UNIVERSITY OF CAMBRIDGE
Department of Veterinary Medicine

PhD Project: Decoding the Causes of Multidrug Resistance using Genomics

Start Date: 1st October 2025

Supervisor: Dr Lucy Weinert

Superbugs are multidrug-resistant (MDR) bacteria that pose one of the most serious threats to human and animal health today. These bacteria have developed resistance to multiple types of antimicrobial drugs, making them extremely difficult to treat. While overuse and misuse of antibiotics are major contributors to this problem, another concerning issue is the "over-representation of MDR" (Lehtinen et al. 2019). This phenomenon occurs when resistance genes cluster together in bacterial populations more frequently than expected by chance, resulting in strong correlations between resistances to different drugs. This means we often find not just isolated cases of resistance, but clusters of MDR bacteria, which is a significant challenge.

The reasons behind these clustered resistance mechanisms are not well understood and are a topic of intense debate. This PhD project aims to delve into these mysteries using genomic data from various bacterial pathogens. We'll test hypotheses such as whether resistance genes are linked on mobile genetic elements, if bacterial ecology or epidemiology play a role, or whether some bacteria are inherently better at acquiring resistance mechanisms.

This is primarily a bioinformatics project where the student will gain skills in genomic analyses. However, there might be opportunities to test some hypotheses in the lab where the student will gain skills in microbiology.

By understanding why and how these resistance mechanisms cluster together, we can develop strategies to combat antibiotic resistance and enhance the effectiveness of current antibiotics in treating infections.

Lehtinen, S., Blanquart, F., Lipsitch, M., Fraser, C., & with the Maela Pneumococcal Collaboration. (2019). On the evolutionary ecology of multidrug resistance in bacteria. PLoS pathogens, 15(5), e1007763.

How to apply: Contact the Supervisor to discuss the project before submitting an official application. More info on applying here: https://www.postgraduate.study.cam.ac.uk/courses/directory/cvvtmpvet