

## **PhD project: Developing an ecological and functional understanding of intestinal spore-forming 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 successful candidate will characterise spore-forming gut bacteria using anaerobic microbiology techniques combined with genomics. The aim is to develop a better understanding of the functions and ecology of commensal human intestinal spore-formers.

### **Background:**

Our intestinal microbiota consists of a diverse community of microorganisms with proven health benefits. To survive long term in human populations, all gut bacteria have evolved to effectively transmit between, and colonise new hosts. Some bacterial species are maternally transmitted during birth or shortly afterwards, but beyond early-life, many are acquired from different human and environmental sources and rely on endospores (spores for short) to successfully transmit.

Spores are produced by distinct bacterial families within the Firmicutes phylum (recently renamed as Bacillota). They promote transmission of anaerobic gut bacteria in aerobic ambient conditions by storing DNA in a viable but dormant state. Upon ingestion by a new host, the spore germinates, re-forming a new vegetative cell ready to colonise the gut. However, despite their prevalence in human populations, the ecology, metabolic functions and evolution of intestinal spore-formers remain poorly characterised.

Specific aims will include:

1. Establish culture collection using different anaerobic microbiology techniques to enrich and isolate intestinal spore-formers.
2. Characterise phenotypic properties of intestinal spores including their resistance properties, the sporulation triggers that lead to formation of a spore and the germinants that initiate exiting of dormancy and formation of a new vegetative cell.
3. Use other functional approaches such as transcriptomics and proteomics to identify sporulation-specific genes and proteins.
4. Use comparative genomic approaches to understand conserved sporulation-associated genes in the intestinal microbiota.

This project will give the successful candidate in-depth exposure to phenotypic techniques to characterise gut bacteria in addition to computational microbiome analysis techniques.

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: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 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](mailto:Hilary.Browne@ucc.ie). Deadline for applications is 26<sup>th</sup> 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](mailto: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 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