UFR de Chimie et de Biologie
UNIVERSITÉ Grenoble Alpes

Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2024-2025

Laboratory/Institute: TIMC (Translational Innovation in Medicine and Complexity)
Director: Alexandre MOREAU-GAUDRY
Team: TrEE (TRanslational microbial Evolution & Engineering)
Head of the team: Fabien PIERREL
Name and status of the scientist in charge of the project:
Elena BÜLOW, Contract researcher and Corinne MERCIER, Professor **HDR:** yes ■ (Corinne Mercier)
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Program of the Master's degree in Biology:

■ Microbiology, Infectious Diseases, Immunology ☐ Structural Biology of Pathogens
☐ Physiology, Epigenetics, Differentiation, Cancer ☐ Neurosciences and Neurobiology

Title of the project:

Monitoring antibiotic resistant pathogens in hospitals by metagenomic characterization of sink and hospital wastewater biofilms in comparison with conventional culturing methods

Objectives (up to 3 lines):

In the context of the "one health" approach, the proposed project will isolate multi resistant carbapenemase producing *Enterobacteriaceae* from hospital wastewater collected at the Grenoble University Hospital and compare the genomes of isolated strains and their mobile genetic elements by next generation sequencing.

Abstract (up to 10 lines):

The emergence and spread of antibiotic-resistant bacteria (ARB) and antibiotic-resistant genes (ARG) compromise the effectiveness of antibiotic treatment. Here, we investigate the prevalence of ARB, specifically carbapenemase-producing Enterobacteriaceae (CPE), which are resistant to last-resort antibiotics, in hospital wastewater (WW) collected from a WW outlet joining the adult intensive care unit (AICU) of the Grenoble Alps University Hospital. The samples were collected monthly over a period of 16 months and samples from January to April 2023 and January to April 2024 were characterized by bacterial cultures. Interestingly, the CPE isolated in 2023 differed from those isolated in 2024: indicating that a population switch occurred between April and December 2023, a time period during which the samples were not analyzed by bacterial cultures. To verify this hypothesis, the remaining samples (July 2023 till December 2023) will be analyzed by culture and all the isolated CPE strains will be sequenced and their genome will be compared to those of the CPE isolated from patients hospitalized during the respective time period

Methods (up to 3 lines):

Characterization of biofilms (hospital WW and sink drain biofilms) by conventional culturing techniques; analysis of the CPEs and their mobile genetic elements such as plasmids by genomic sequencing, epidemiology, genomics

Up to 3 relevant publications of the team:

Buelow *et al*., FEMS Microbiol Ecol., 2018; Buelow *et al*., Water Res X., 2020; Buelow *et al*., BioRxiv 2023

Requested domains of expertise (up to 5 keywords):

Microbiology, molecular biology, bioinformatic analysis of sequencing data, statistical analyses