

Investigating the Post-Antibiotic Effect at a single-cell resolution

Supervisory team:

Main supervisor: Dr Tobias Bergmiller (University of Exeter)

Second supervisor: Dr Stefano Pagliara (University of Exeter)

Dr Thomas Gorochofski (University of Bristol)

Collaborators: Dr Jeremy Metz (University of Exeter)

Host institution: University of Exeter (Streatham)

Project description:

Antibiotics are our most potent weapons against bacterial infections. A puzzling effect of antibiotic action is the post-antibiotic effect (PAE): after the antibiotic has been removed, surviving bacteria remain temporarily growth-inhibited. Bacteria repair antibiotic damage during this growth lag, and expel residual antibiotic using efflux pumps. Importantly, PAE enables the immune system to combat the infection. For bacteria, rapid exit from growth arrest is vital for repopulation. Our recent work showed that individual bacteria strongly differ in efflux (Bergmiller et al., Science 2017), suggesting that bacteria use strategies to overcome PAE. Specifically, by investing into fast-awakening subpopulations, bacteria can ensure fast regrowth after a growth lag. To examine such a scenario, this project will investigate the lag-time distribution of single bacterial cells recovering from PAE, and the role of efflux pumps for single-cell lag times. Benign and uropathogenic *Escherichia coli* strains will be used as model systems. You will use imaging and microfluidics to expose bacteria to antibiotics and to measure the lag-time distribution of single cells, and efflux dyes and fluorescently labeled antibiotics to establish a link between lag-time distributions and single-cell efflux activities. The supervisors will be Dr. Tobias Bergmiller and Dr. Stefano Pagliara, both at the University of Exeter, Biosciences, combining a range of complementary skills, such as molecular biology, quantitative single-cell microbiology and microfluidics. Dr. Thomas Gorochofski from the University of Bristol will act as external supervisor to complement the project with skills in machine learning and automated computer-aided image analysis.