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Impact of Advanced Wastewater Treatment on the Spread of Antimicrobial Resistance

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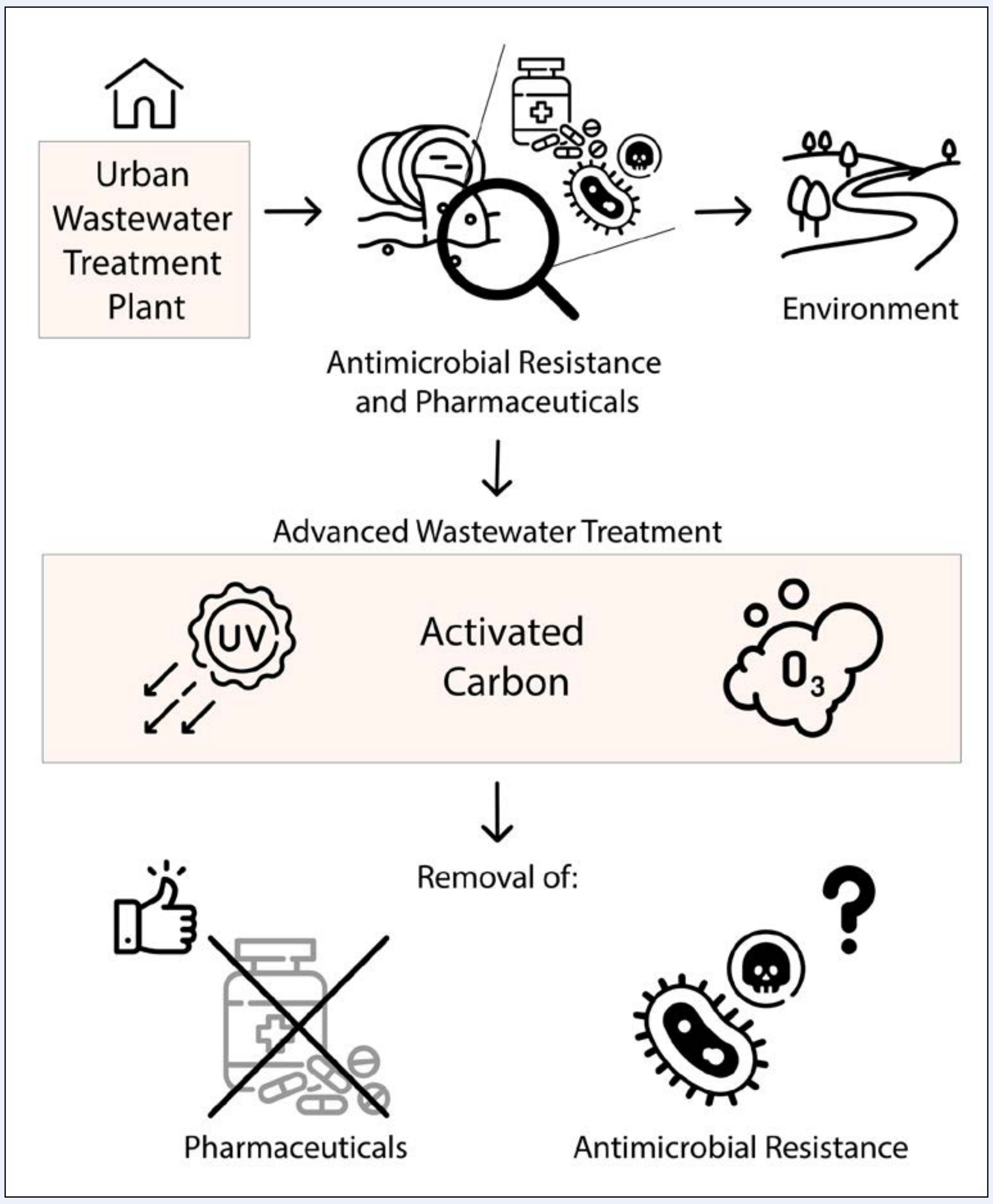
Motivation

Antimicrobial resistance (AMR) is a global health and development threat and requires urgent multisectoral action according to the World Health Organization [1]. Wastewater treatment plants (WWTPs) release both antibiotic resistance bacteria (ARB) and antimicrobial resistance genes (ARGs) into the environment [2]. Advanced wastewater treatment (AWWT), such as activated carbon, UV and ozonation, is currently emerging as an effective treatment to remove pharmaceuticals. The most promising AWWT, ozonation, shows in lab-scale studies that ARB&ARGs are regrowing after application [3, 4]. With the ability of bacteria to acquire genes from the environment and other bacteria (horizontal gene transfer – HGT), the spread of AMR can be accelerated. The impact of AWTT on the spread of AMR in the environment should therefore be studied.



Technological challenge

The analytical challenge is associated with the detection and quantification of AMR in low concentrations. Moreover, HGT will be monitored with fluorescent microscopy where adequate bacterial and plasmid models must be selected for a robust experimental design. Furthermore, wastewater samples consist of a broad unculturable bacterial community. The computational challenge is to identify the microbial population using metagenomics, where bioinformatics, microbiology and molecular biology knowledge is required to analyze the complex big data.

Research goals

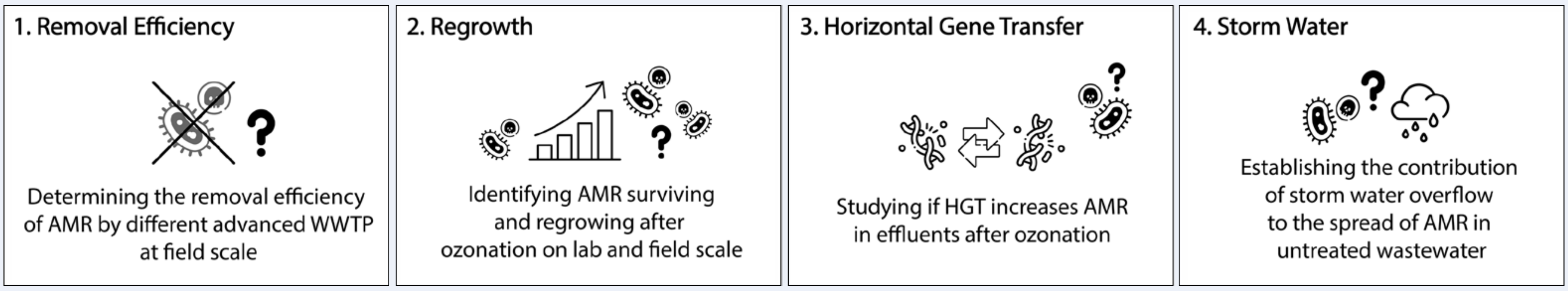


Fig 1. Research goals to study the impact of AWWT on the spread of AMR in the environment.

[1] World Health Organization (2015) Report of the 6th meeting of the WHO advisory group on integrated surveillance of antimicrobial resistance.
[2] Rizzo et al. (2013) Sci. Total Environ. 447, 345–360.
[3] Iakovides et al. (2019) Water Res. 159, 333–347.
[4] Jäger et al. (2018) Environ. Pollut. 232, 571–579

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