Department of Veterinary Medicine: Non-Funded PhD

Project Title: Uncovering the natural diversity, function, and ecology of opportunistic pathogens within the human gut microbiome

Supervisor: Dr Alexandre Almeida

Supervisor profile page: https://www.vet.cam.ac.uk/staff/dr-alexandre-almeida

Our intestinal tract is colonised by a diverse community of commensal microorganisms with beneficial roles to human health. However, many microbial species naturally inhabiting the human gut have the potential to cause disease (deemed opportunistic pathogens). This switch from commensal to pathogen can occur for various reasons, including a compromised host immune system, depletion of the commensal microbiome, and acquisition of virulence/pathogenic traits. Some of the most notable examples of opportunistic pathogens are bacterial species belonging to the Enterobacteriaceae family, such as Escherichia coli and Klebsiella pneumoniae. A huge body of research has focused on characterising the biological functions of these organisms in a clinical setting to identify the main factors underlying their pathogenicity. However, much less is known about the variants that are circulating asymptomatically in the human population and how they differ from their pathogenic counterparts.

This project will leverage a large-scale dataset of over 30,000 global human gut metagenomes to uncover the hidden diversity, function, and ecology of opportunistic pathogens colonising healthy individuals worldwide. Using a combination of computational genomics methods, phylogenetics, multivariable statistics and machine learning, this work will identify the main genetic and functional traits distinguishing pathogenic from non-pathogenic lineages of known Enterobacteriaceae species with the potential to cause severe disease. These data will be further contextualized with the composition of the gut microbiome from the same individuals to identify evidence of colonisation resistance and better understand how the commensal microbiome influences pathogen evolution and adaptation. By characterising the bacterial populations asymptomatically carried in humans and their associated microbiomes, this project will provide a more complete view of the background diversity and function of enteric pathogens in urgent need of new treatments, paving the way for the development of targeted approaches to treat and mitigate disease onset and emergence. For further information about the project, please contact Dr Almeida.

Funding: This project is non-funded and open to applicants seeking funding elsewhere. Applicants that apply for a start in 23/24 will be considered for the University of Cambridge funding competition if they apply before the deadline (early January 2023)

How to apply:

Contact the Supervisor to discuss the project before submitting a formal application.

More here on application process here: PhD in Biological Sciences at the Department of Veterinary Medicine | Postgraduate Admissions (cam.ac.uk)