

PhD project: Phylogenetic and functional characterisation of novel gut bacteria

Supervisor: Dr. Hilary Browne, School of Microbiology and APC Microbiome Ireland

Overview:

We seek a motivated candidate to undertake a fully funded 4 year PhD. The PhD candidate will characterise novel gut bacteria from the *Blautia* genus using primarily *in silico* approaches including genomic and phylogenomic techniques. The aim is to develop a better understanding of *Blautia* phylogenetic structure, species diversity and encoded metabolic functions linked to human health such as pathogen inhibition.

Background:

We are colonised by diverse microbial communities that provide beneficial functions through their metabolic activities and host interactions. Recent culture-based and culture-independent sequencing approaches have highlighted the huge species-level diversity in the intestinal microbiota. The ability to culture, isolate and whole-genome sequence, at the strain level, and also at scale, allows generation of high-quality finished genomes for functional predictions. This combined with phenotypic characterisation of the associated isolates leads to a better understanding of the evolution and functions of novel gut bacteria.

This project will focus on *Blautia*, a diverse and highly prevalent, but poorly characterised genus of anaerobic gut bacteria. The lab has developed a large culture collection of *Blautia* isolates paired with high-quality hybrid genomes for analysis.

Specific aims will include:

1. Creation of a large collection of high-quality genomes from both public sources and generated within the lab. These genomes will be used to create a phylogenetic blueprint to understand *Blautia* population structure and evolution.
2. Detailed functional annotation of genomes will be used to predict metabolic capabilities and functions including spore-formation.
3. Phenotypic validation of genomic findings using anaerobic microbiology techniques. This could include functions linked to spore-formation, carbohydrate metabolism or pathogen inhibition.

This project will give the successful candidate in-depth exposure to microbial genomics, phylogenomics and anaerobic microbiology techniques. A willingness to travel is required as there may be opportunities to receive bioinformatics training with collaborators in the UK.

Relevant references:

1. Browne, H. P. *et al.* Culturing of ‘unculturable’ human microbiota reveals novel taxa and extensive sporulation. *Nature* **533**, 543 (2016). <https://doi.org:10.1038/nature17645>
2. Browne, H. P. *et al.* Host adaptation in gut Firmicutes is associated with sporulation loss and altered transmission cycle. *Genome biology* **22**, 204 (2021). <https://doi.org:10.1186/s13059-021-02428-6>
3. Browne, H. P., Neville, B. A., Forster, S. C. & Lawley, T. D. Transmission of the gut microbiota: spreading of health. *Nature Reviews Microbiology* **15**, 531 (2017). <https://doi.org:10.1038/nrmicro.2017.50>
4. Kumar, N. *et al.* Adaptation of host transmission cycle during *Clostridium difficile* speciation. *Nature genetics* **51**, 1315-1320 (2019). <https://doi.org:10.1038/s41588-019-0478-8>

5. Browne, H. P., Shao, Y. & Lawley, T. D. Mother–infant transmission of human microbiota. *Current Opinion in Microbiology* **69**, 102173 (2022).
<https://doi.org/10.1016/j.mib.2022.102173>

Application process:

Candidates should hold, or expect to hold, a 2H1 (or better) grade in a degree related to bioinformatics, microbiology or an equivalent life sciences degree. The successful candidate will be based in the School of Microbiology and will work under the supervision of Dr Hilary Browne. The position is fully funded through an ERC Starter grant and support includes stipend and fees. Applications consisting of a CV and covering letter (detailing your motivation for undertaking a PhD and your interest in this project) should be submitted by email to Hilary.Browne@ucc.ie. Deadline for applications is 26th April 2024. Potential candidates will be asked to attend an interview (remotely if necessary). Preferred start date is October 2024.

Funding Details:

This full-time PhD position is funded for up to 4 years including a tax-free stipend of €24,000 per annum. Fees are also covered by the grant for 4 years. The scholarship for the PhD degree is subject to academic approval. For further information on the project and informal enquiries please contact Dr Hilary Browne Hilary.Browne@ucc.ie

Key Duties and Responsibilities:

- To conduct a specified programme of research under direction of the supervisor
- To participate in the dissemination of the results of the research (oral and written) in which you are engaged, as directed by your supervisor.
- To contribute and produce high quality peer reviewed publications and other outputs.
- To present research progress and project outcomes at project meetings and relevant conferences.
- To engage in the wider research and scholarly activities and educational and outreach programmes as appropriate.

Eligibility Criteria:

- An upper second class or first-class honours BSc degree and/or a MSc degree in bioinformatics, microbiology or an equivalent life sciences degree
- Deep interest in studying the human intestinal microbiota
- Ability to communicate effectively with scientists from multiple disciplines.
- Ability to take initiative and work independently while contributing to the team's shared goals
- Well organised with attention to detail and timelines