Matishalin Patel

✉ *Matishalin.Patel@hull.ac.uk*
matishalin.com

Research

2022 → now **University of Hull**, *Lecturer*, Centre for Data Science, AI, and Modelling.
Setting up an independent research program using mathematical biology and computational simulations to understand the evolution of between species Major Transitions. Also investigating the behavuiour and evolutionary pressures on reinforcement learning agents in Animal-AI. I give lectures and supervise projects for the MSc DataScience and AI course.

2021 → 2022 **University of Cambridge**, *Post-doctoral Research Associate*, Centre for the Future of Intelligence.
Using evolutionary theory to understand the foundations of intelligence and use these insights to build better Artificial Intelligence algorithms. My research investigates evolutionary tradeoffs in brain structure and behavioural complexity and how this leads to transitions in intelligence. I directly implement artificial agents and evaluate their performace as well as modelling evolutionary pressures on neural architectures in a more abstract way.

2020 → 2021 **University of Cambridge**, *Post-doctoral Research Associate*, Dept. of Zoology.
Inter-group conflict is a powerful shaper of social behaviour. I developed models to help understand these effects. I worked with field researchers from Exeter to create models informed by the real world behaviours of Banded Mongooses.

2015 → 2019 **University of Oxford**, *DPhil*, Dept. of Zoology, Helping and Harming.
My DPhil focused on the evolution of altruism and spite.

DPhil thesis

title *Helping and Harming*

supervisors Stuart West and Michael Bonsall

description My DPhil focused on the evolution of altruism and spite. I modelled the evolution of a public good (Cry toxin) in a bacteria that infects a seasonally varying host — looking at the short and long term dynamics. I developed theory on the evolution of spiteful behaviour and how it is sometimes conflated with selfishness when fitness effects are mis-partitioned. I investigated how a host can evolve to control the relatedness among its symbionts to force cooperation and reap the benefits.

Education

2021 **Machine Learning**, *Stanford University*, Remote.
I learnt how to implement and interpret supervised and unsupervised machine learning algorithms such as feed-forward neural networks, logistic regressions, K-means, and Support Vector Machines. I also learnt algorithm testing, performance evaluation, and pipeline testing and construction.

2014 → 2015 **MSc. Computational Methods in Ecology and Evolution**, *Imperial College London*, London, *Distinction*.
I took modules in multivariate calculus, linear algebra, statistics (linear models, GLMs and ANOVA), Maximum likelihood methods, and Bayesian statistics. The course also covered agent based simulation and evolutionary simulations as well as model fitting and phylogenetic methods.

2011 → 2014 **MA Biological Sciences**, *University of Oxford*, Oxford, *1st*.
I focused on: social evolution, behavioural ecology, evolutionary ecology, bio-mechanics, and animal cognition.

Publications

M. Patel, S. A. West. Microbial warfare and the evolution of symbiosis. *Biology Letters* 18:1820220447, 2022.

M. Patel, S. A. West, and J. M. Biernaskie. Kin discrimination, negative relatedness, and how to distinguish between selfishness and spite. *Evolution Letters*, 4(1):65–72, Feb. 2020.

M. Patel, B. Raymond, M. B. Bonsall, and S. A. West. Crystal toxins and the volunteer's dilemma in bacteria. *Journal of Evolutionary Biology*, 32(4):310–319, 2019.

J. C. C. Vila, M. L. Jones, M. Patel, T. Bell, and J. Rosindell. Uncovering the rules of microbial community invasions. *Nature Ecology & Evolution*, 3(8):1162–1171, Aug. 2019.

C. Karlsson, J. K. Willis, M. Patel, and T. M. de Perera. Teleost fish use optic flow to estimate distance travelled. *Communications Biology*, 2021.

Prepared for publication

M. Patel, M. A. Cant, and R. A. Johnstone. Group warfare and environmental harshness. 2022.

M. Patel, S. A. West, and M. B. Bonsall. Combining social evolution and disease ecology in a bacterial population. 2022.

Teaching

2023 → now **Lecturer, Programming for Data Science and AI**, *DAIM*, Hull.
Teaching a 4-week introductory course to Python programming and best practices in scientific programming in general.

2022 **Lecturer, Part 1B: Evolution and Animal Diversity**, *Zoology*, Cambridge.
Gave 3 lectures and 1 seminar on Development of Adaptive Behaviour course.

2021 → 2022 **Part 1A: Ecology and Evolution Tutor**, *Lucy Cavendish*, Cambridge.
Teaching a group of 3 undergraduate students in weekly supervisions for all three terms of the 2021-2022 academic year.

2020 → 2022 **Lecturer, Part II Zoology: Evolution and Behaviour**, Cambridge.
Researched and designed a four lecture module on parental care and the fundamentals of social evolution. Using Panopto and Moodle to deliver the course and interact with students.

2019 → 2020 **Statistics Tutor, New College**, Oxford.
Gave a term of Statistics tutorials to second year undergraduates for two successive years. Tutorials were in groups of 2-4 and each tutorial went over key concepts and past paper examples.

2016 → 2019 **Undergraduate Statistics demonstrator**, Oxford.
Demonstrator for the undergraduate bio-statistics course: statistical modelling, data management, and R programming skills.

2017 → 2019 **Undergraduate Tutor in ecology and social evolution**, Oxford.
Tutorials on programming, social evolution, Neutral theory and sensory ecology. Tutorials given to groups of two students at a time, from various Oxford colleges, and tutorial work in essay or problem sheet form.

Talks

2021 **Intra-group cooperation and Intergroup conflict in Banded Mongooses**, *Max Planck, Germany*, Invited talk to the Institute for Evolutionary Biology discussing my postdoctoral work and future plans as part of an internal seminar series.

2021 **Major Transitions Past and Future**, *CRI Paris, France*, Invited talk to the CRI Paris where I presented my thesis work and future research plans in an internal seminar.

2018 **Crystal Toxins: A volunteers' dilemma**, *EMPSEB 2019*, Conference Talk at EMPSEB 2019 in Granada Spain. I presented the findings from my work on volunteers' dilemmas.

Funding and Awards

2016 **BBSRC Interdiscplinary Bioscience DTP award**, *Oxford University*, £15,000 stipend and £5000 a year research expenses for 4 years.

2015 **Imperial College Masters Scholarship**, *Imperial College London*, Course fees paid and £10,000.

Scientific Activities

2019 **Symposium Chair Evolution 2019**, Co-chairing a symposium titled "Mathematical models in evolutionary biology". Aimed at exploring the consequences of the premises and axioms we use when developing models.

2018 **Symposium Chair Evolution 2018**, Co-chaired a symposium titled "Major transitions in individuality and levels of selection".

2018 **Poster - Evolution 2018**, Presented a poster of a paper at Evolution 2018 — "Crystal Toxins and the volunteer's dilemma in bacteria.".

2015 $\rightarrow$ 2018 **Cheltenham Science festival**, Three years of public outreach at Cheltenham Science Festival, UK.