

# PARRTAE

## Probing Antibiotic Residues and Resistance Transfer in Aquatic Environments

**DURATION**

1/09/2021 – 1/12/2024

**BUDGET**

250 000 €

**PROJECT DESCRIPTION**

Aquatic ecosystems are subjected to intense pressure by human activities. As a consequence, they are exposed to possibly toxic substances. Some of these substances are known to contribute to increased resistance to antibiotics in bacterial populations. In addition this antibiotic resistance can easily be transmitted between different bacteria, for example via transferrable plasmids with antibiotic resistance genes. This transfer also occurs more in the presence of antibiotic residues, even in very low concentrations. Antibiotic resistance is increasing in pathogenic, commensal, and environmental bacteria. The problem has escalated by the (over)use of antibiotics, causing selective pressure on the guts microbiome, both in antibiotic-treated human and (livestock) animals. These resistant bacteria but also antibiotic residues may enter the environment via feces and urine, for example via the fertilization of the soil with raw manure, and via run off and infiltration, they may reach surface and groundwater. Today we face a real risk that the emergence of multi-resistance in bacterial pathogens may render some infections untreatable and throw humanity back to the pre-antibiotic era. It is estimated that by 2050 yearly 10 million people will die annually due to non-treatable infections. Countries like Belgium, (especially Flanders), are densely populated both with people and livestock coupled to a high antibiotic use leading to an enhanced risk on the dissemination of antibiotic residues and antibiotic resistance genes. The international project PARRTAE aims to study bacteria, antibiotic resistance genes (ARGs) and antibiotic residues in European water courses. We hypothesize that local water microbiota, antibiotic residues, and recipient species will affect the type of plasmids transferred. The project will determine common ARG plasmids circulating in European waters and their inherent properties as a fundament to understand and prevent their dissemination.



Samples will be collected from groundwater, surface water, wastewater, marine water environments in the North Sea and the Atlantic including ports, and aquaculture facilities. Sites will be included with high and low suspected loads of antibiotic residues, for example respectively basin of the Ijzer and surface water in Scandinavian countries. These samples will be investigated for the presence of antibiotic residues by means of mass-spectrometry (LC-MS/MS) and for the presence of antibiotic resistance genes using certain indicator organisms such as *Escherichia coli*, *Shewanella* and *Vibrio*. Besides this, culture-independent techniques will also be used to study the antibiotic resistance in the water microbiome. Transfer of ARG-containing plasmids will be analyzed using indicator bacteria *E. coli*, *Vibrio* spp., and *Shewanella algae* as recipients. The effects of the acquired plasmids on the physiology of our bacterial models will be analyzed via experimental lab systems. The influence on fitness and virulence of bacteria in a live host will be studied by host interactions in a shrimp (*Artemia*) model.

# PARRTAE

This project joins different disciplines (health, aquaculture, fresh and marine water) to detect emerging resistance plasmids and their corresponding bacterial hosts in European waters of diverse origins. We expect to scientifically elucidate the impact of circulating resistance plasmids and of antibiotic residues in the aquatic environment on the spread of the antibiotic resistance problem. The consortium will interact with relevant agencies and authorities in each of the partner countries; for Flanders this will be the Flanders Environment Agency (VMM). The project will generate policy advice as well as scientific publications and communications and a PhD at ILVO.



## CONTACT INFORMATION

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## LINKS

<https://www.ipiamr.eu/projects/parrtae/>