

The University of Queensland - IIT Delhi Academy of Research Joint PhD Project

PROJECT TITLE	FUNCTIONALISATION OF ANTIMICROBIAL PEPTIDES
PROJECT CODE	UQIDAR 00175
PROJECT DESCRIPTION	<p>Antimicrobial resistance is a substantial economic and health threat to the global community, with an estimated 10 million annual deaths and 2-3.5% decrease in GDP by 2050. It particularly impacts healthy aging, with susceptibility to infections increasing with age, and medical procedures such as hip replacements reliant on effective antibiotics. In order to design new antibiotics to treat drug-resistant infections we need to improve our understanding of the chemical biology of antibiotic activity. This requires new tools and techniques to advance our knowledge of bacterial metabolism, efflux pumps and other responses to antibiotics, allowing key aspects of bacterial growth, division, metabolism and resistance to be better understood. Antimicrobial peptides are a class of antibiotics that include widely used therapeutics such as daptomycin, bacitracin and the polymyxins, as well as promising new antibiotic scaffolds, such as teixobactin [1], telomycin [2], odilorhabdins [3], laspartomycin C [4] and temporin B [5]. This project will focus on the chemical synthesis of derivatised antimicrobial peptides that can then be converted into both antibiotic-derived mechanism-specific fluorescent probes, and into novel hybrid therapeutics that link the antimicrobial peptide with other antibiotics, virulence inhibitors or biofilm disruptors. It will combine the peptide synthesis expertise of IITD supervisor Haridas, the antibiotic development expertise of UQ primary supervisor Blaskovich, and the microbiology experience of UQ co-supervisor Elliott, building on a foundation of other fluorescent probes derived from major classes of antibiotics [6,7]. References: [1] Chem. Sci., 2017, 8, 8183-8192 [2] J. Am. Chem. Soc. 2015 137 7692-7705 [3] Molec. Cell 2018, 70, 83-94 [4] J. Med. Chem. 2016 59 3569-3574 [5] Scientific Reports, 2019, 9, 1385 [6] Trends Microbiology 2019, 27 339-354 [7] MedChemComm, 2019, 10, 901-906</p>
PROJECT OUTCOMES	<p>This project will produce:</p> <ol style="list-style-type: none"> 1. novel antimicrobial peptide derivatives based on known antibiotic scaffolds that contain a handle that can be readily derivatised to introduce other functionalities 2. antibiotic-derived fluorescent probes, new tools for investigating the mode of action and bacterial localization of the novel antimicrobial peptides, prepared by attaching a fluorophore component. The interactions of these with bacteria will be studied using high resolution confocal microscopy. 3. hybrid antimicrobial peptide conjugates, in which the antimicrobial activity of the parent peptide is enhanced by linking to other components with complementary antimicrobial activity, or the ability to reduce bacterial virulence or biofilm formation. These will be tested in a suite of antibacterial assays.
ADVISORY TEAM	<p>Dr Mark Blaskovich http://researchers.uq.edu.au/researcher/1614 m.blaskovich@uq.edu.au Institute for Molecular Bioscience (IMB) The University of Queensland</p> <p>Professor V Haridas https://vharidaschemistry.wixsite.com/orgmoldesign haridasv@chemistry.iitd.ac.in Department of Chemistry Indian Institute of Technology Delhi</p>

TYPE OF
STUDENT
DISCIPLINE
BACKGROUND
OF STUDENT

Applications are open to i/a students [who meet eligibility criteria](#).
note: i-students must have own scholarship to apply (CSIR, UCG-NET, etc)
Ideally, this project requires students with a background in organic synthetic chemistry

IDEAL
CANDIDATE

Essential capabilities:

- competence in organic synthetic chemistry competence in purification and characterization of compounds

Desirable capabilities:

- medicinal chemistry microbiological assays confocal microscopy molecular modelling

Expected qualifications (courses, degrees, etc):

- BSc in chemistry (synthetic) or related

APPLICATION
PROCESS

Apply online by the due date: <https://www.uqidar.org/students/how-to-apply/>