

Department of Veterinary Medicine: PhD Project

Project Title: Retracing the evolution and host adaptation of the human gut microbiome

Supervisor: Dr Alexandre Almeida

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

Project details: The human gut microbiome represents a large and diverse ecosystem of microbial species with a wide-reaching impact in human health and disease. Recent developments in DNA sequencing and bioinformatics methods have enabled the discovery of thousands of new gut-associated bacterial species that lack any cultured representatives. Specifically, current estimates suggest that ~70% of the ~4,600 known human gut bacteria have not yet been cultured under laboratory conditions. However, by having access to the DNA sequences (i.e., genomes) of these largely unknown organisms we are able to explore their diversity and functional capacity without the need for experimental manipulation.

As the gut microbiome is now recognized as an important player in the maintenance of human health, new therapies are being developed to promote the intestinal colonization and engraftment of gut species deemed beneficial to health. With this purpose in mind, there is a need to better understand the ecological and evolutionary principles that govern the assemblage and structure of the intestinal microbiome. In particular, the main factors and functional features essential for survival and successful colonization of the human intestinal tract remain largely unknown.

The aim of this project is to explore the evolution and host adaptation of the gut microbiome through a large-scale analysis of hundreds of thousands of microbial genomes from the human gut, skin and oral cavity, as well as those from other animals and environments. This will involve the development and application of bioinformatics pipelines for performing microbial genome-wide association studies (mGWAS), protein annotation, functional prediction and metabolic modelling. Candidate features and mechanisms may be further experimentally validated depending on the student's interest and experience. Ultimately, this project will provide new crucial insights into the genomic adaptation of the gut microbiome that will aid the development of new strategies to improve the efficacy of targeted microbiome-based therapeutics.

Funding: This project is open to self-funding students or students wishing to apply for the Cambridge Postgraduate Funding competition. More info here:

<https://www.postgraduate.study.cam.ac.uk/funding-overview/university-funding>

How to apply: Contact the Supervisor (aa2369@cam.ac.uk) to discuss the project before submitting an official application. More here on application process here:

[PhD in Biological Sciences at the Department of Veterinary Medicine | Postgraduate Admissions \(cam.ac.uk\)](https://www.vet.cam.ac.uk/postgraduate-admissions)