PhD Project Advertisement

Project No/title: FBS2026 57 Nash ar / *Immunomodulation to combat common inflammatory conditions in livestock using cell culture models*

Lead supervisor: Dr Debbie Nash, Department of Life Sciences, Aberystwyth University

Email: dmn@aber.ac.uk

Co-supervisors:

Dr Kirsty Kliem, University of Reading

Dr Amanda Gibson, Aberystwyth University

Project Details

Cattle and pigs often suffer conditions that activate the innate immune system, including endometritis (uterine inflammation in both species), and mastitis (cows), commonly caused by Escherichia coli (E. coli). Endometritis and mastitis are important agricultural problems because they cause infertility, lower yields/milk quality/saleability and affect animal welfare. Treatments are some of the largest costs to the UK diary industry and rely on antibiotics which lead to antimicrobial resistance.

Immunomodulation is a clinical tool for infection control. Exposure to micro-doses of a bacteria (such as E.coli) or it's antigen (lipopolysaccharide; LPS) can induce 'trained' immunity leading to long-lived protection against future infections. Alternatively micro-dosing may prime the immune system into 'tolerance', reducing chronic inflammation. The potential to induce 'trained' or 'tolerance' responses to treat endometritis or mastitis in livestock remains unexplored, but has great potential

Research aims: To determine whether cow and pig blood immune cells (peripheral blood mononuclear cells: PBMCs), and uterine, and mammary cells can be induced to 'tolerate' or be 'trained' to the E. coli antigen lipopolysaccharide (LPS) following an ultra-low dose priming protocol.

What you will do:

1) Optimise and validate a low-dose LPS priming protocol using bovine and porcine PBMCs: Discarded blood will be collected from a local abattoir and PBMCs isolated and cultured in the laboratory. Low-dose LPS stimulation will be compared to responses of the same cells later challenged with a 'infection' dose of LPS. The responses will be assessed by measuring immune marker secretion by the cells

2) The priming protocol devised in 1), will be tested using bovine PBMCs collected from cattle with known reproductive status, to determine whether health and metabolic status of the animal impacts responses

3) The priming protocol will be applied to bovine and/or porcine endometrial cells Endometrial tissues will be collected from uteri discarded from abattoirs.

4) The priming protocol will be applied to bovine mammary cells. A commercially available bovine mammary cell line will be used to verify the priming protocol in this cell type.

References:

1. Netea MG, Dominguez-Andres J, Barreiro LB, Chavakis T, Divangahi M, Fuchs E, et al. Defining trained immunity and its role in health and disease. Nat Rev Immunol. 2020;20(6):375-88.
2. Byrne KA, Loving CL, McGill JL. Innate Immunomodulation in Food Animals: Evidence for Trained Immunity? Front Immunol. 2020;11:1099.
3. Biswas SK, Lopez-Collazo E. Endotoxin tolerance: new mechanisms, molecules and clinical significance. Trends Immunol. 2009;30(10):475-87. 6.

4. Lajqi T, Kostlin-Gille N, Bauer R, Zarogiannis SG, Lajqi E, Ajeti V, et al. Training vs. Tolerance: The Yin/Yang of the Innate Immune System. Biomedicines. 2023;11(3).
5. Nash DM, Giles JL. Uterine Inflammation and lessons learned from large animal models of endometritis. Nature Reviews Immunology 2025(On-line ahead of publication: https://www.nature.com/articles/s41577-025-01200-2).

Student profile

Essential for project: A background in animal or livestock science or veterinary bioscience.
Must be willing to visit a livestock abattoir, liaise with staff there to arrange collections, and collect blood/uterine tissue from the meat processing line in person.
Desirable for project: Tissue or cell culture experience
Experience of running laboratory analyses, such as ELISA
Demonstrable interest in cell biology, reproductive health in livestock animals, and immune responses.
UK 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: Research training includes core skills needs assessment, activities for careers in research, data handling and statistics. Laboratory skills will be gained in cell culture techniques, RT-PCR, Luminex multiplex protein assay and blood cell isolation. Whole animal contexts and hands-on experience will be embedded through assisting with blood sampling/preparation from lactating cows at University of Reading's Centre for Dairy Research. Training will be offered in scientific communication (publication writing, conference presentations). Attendance and presentation at departmental seminars and the DLS annual research festival (poster and short communications). We encourage participation at scientific meetings, such as British Society for Animal Science and British Society for Immunology annual conferences. Supervisors provide industry communication with links to the Welsh Government initiative, Farming Connect (Farming Connect - helping you drive your business forward | Farming Connect (gov.wales)), for which the Knowledge Exchange Hub is based at Aberystwyth University.

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 based at AU with Drs Nash and Gibson. Integral to the supervisory team, Dr Kliem will join meetings on-line and provide one to one support for work undertaken at UoR. Supervisory meetings will be fortnightly in person with Drs Nash and Gibson with Dr Kliem joining remotely once a month. Meetings will include data presentation enabling prompt feedback opportunities. A literature review is required in year one, with extensive written feedback provided by supervisors. All supervisors have an 'open door' policy to address ad hoc queries and concerns. The student will work in the group of Dr Nash, shared with another colleague, facilitating peer support (PhD students, a technician and PDRA), for example, with informal trouble shooting discussions, coordinating orders. Fortnightly lab group meetings include data presentations to the group, enabling peer feedback, troubleshooting, assigning laboratory maintenance tasks, health and safety compliance and actions.

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.