) that are a major importance for both environmental and socio-economic reasons.

### References

- 1- Bruto M, Labreuche Y, James A, Piel D, Chenivesse S, Petton B, Polz MF, **Le Roux F**. Ancestral gene acquisition as the key to virulence potential in environmental *Vibrio* populations. ISME J. 2018 Dec;12(12):2954-2966.
- 2- Labreuche Y, Chenivesse S, Jeudy A, Le Panse S, Boulo V, Ansquer D, Pagès S, Givaudan A, Czjzek M, **Le Roux F**. Nigritoxin is a bacterial toxin for crustaceans and insects. Nat Commun. 2017 Nov 1;8(1):1248.
- 3- Bruto M, James A, Petton B, Labreuche Y, Chenivesse S, Alunno-Bruscia M, Polz MF, **Le Roux F**. *Vibrio crassostreae*, a benign oyster colonizer turned into a pathogen after plasmid acquisition. ISME J. 2017 Apr;11(4):1043-1052.
- 4- Lemire A, Goudenège D, Versigny T, Petton B, Calteau A, Labreuche Y, **Le Roux F**. Populations, not clones, are the unit of vibrio pathogenesis in naturally infected oysters. ISME J. 2015 Jul;9(7):1523-31.

**Eligibility criteria.** To apply for the position, candidates must hold a Master 1 in molecular biology, microbiology. Very good written and spoken English is a requirement for the position. Application should include: i) a Curriculum Vitae; ii) the description of your past achievements (max. 1/2 page); iii) references.

**Selection process.** A first selection will be based on CV, past achievements and references letter. A second selection will be based on an interview with F. Le Roux.