CO(L)LABORATORY

2024 PhD Studentships

To paddle or not to paddle? Examining microbial contamination and risk to communities in Nottingham's rivers

Project Aims

There is growing public concern about the contamination of rivers and streams in the UK and implications to human health. Yet, while the levels of faecal bacteria in designated bathing waters (primarily coastal) are carefully monitored and regulated, this doesn't include most rivers and streams that are used recreationally by community members. Due to antibiotic resistance, some bacterial infections are becoming more difficult to treat, making it increasingly important to prevent infections whenever possible.

While local rivers and streams in Nottingham are extensively used for recreation by residents, there is only one designated bathing water site at West Lake at Colwick Country Park. All other local rivers, streams and lakes are not monitored for the presence of potentially harmful bacteria. Nottinghamshire residents accessing these sites both formally (e.g. organised water sports, angling, etc.) and informally (e.g. paddling) therefore have a high level of exposure to potential harmful bacteria, with water-borne illness being a well-known issue experienced by local water sportspersons, colloquially termed "Trent belly".

This project will take a citizen science approach, engaging local community members in the collection of river water samples at the sites they use and care about. Samples will be analysed microbiologically to determine the levels of faecal bacteria, and their sensitivity/resistance to common antibiotics. Samples will be taken at regular intervals over time, to help us understand how long faecal bacteria remain in the river after sewage contamination occurs.

This research will be undertaken in partnership with the Environment Agency East Midlands branch, supporting their ongoing efforts to monitor local water quality. The data will be used to develop a model to quantify the risk to human health that will be shared with community participants along with information about antibiotic resistance and advice on infection prevention.

This project has been co-created and is supported by researchers from Nottingham Trent University, the University of Nottingham, and partners at The Environment Agency, East Midlands. The successful candidate will be enrolled at the University of Nottingham.

Project Aims

1. Determine the numbers of antibiotic resistant and antibiotic susceptible faecal bacteria in a wide range of local river water and sediment samples, and how these change over time in local river water sites frequently used recreationally by the community.
2. Engage local community members with issues around antibiotic resistance and how it can be tackled.
3. Develop a model for quantitative assessment of risk to human health from faecal contamination of river water and a tool for data visualisation and dissemination.

Supervisory Team

1. Lead Academic Supervisor: Dr Jody Winter, NTU
2. Academic Co-Supervisor: Dr Dov Stekel, UoN
3. Community Supervisor: Martin Winter, The Environment Agency (East Midlands)

Key Details

Host University:	Nottingham Trent University
School / department:	School of Science & Technology
Start date:	03 April 2024
Financial offer:	Tuition fees covered in full (worth approx. £15k across full PhD programme). Monthly stipend based on £18,622 per annum, pro rata, tax free.
Working hours	Full-time (minimum 37.5 hrs per week), or part-time (minimum 20hrs per week).
Working Style:	Primarily in-person at host university. Flexible working supported. Working pattern to be agreed between successful candidate and lead supervisor.

Competencies

Co(l)laboratory Core Competencies		
Category	**Competency**	**Assessed: Application (A), Interview (I)**
Comprehension and evaluation	Strong understanding of the project and its subject matter.	A / I
	Analytical, researcher mindset with keen attention to detail.	A / I
	Communicate complex concepts with clarity and precision.	A / I
	Able to identify connections, patterns, gaps, and irregularities in information/data.	I
	Able to interpret data/information confidently with logic and empathy to derive meaning.	I
Social and emotional	Demonstrable experience of responding effectively changing contexts, information and demands.	A
	Ability to persevere in the face of challenges/failures and to remain constructive in developing solutions.	A
	Demonstrable passion for learning with clear drive and curiosity to undertake this specific research project.	A / I
	Willingness to immerse oneself in the research subject matter and make a contribute to new knowledge through a PhD.	A / I
	Strong desire to make a positive community impact through the research.	A / I
	Willingness to think deeply about complex concepts and engage with academic ideas and theory.	A / I
Preparedness and potential for success	Experience of working, collaborating and communicating effectively with different stakeholders.	A
	High level of self-motivation and ability to work with minimal guidance.	A / I
	Strong organisational and time-management skills with the ability to balance and prioritise multiple tasks.	A / I
	Ability to identify potential challenges and complexities and thoughtfully consider possible solutions.	A / I
	Able to identify the technical, personal, or professional skills required for a task and take action to develop these.	A / I
Community Context	Genuine desire to undertake community-engaged research over more traditional approaches to research.	A
	Understand the impact of and need for the inclusion of diverse experiences and points of view in research.	A / I
	Appreciation/understanding of the importance of community insight and experience in the generation of new knowledge.	A / I
	Awareness/understanding of the broader societal context related to the subject matter of the project.	A / I

