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Motivation

The consumption of antibiotics worldwide, particularly at farm level, has triggered a higher incidence of antibiotic resistant bacteria (ARB) in animals and in their manure. Due to manure application to soils, these ARB, antibiotic resistance genes (ARG) and antibiotic residues present in the manure contaminate water and soil ecosystems [1].

Bacterial communities of manure and soil are largely distinct. However, with the application of manure to soil, introduction of new communities in an already established one occurs, potentially facilitating the spread of multiple ARG [2].

The fate of ARG in the environment is complex and some may even persist in the environment in the absence of selective pressures. The mobilization of genetic elements through conjugative plasmids plays a key role in this complex cycle.

Technological Challenge

This project aims at testing links and relations between multiple variables affecting ARG abundance, conjugation rates and bacterial diversity. This represents a great and crucial step to understand the fate of resistance in the environment.

The accurate monitoring of conjugation rates requires the selection of adequate bacterial strains and plasmids, followed by the establishment of test systems that mimic, as close as possible, the “real” conditions occurring in the environment.

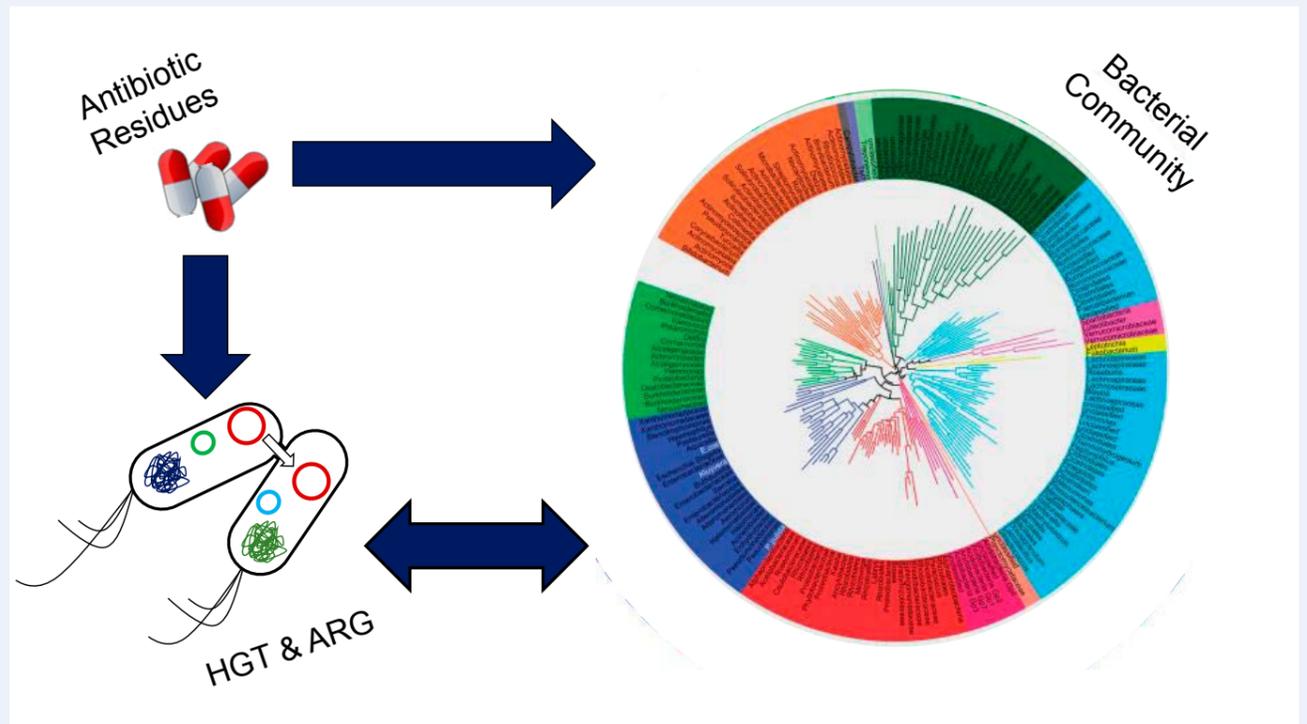


Figure 1. Impact of antibiotics residues, conjugation rates, ARG abundance and bacterial communities in manure, soils, manured soils and water runoffs.

Research goals

The main goal of the present research project is to study the factors affecting the exchange and proliferation of ARG in the microbial communities from different ecosystems (from gut to water). Therefore, this research will focus on:

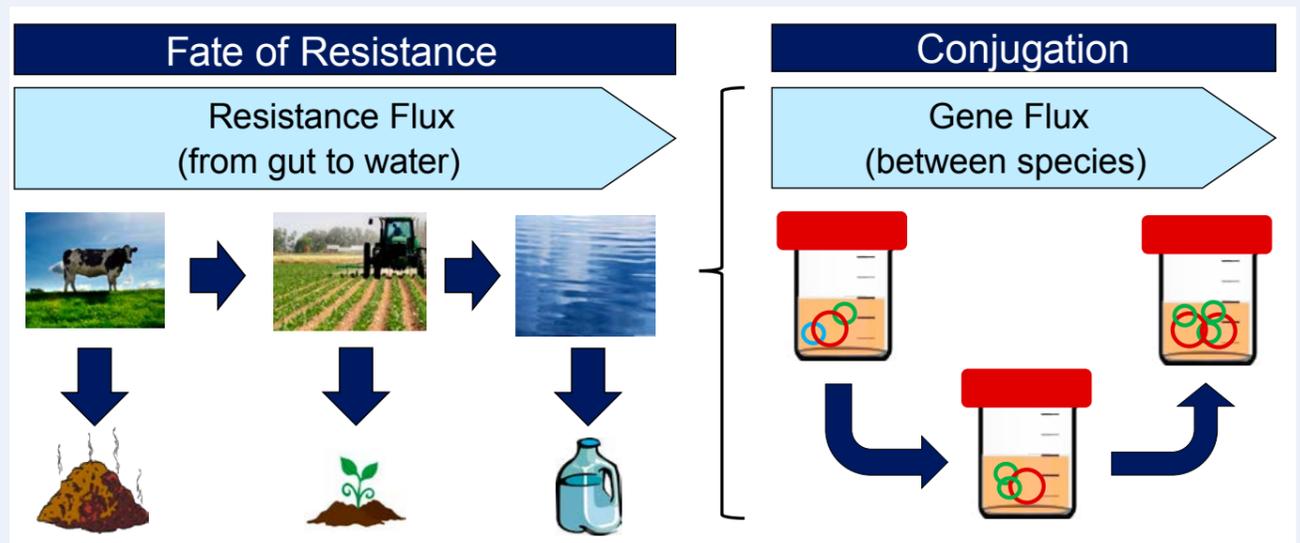


Figure 2. Overview of experimental design.

- 1. Conjugation experiments:** modelling the effect of antibiotic residues on conjugation and identification of major resistance vectors, in a microcosm test system
- 2. Fate of resistance:** impact of manure application on ARG abundance and on the native bacterial community. Role of risk factors (type and treatment of manure, abiotic factors) for the persistence and transport of antibiotic residues and ARG in treated soils and receiving water

[1] Heuer et al. (2011) Curr Opin Microbiol 14:236–243
 [2] Udikovic-Kolic et al. (2014) Proc Natl Acad Sci 111:15202–15207.