

# Matthew Asker

PhD in Applied Mathematics, University of Leeds - UK citizen  
Supervised by Prof. Mauro Mobilia and Prof. Alastair M. Rucklidge

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[Personal site](#)  
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## EDUCATION

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### • University of Leeds

*PhD Applied Mathematics; Evolution of Populations in Fluctuating Environments*

Leeds, England

*Oct. 2021 – present*

- **Research (PhD project):** Part of an international group using techniques from statistical physics and computational methods (Python, C++) to understand the eco-evolutionary dynamics of populations under varying environments. Relevant to the problems of antimicrobial resistance and species diversity.
- **Taught master's courses:** Taken the modules Advanced Mathematical Methods (90%), Advanced Nonlinear Dynamics (91%), and Advanced Evolutionary Modelling (93%).
- **Seminar series attended:** Regularly attend the Leeds Applied Nonlinear Dynamics seminar series, the Mathematical Biology seminar series, and many post-graduate researcher (PGR) seminars.
- **Seminar organisation:** Organised the biweekly Joint Mathematics PGR seminar series (2 semesters) and the weekly Applied Mathematics PGR seminar series (2 semesters).
- **Teaching assistant:** Tutored multiple groups of students in MATH1005 Core Mathematics via in-person tutorials and online marking feedback (4 semesters) and marked exams for the course (3 semesters). Additionally marked exams for MATH1331 Linear Algebra with Applications (1 semester) and MATH5567 Advanced Evolutionary Modelling (1 semester).

### • University of Manchester

*MPhys Physics with Theoretical Physics; Grade: First-Class*

Manchester, England

*Sep. 2017 – Jun. 2021*

- **Research Project:** Modelled COVID-19 using a modified percolation model. Calculated the fractal dimension of the spread of the disease through [Germany](#) and the [USA](#) and used this as a proxy for disease spread. Fit a [percolation model with a travel term](#) to the data. Found that effect of lockdowns on the real-world data corresponded to a decrease in the travel term in the model. All code written in Python.
- **Relevant modules:** Mathematical Biology (94%), Statistical Mechanics (91%), Statistical Methods (86%), Advanced Statistical Physics (94%).
- **Mentorship:** Mentored 10 first year physics students (4 semesters). Prepared engaging activities for weekly meetings, and facilitated discussion surrounding problems in the course. Physics scheme won the PASS Legacy Award in 2019 and was nominated for the Innovation Award in 2020.

## RESEARCH INTERESTS AND EXPERTISE

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Biological questions of evolution at the population and cell levels are of great interest to me. Using my expertise in non-equilibrium statistical physics, population dynamics, and evolutionary game theory, I would like to understand how key features of biological systems (e.g. spatial structure, dynamic environments, phenotypic plasticity, demographic stochasticity) impact their evolution. More specifically, I have experience in working with stochastic population dynamics systems in both well-mixed and spatially-structured settings, with a focus on non-constant environments. I am particularly interested in features of such systems which can be used to better understand clinical issues such as antimicrobial resistance and cancer.

## PUBLICATIONS

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I currently have published 3 papers, including one first-author, and I am preparing 2 other publications, both of which will be first-author.

- L. Hernández-Navarro, **M. Asker**, and M. Mobilia. “Eco-evolutionary dynamics of cooperative antimicrobial resistance in a population of fluctuating volume and size”. *J. Phys. A: Math. Theor.* **57**, 265003 (2024)
- **M. Asker**, L. Hernández-Navarro, A. M. Rucklidge, and M. Mobilia. “Coexistence of Competing Microbial Strains under Twofold Environmental Variability and Demographic Fluctuations”. *New J. Phys.* **25**, 123010 (2023)
- L. Hernández-Navarro, **M. Asker**, A. M. Rucklidge, and M. Mobilia. “Coupled environmental and demographic fluctuations shape the evolution of cooperative antimicrobial resistance”. *J. R. Soc. Interface* **20**, 20230393 (2023)

## PRESENTATIONS AND SCHOLARSHIP

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- **L24EEDs Workshop:** Co-organised the [Leeds 2024 Eco-Evolutionary Dynamics workshop](#) on “Mathematical modelling of microbial communities: cooperation, dynamics, and resistance”, with around 65 attendees (9 invited speakers, 25 contributed speakers) from 9th-12th July 2024.
- **Project website:** Set-up and manage the website [eedfp.com](#) as a hub for the overarching research project I work within, in collaboration with researchers from Virginia Tech and Imperial College London. Additionally, used the site as the homepage for the workshop I co-organised (see above).
- **Dissemination:** Invited to give seminars at Virginia Tech and Stony Brook University. Contributed a talk at the Center for Soft Matter and Biological Physics 2024 Annual Symposium (Virginia Tech), L24EEDs workshop (University of Leeds), two School of Mathematics PGR conferences (University of Leeds), and multiple internal seminar series. Presented posters at 3 external conferences and attended 2 schools.

## GRANTS AND AWARDS

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- 2024: **Travel Grant** - *London Mathematical Society*: an award of £500 to provide partial support for UK-based early career researchers to attend conferences or undertake research visits.
- 2023: **Best talk in Applied Mathematics** - *University of Leeds*: a prize given to the best talk in the applied department at the annual PGR conference in the School of Mathematics.
- 2020: **PRACE Summer of HPC Scholarship** - *Partnership for Advanced Computing in Europe (PRACE)*: a scholarship covering accommodation, travel costs, and a stipend for an intensive 2 month research programme at a high-performance computing centre in Europe. (Held remotely due to COVID)
- 2017: **Physics Entrance Scholarship** - *University of Manchester*: an award of £1000 for outstanding results (A\*A\*A\*) in pre-university exams.

## CAREER ASPIRATIONS

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In the short-term, I would like to continue developing my theoretical toolkit in mathematical biology and my knowledge of biological systems to enhance my ability to ask and address questions of significant importance to theorists and experimentalists. I would like to form close collaborations with experimentalists to help guide the course of this research. Following this, I aim to acquire funding through an individual fellowship so that I can start my own long-term programme of research. In the long-term, I would like to establish myself as an academic in theoretical biology with strong links to experimental work, enabling me to win larger grants and eventually culminating in securing a permanent position at a university or research institution.

## EXTRA-CURRICULAR ACTIVITIES

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- **Football**

*Player & Supporter*

- When I'm not experiencing the highs and lows of my beloved [Ipswich Town](#), I enjoy playing 5-a-side football.

- **Outdoors Explorer**

*Enthusiast*

- Regular hiker and runner with a sprinkle of backpacking and climbing mixed in.

## REFERENCES

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- Prof. Mauro Mobilia, University of Leeds - [m.mobilia@leeds.ac.uk](mailto:m.mobilia@leeds.ac.uk)
- Prof. Uwe C. Täuber, Virginia Tech - [tauber@vt.edu](mailto:tauber@vt.edu)
- Dr. Florence Bansept, Aix Marseille Université - [fbansept@imm.cnrs.fr](mailto:fbansept@imm.cnrs.fr)