**University of Leicester**

**BBSRC MIBTP Studentship Project 2025-6 entry.**

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**Section 2 – *Project Information***

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| **Project Title** | **Beyond known characteristics: Moonlighting activity of natural products** |
| **Project Summary** | |
| Bacteria colonize virtually all habitats on our planet, including soil, water, plants, animals and humans. There, they commonly live in polymicrobial communities, sharing their environment with other bacteria, fungi and viruses. Accordingly, they are in constant interaction with those other microorganisms, and these interactions can either be physical or chemical. While physical interaction requires close proximity between organisms, chemical interactions can be mediated over longer distances, through the secretion of small molecules, among which natural products are the most important ones. Natural products have diverse chemical structures and bioactivities, which range from cell-cell signalling, nutrient acquisition, antifungal and antibacterial activity to stress resistance, enabling them to shape the fate of individual cells, as well as whole microbial communities1. Aside from the already large diversity in structure and function, some natural products can also perform more than one biological role, also known as moonlighting. Recent findings highlight examples of moonlighting, such as an iron-binding molecule that not only sequesters iron but also enhances the production of reactive oxygen species in competing bacteria2, as well as a quorum-sensing molecule that simultaneously traps iron3.  **Project Aim:** The aim of this project is to unravel moonlighting activity of natural products and understand how this influences bacterial competition and interaction in different ecosystems.  The **objectives** of this PhD project are:   i) Characterize the natural product profiles of bacterial communities,  ii) Predict and investigate natural product moonlighting activities  iii) Evaluate how these moonlighting activities affect the dynamics and composition of polymicrobial communities.  This PhD project has the potential to transform our understanding of bacterial interactions in polymicrobial communities by revealing how natural product moonlighting influences microbial competition and ecosystem dynamics. Ultimately, the findings from this research could drive advancements in multiple fields, leading to practical solutions in combating antibiotic resistance, increasing plant and animal health, and improving ecological management of microbial communities.  Techniques that will be undertaken during the project  The successful student will have the opportunity to work at the intersection of microbiology, microbial ecology and chemical biology and receive training in microbiological methods, molecular biology, metabolomics and data analysis. Relevant techniques include bacterial genetics, co-culturing techniques, metabolite extraction, sample processing and mass spectrometry guided metabolite analysis. | |
| **References** | |
| 1. Phelan VV*,* et al.  *Nat Chem Biol* **8**, 26-35 (2011).  2. Jenul C*, et al.* *Cell Rep* **42**, 112540 (2023).  3. Lin J, *et al*. *Front Cell Infect Microbiol* **8**, 230 (2018). | |