**Project Title**: Clinical wastewater as a neglected reservoir for free-floating extracellular DNA and its role in dissemination of carbapenemases

**Supervisor**: Dr. Michael Savin-Hoffmeyer

**Institute/Group**: Institute of Hygiene and Public Health, One Health

**Webpage**: https://www.ukbonn.de/ihph/bereiche/onehealth/

**Requirements**:

- Basic knowledge of microbiology techniques
- First experience in a laboratory setting
- Familiarity with molecular biology methods and DNA analysis
- Strong analytical skills
- Good communication and teamwork abilities

**Skills to be Learned (max. 50 words)**:

- Advanced microbiological and molecular biology techniques
- Environmental sampling and analysis
- Data analysis and interpretation
- Handling and analysis of extracellular DNA and intracellular DNA

**Project Description (max. 150 words)**:
The occurrence of antibiotic-resistant bacteria and genes encoding resistance to commonly used antimicrobials has been extensively reported in wastewater treatment plants (WWTPs) worldwide. However, resistance to "last-resort" antimicrobials, such as carbapenems, has only recently started to be assessed. One limitation of these studies is the focus on intracellular DNA (iDNA) while neglecting extracellular DNA (exDNA), which is derived from active cells and dead cells broken down during intensive WWTP processes. Free genetic material, including antimicrobial resistance genes (ARGs), is released into the environment through WWTP effluents. This study aims to demonstrate that clinical wastewater represents a significant reservoir for exDNA and plays a crucial role in disseminating plasmids carrying genes encoding carbapenemases. Objectives include determining exDNA concentrations in clinical and municipal wastewater, comparing carbapenemase gene abundances in exDNA and iDNA, and analyzing transformable plasmids in wastewater and surface water.

**Support Concept (max. 75 words)**:
The project will provide comprehensive training in advanced microbiological and molecular biology techniques, focusing on environmental DNA analysis. Students will gain hands-on experience in environmental sampling and data interpretation, mentored by experienced researchers in antimicrobial resistance. Regular feedback sessions and progress reviews will ensure the student's development and successful project completion.