Nottingham BBSRC DLA Programme : Identifying and characterising insecticidal neurotoxic peptides from the centipede, *Scolopendra hardwickei*, venom (CASE project)

University of Nottingham, School of Life Science

Start date September 2026

About

Thanks to £14m of funding awarded by the Biotechnology and Biological Sciences Research Council (BBSRC), the University of Nottingham and Nottingham Trent in partnership with the National Biofilms Innovation Centre (NBIC) are offering fully funded innovative four-year cohort-based training in frontier science.

Postgraduate researchers will be recruited to a research cluster within each of the overarching research areas:

- Alternative and Emerging Protein sources for Sustainable food and feed (Sustainable Agriculture and Food Security) - Cluster lead Professor John Brameld
- RIC@N-DLA: Multiscale RNA Science from mechanisms to applications (Bioscience for Human Health) – Cluster lead Dr Federico Dajas-Bailador
- Future Genomes Across Life – Engineering biology for sustainability and innovation (Biotechnology for Sustainable Growth) – Cluster lead Professor Thorsten Allers

Project description

We invite applications for a BBSRC fully funded CASE studentship to identify and characterise insecticidal neurotoxic peptides from the centipede, Scolopendra hardwickei, venom. This sits under our Biotechnology for Sustainable Growth theme and is offered through partnership with Syngenta.

Many pesticides act on targets in the nervous system, particularly ion channel proteins. While effective at protecting crops and domestic animals thus far, many pesticides are being compromised by the emergence of target site resistance and replacements with unique activities are required. Concerns over impacts on beneficial organisms, for example, bees, have led to bans on neonicotinoids. Historically, highly successful pesticides have been derived from natural plant and bacterial toxins, e.g. pyrethroids, neonicotinoids and avermectins; so it seems logical to study natural neurotoxins as potential sources of new active compounds. Venomous animals paralyse their prey in order to rapidly subdue it. To achieve this, many venom components are directed at ion channel proteins in the nervous system to prevent rapid signalling and causing paralysis. Centipedes can subdue prey animals often larger than themselves but have received very little attention.

We recently showed the application of venom and its fractions from the centipede, *Scolopendra hardwickei*, to both human and insect voltage-gated sodium channels (Na_V) has a major impact on their normal functioning, generally causing a gain of function in these channels. We also noted an antagonistic effect against nicotinic acetylcholine receptors (nAChRs). Through collaboration, there is also an indication of at least one TRPA1 channel ligand, and insect homologs of TRPA1 could represent a new insecticide target. Venoms from other closely related species have also indicated the presence of peptides targeting voltage-gated calcium (Ca_V) channels, voltage-gated potassium (K_V) channels and TRPV1 channels, and so it is likely that

other neuroactive components are present in *S. hardwickei* venom. Following this, we generated a transcriptome from the venom glands of *S. hardwickei* and identified 415 separate peptide and protein components within numerous families, each having well-conserved sequences. The majority of smaller peptide components were rich in cysteine residues that form multiple disulphide bridges, a hallmark of peptide neurotoxins.

The project aims to identify insecticidal peptide neurotoxins from *S. hardwickei* venom and determine their insect ion channel targets, modes/sites of action and selectivity.

Why choose this project?

The project will provide training in a wide range of techniques including bioinformatic approaches; solid-phase peptide synthesis; HPLC purification, and mass spectrometric (ESI/MALDI) analyses of products; electrophysiological techniques such as voltage-clamp and patch-clamp coupled to protein expression in Xenopus oocytes and cell cultures for pharmacological characterisation of venom peptides; molecular biology techniques to engineer target ion channel cDNAs and cRNAs for expression; in-silico molecular modelling of peptides and sites of action; pest bioassays to evaluate the potential of putative insecticidal peptides.

The bioinformatics, some peptide synthesis, molecular biology and electrophysiology will be performed in the academic environment at the University of Nottingham; while most peptide synthesis, purification and analysis, and the bioassays will be performed at Syngenta under the supervision of a team led by Dr Jim Goodchild.

The successful candidate will engage with a training programme provided by the DLA and within the School of Life Sciences. This wide range of training and experiences in both academia and industry will equip the student for employment in neurobiology and ion channel research, including the pesticide industry.

For informal enquiries about the project please contact Dr Ian Mellor.

Requirements

Applications are invited from candidates with backgrounds in Bioscience, Biochemistry, Microbiology, Biotechnology, Chemistry, Chemical/Biochemical/Process Engineering, Environmental Science, Pharmacy, Computer Science, Maths or related disciplines who have/expect to graduate with a first/upper-second UK honours degree, or equivalent qualifications gained outside the UK.

Applications are also welcome from candidates with a 2:2 undergraduate degree or lower, who hold a Masters degree in a relevant area or three or more years of full-time work experience relevant to your undergraduate degree, or to the PhD projects you are applying for.

Funding details

Funding is available for four years from October 2026. The award covers tuition fees at the UK rate, plus an annual stipend. The UK Research and Innovation (UKRI) stipend is tax free and was set at £20,780 for 2025/26 entry.

UK and International candidates are eligible to apply.