PhD Studentship in "Phase Behaviour and Disruption in Model Bacterial Cell Envelopes"

Project Summary

Gram-negative bacteria are a major health threat due to their rapidly increasing resistance to antibiotics. A key aspect of this resistance is the protective outer membrane that surrounds these bacteria. Scientifically, this outer membrane is interesting because of the different soft matter states it may represent. Technically, however, it is challenging to investigate the outer membrane at the relevant molecular length scales. In this project, we will overcome this challenge by developing and characterising model systems with which we can vary and study multiple aspects of this outer membrane. These model systems can next be used as a testbed for next-generation antibiotics.

Over the past years, there has been extensive progress on the validation of various antimicrobial peptides on model membranes, often combining techniques such as nuclear magnetic resonance, molecular dynamics simulations, x-ray and neutron scattering techniques, circular/linear dichroism, and atomic force microscopy (AFM). However, it remains technically challenging to acquire insights on molecular modes of action antibiotics on real bacterial membranes. AFM approaches offer substantial promise to overcome some of the challenges involved, as it now offers nanoscale-resolution visualisation of bacteria under antimicrobial attack, but interpretation of data remains non-trivial, and while bacterial cell envelopes can be modulated using mutations, these offer only a limited range of variability.

This project will build on previous bacterial model systems developed at ISIS Neutron and Muon Source, Harwell Campus Oxford. We will incorporate common outer membrane proteins in these systems to generate more realistic mimics, and use (primarily) AFM and neutron reflectometry to discover how these model cell envelopes are organised and are affected by current and next-generation antibiotics, thus supporting antibiotic development in response to antimicrobial resistance.

The project will be jointly supervised by Prof. Bart Hoogenboom (London Centre for Nanotechnology, University College London) and Dr Luke Clifton (ISIS Neutron and Muon Source, Biology Group, Harwell Campus Oxford). While the student will be based at University College London, we anticipate that about 1.5 year of the project (and in particular its second year) will take place at Harwell.

Eligibility

Suitable candidates for this post will have an upper second class/first class honours undergraduate degree and/or a post-graduate masters qualification in natural or life sciences. Demonstratable interest and experience in biophysics, microbiology, microscopy and/or chemical biology can be of advantage in the recruitment process, as is a general appetite for working at the interface of different scientific disciplines.

Applicants must be meet the EPSRC eligibility conditions to be eligible for the award – in summary this typically means that applicants must have no restrictions on their right to live in the UK permanently and have 3 years residency in the UK/EEA/Gibraltar/Switzerland immediately before the start of their course. There is limited flexibility to offer awards to those who don't meet the EPSRC eligibly criteria, however note that the award covers Home tuition fees only. Please see UKRI website for further details.

Application procedure

Interested candidates should submit a supporting statement, a full CV (including contact details for at least two academic referees) and a copy of transcripts to-date to b.hoogenboom@ucl.ac.uk. Successful candidates will be invited to submit a formal application to UCL.

The closing date for applications is 17th January 2022, but early applications are welcome, and interviews will be held as soon as possible after the application deadline. The project will commence in October 2022. Any inquiries or further information about the studentship should be emailed to Prof. Bart Hoogenboom (b.hoogenboom@ucl.ac.uk) and Dr Luke Clifton (luke.clifton@stfc.ac.uk).

Funding notes

The studentship will cover Home tuition fees, the annual EPSRC base stipend of £17,609 per year increasingly annually with inflation. The studentship is funded for 4 years on a full-time basis and will be part of the EPSRC Centre for Doctoral Training on Advanced Characterisation of Materials (UCL, Imperial College London & Trinity College Dublin)