

## PhD Project Advertisement

**Project No/title:** FBS2026 54 Morpew aq / *Close encounters of the protein kind: Exploiting protein-protein interactions for liver fluke control*

**Lead supervisor:** Dr Morpew Russ, Department of Life Sciences, Aberystwyth University

**Email:** rom@aber.ac.uk

**Co-supervisors:**

Prof. Aaron Maule, Queen's University Belfast

Dr Wayne Aubrey, Aberystwyth University

Prof. Karl Hoffmann, Aberystwyth university

### Project Details

Parasitic worms are responsible for >55% of livestock diseases threatening global food security. Infection from the parasitic liver fluke, *Fasciola hepatica*, has a negative impact on livestock production and welfare. With no vaccines, control is reliant on drugs, particularly triclabendazole which is effective against juvenile and adult worms. However, control is failing, and our overreliance has led to triclabendazole resistance demonstrating the need for alternative drugs. One option to uncover new drug targets is to explore the interactions of proteins at the cellular level and how they interact with other proteins, namely protein-protein interactions (PPIs). We now know that many biological functions are regulated via PPIs. Therefore, modulating or disrupting a PPI network represents a novel target for developing new drugs. New proteomic approaches for the analysis of PPIs are now available and have been utilised in many systems. However, none have been explored within any parasitic worm to date.

**Research aims:** To investigate protein-protein interactions (PPIs) of the liver fluke using new proteomic approaches validated through RNAi and support with machine learning. To characterise PPIs of the liver fluke and the PPIs formed between the liver fluke and the host.

**What you will do:** The successful PhD student will initially map protein-protein interactions PPIs in the liver fluke using novel proteomic approaches. This will be supported by network theory to identify key PPI nodes and experimental PPI network data will be applied to computationally mapped liver fluke networks, driven by gene expression data, to examine flux through biological pathways and through identified key nodes. These targets will then be knocked down using RNA interference to assess their impact on the survival of the liver fluke. Highly connected node PPIs, that demonstrate a significant detrimental phenotype following RNA interference, will be subjected to computer Aided Drug Discovery (CADD) and in vitro drug screening to identify potential lead compounds for the next generation of liver fluke drugs. Finally, the student will also identify PPIs of liver fluke EVs interacting with host cells.

**References:** Davis CN, Phillips H, Tomes JJ, Swain MT, Wilkinson TJ, Brophy PM, Morpew RM. The importance of extracellular vesicle purification for downstream analysis: A comparison of differential centrifugation and size exclusion chromatography for helminth pathogens. *PLoS Negl Trop Dis*. 2019 Feb 27;13(2):e0007191. doi: 10.1371/journal.pntd.0007191. McVeigh P, McCammick EM, McCusker P, Morpew RM, Mousley A, Abidi A, Saifullah KM, Muthusamy R, Gopalakrishnan R, Spithill TW, Dalton JP, Brophy PM, Marks NJ, Maule AG. RNAi dynamics in Juvenile *Fasciola* spp. Liver flukes reveals the persistence of gene silencing in vitro. *PLoS Negl Trop Dis*. 2014 Sep 25;8(9):e3185. doi: 10.1371/journal.pntd.0003185. Wang H, He M, Willard B, Wu Q. Cross-linking, Immunoprecipitation and Proteomic Analysis to Identify Interacting Proteins in Cultured Cells. *Bio Protoc*. 2019 Jun 5;9(11):e3258. doi: 10.21769/BioProtoc.3258.

### Student profile

**Essential for project:** A background in one or more of the following: animal science, biology, biochemistry, bioinformatics, parasitology, veterinary biosciences.

**Desirable for project:** A background in bioinformatics or machine learning. A background in molecular parasitology. Driving licence

**All FoodBioSystems applicants:** An upper 2nd class degree (or equivalent) in a subject relevant to the project. Candidates with a lower class of Bachelors degree, but merit or above at Masters level will also be considered. Demonstrable skills in problem-solving, team-working, communication and time management.

## Training

**Project specific training opportunities:** The successful student will receive tailored support at both Aberystwyth University and Queen's University Belfast. They will receive training in a wide range of classical parasitology methods. This will include the collection, excystment and in vitro maintenance of worms, including BSL2 GLP and containment procedures, and the purification and quantitation of worm EVs. In addition, the student will gain training in molecular methods that will include proteomics and biomolecule purification, RNA interference and target validation, CADD and compound screening, and target localization through confocal and electron microscopy. This project will also develop multidisciplinary skills providing the student with training in mathematical network theory analysis and machine learning to identify key PPI nodes. This project will provide the student with an excellent insight into industry and big-scale veterinary pharmacology with a short term placement at Boehringer Ingelheim Animal Health UK Limited who will be active participants within this PhD programme.

**FoodBioSystems training opportunities:** Throughout their studentship, all FoodBioSystems doctoral researchers participate in cohort training that covers four key themes: food systems, big data (data analytics and modelling), business, and research fundamentals. All doctoral researchers complete a placement: either project-related with a non-academic (CASE) partner, or unrelated to the project and outside the academic environment (PIPS). Details of training are available on the DTP website: <https://research.reading.ac.uk/foodbiosystems/training/>.

## Project supervision style

The student will be supervised through a series of structured and informal meetings. RM operates an open-door policy and thus will meet with the student weekly on a one to one/face to face basis likely several times each week. In addition, the student will benefit from the monthly RM lab meetings to gain insights into the wider research team. In addition, a monthly online supervisory meeting with all academic supervisors (RM, KH, WA & AM) will be conducted. Every quarter, the online monthly meeting will also allow for the industry partner, BI, to feed into the project. The provision of feedback on completed documents (i.e. literature review) will follow the AU standard of 15 working days. All email correspondence will be answered within the AU standard of 3 working days. The RM group operates a Lab group WhatsApp chat providing often instant support during working hours.

## Stipend (Salary)

FoodBioSystems DTP students receive an annual tax-free stipend (salary) that is paid in instalments throughout the year. For 2025/26 this is £20,780 and it will increase slightly each year at rate set by UKRI.

## Equity Diversity and Inclusion

The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher (DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the [FoodBioSystems DTP website](#) and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- [Guaranteed interview](#) and [applicant mentoring](#) schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups who also meet academic eligibility criteria and the student profile essential for the project.

These are opt-in processes.

Our studentships can be offered to home students on a part-time basis, and studentship end date and stipend payments will be amended to reflect the part-time registration. The minimum registration for DTP funded part-time students is 0.5 FTE (studying an average of 20 hours per week over 8 years). We regret that part time registration is not available to international students due to complexities of visa restrictions.

## Funding note

We welcome applications from candidates with Home/ROI fees and international fees status. This studentship is funded by UKRI and covers stipend, fees at Home/ROI rate, and research costs. The host university will not charge UKRI funded international students the difference between Home/ROI fees and international fees.

**Costs that must be found from other sources or met by the individual student include:** visa fees, healthcare surcharge, relocation costs and guarantor services.

**For up to date information on funding eligibility, studentship rates and part-time registration, please visit the [FoodBioSystems website](#).**