Project Specific Competencies			
Essential	**Assessed: Application (A), Interview (I)**	**Desirable**	**Assessed: Application (A), Interview (I)**
Understanding of wider contextual issues relating to the project (antibiotic resistance, community recreational use of waterways, environmental pollution, etc.)	A / I	Good understanding of the scientific research process and ability to formulate research questions, design experiments, gather and analyse data, draw meaningful conclusions.	A / I
Curiosity and passion for the subject area of the research project.	A / I	Experience working in a Biosciences laboratory, including safe handling of microbes.	A / I
High degree of computer literacy with the ability to learn and use new software and tools (e.g. for use in statistical analysis, data modelling, data visualisation, science communication, etc.).	A / I		

References for Further Reading

- Rivers Trust (2023) Raw sewage in our rivers. Available at: https://theriverstrust.org/ key-issues/sewage-in-rivers [accessed 21st August 2023].
- Rivers Trust (2023) Our rivers in their current state. Available at:https://storymaps.arcgis.com/collections/6730f10b64184200b171a57750890643?item=3 [accessed 21st August 2023].
- World Health Organisation (2023) Antimicrobial resistance. Available at:https://www.who.int/health-topics/antimicrobial-resistance [accessed 21st August 2023].
- Murray et al (2022) Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The Lancet 399 (10325) 629.
- World Health Organisation (2016) Global action plan on antimicrobial resistance. Available at:https://www.who.int/publications/i/item/9789241509763 [accessed 21st August 2023].
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- Rivers Trust (2023) State of our rivers. Available at: https://theriverstrust.org/key-issues/stateof-our-rivers [accessed 21st August 2023].
- Eur-Lex (2006) Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC. Available at: https://eur-lex.europa.eu/eli/dir/2006/7/2014-01-01 [accessed 21st August 2023].
- Mukherjee et al (2021) Elevated incidences of antimicrobial resistance and multidrug resistance in the Maumee River (Ohio, USA), a major tributary of Lake Erie. Microorganisms 9 (5) 911.
- Solaiman et al (2022) Effects of season and water type on the distribution and antimicrobial resistance of Enterococcus faecalis and Ent. faecium from surface and reclaimed water. Journal of Applied Microbiology 133 (2) 477.
- Singh et al (2021) High prevalence of drug resistance and class I integrons in Escherichia coli isolated from River Yamuna, India: a serious public health risk. Frontiers in Microbiology 12: 621564.
- Kimera et al (2021) Occurrence of ESBL producers, quinolone and carbapenem resistant Enterobacteriaceae isolated from environmental samples along Msimbazi River Basin ecosystem in Tanzania. Int. J. Environ. Res. Public Health 18 (16) 8264.
- Vergurg et al (2019) Abundance and antimicrobial resistance of three bacterial species along a complete wastewater pathway. Microorganisms 7 (9) 312.

References for Further Reading

- Food Standards Agency (2023) Pathogen Surveillance in Agriculture, Food and Environment Programme. Available at: https://www.food.gov.uk/our-work/pathogen-surveillance-inagriculture-food-and-environment-programme [accessed 21st August 2023].
- Hart et al (2023) Environmental surveillance of antimicrobial resistance (AMR), perspectives from a national environmental regulator in 2023. Eurosurveillance 28 (11) 2200367.
- Commission Regulation (EC) No 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs. Available at: https://www.legislation.gov.uk/eur/2005/2073/annexes/2020-01-31 [accessed 21st August 2023].
- British Canoeing (2022) Why Blue Space Matters: Beth Gill on the health of our rivers. Available at: https://www.britishcanoeing.org.uk/news/2023/why-blue-space-matters-beth-gillon-the-health-of-our-rivers [accessed 26th September 2023].