Proposal of PhD subject
INSERM 1092 – O. BARRAUD – C. DAGOT

Name of Team and Head:
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Precision on the framework (Name of the supervisor (s)):
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Keywords:
Effluents, anthropogenic pollution, antibiotic resistance, biofilms, integrons

Profile and skills required:
Molecular biology and bioinformatics but also a desire to work in the environment, a taste for experimentation and data acquisition, a good capacity of synthesis, autonomy in the relevant initiative, scientific curiosity.

Topic title:
Dissemination of antimicrobial resistance: coupling exposure epilithic biofilms in effluents, research biomarkers control and bioinformatics modelling for monitoring and risk prediction

Description of the research problem:
The antibiotics discovery has largely contributed to the increase in life expectancy but has been accompanied by a growing and worrying increase in bacterial resistance, questioning antibiotic therapy. Although the first resistances were mainly detected in a clinical setting, the propensity of these bacteria to colonize the different anthropised environmental matrices (water, soil, sediments) was very quickly observed. Different stakeholders, including environmental and health managers, are lacking to predict the occurrence of resistance and thus project proposes measures for monitoring, control, management and prospective risk analysis.

Themes Area Context:
Environment, antimicrobial dissemination, anthropogenic pollution

Objectives:
The INSERM U1092 laboratory develops a "One Health" approach to analyse this microbial contamination, coupling the clinical and animal approaches, from the patient to the animal and the human, with the return to the environment. The research work proposes to validate a set of biomarker (s) as an effluent characterization tool to predict their typology in terms of risks of dissemination of resistances.

Method :
It involves coupling an in situ experimental approach with a fine molecular approach, a bioinformatic treatment and models construction. The experimental approach is based on the use of biofilms recognized as accumulators of germs and privileged places of transfer of genes. The molecular markers used will be the integrons, whose quantitative relationship with a global bacterial resistance has been demonstrated. The discrimination of the resistance genes will be carried out by characterizing the constitutive cassettes of the integrons, knowing that the first results carried out in the laboratory showed that these cassettes were different according to the effluents, some being common to several effluents, others, sometimes of identity Hitherto unknown, appearing more specific to a given effluent. If the preliminary work, limited by the methodology used, allowed a first qualitative analysis of the genes

carried by the cassettes, the development of high-throughput sequencing (NGS) must allow the construction of a much more accurate, robust and *in fine* the development of specific qPCRs to these cassettes in order to quantify them in the different types of effluents.

Expected result:
The ultimate objective is to propose a system linking "environmental sentinels" (biofilms) and qPCR tools to feed a predictive model for the spread of antimicrobial resistance in effluents allowing risk anticipation.

References:
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