LAURA E WADKIN

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School of Mathematics, Statistics & Physics ◇ Newcastle University ◇ NE1 7RU

orcid.org/0000-0001-7355-2023 Laura E Wadkin Laura E Wadkin

Interests: Mathematical biology and ecology, tree disease, stem cells, stochastic modelling

EDUCATION AND QUALIFICATIONS

Newcastle University *2016–2020*
PhD in applied mathematics 'A mathematical framework for stem cells'

Newcastle University *2012–2016*
MMath Hons Mathematics, 1st

EMPLOYMENT

Newcastle University
Post-doctoral Research Associate *Feb 2021–Feb 2023*
LMS Early Career Fellow *Sep 2020–Jan 2021*

GRANTS

LMS Early Career Research Fellow Grant (£7000) *Sep 2020*

PRIZES

Newcastle Applied Mathematics PGR Prize *Jun 2020*
Smith Institute TakeAIM Awards: 2nd Prize *Feb 2020*
Newcastle Applied Mathematics PGR Prize *Jun 2019*
ABTA Doctoral Researcher Awards: Honourable mention for doctoral work *May 2019*
London Mathematical Society Women in Mathematics Day: best poster *Oct 2018*
STEM for BRITAIN Silver Prize, presented in the House of Commons *Mar 2017*
IMA Graduation Prize for outstanding achievement *Jun 2016*

RESEARCH AND TECHNICAL EXPERTISE

PhD: A mathematical framework for human pluripotent stem cell behaviours. I developed mathematical models of key stem cell behaviours, including their kinematics, colony growth and pluripotency. My approach has been inherently inter-disciplinary, using specialist experiments (Biosciences Institute, Newcastle University) and a wide range of statistical analysis and modelling techniques, including agent-based and stochastic differential equations.

Early career fellowship: I was awarded an independent grant to further explore the spatial properties of pluripotency within stem cell colonies.

Post-doctoral: In my current role I am using a combination of 'local' lattice and 'global' continuum models to perform systematic modelling and parameter inference of past and present tree epidemics in the UK.

Proficient at Matlab, R, LaTeX with experience in Python and HPC.

Trained in the use of ImageJ, IMARIS 3D/4D Microscope analysis software.

Experienced in inter-disciplinary teams combining laboratory experiments, image analysis and mathematical modelling.

PUBLICATIONS

- L. E. Wadkin *et al.*, OCT4 expression in human embryonic stem cells: spatio-temporal dynamics and fate transitions. Accepted. Phys. Biol. (2020).

  An analysis of the spatio-temporal behaviour of the pluripotency transcription factor OCT4, quantifying its intra-cellular self-regulation and spatial correlations within colonies.

- L. E. Wadkin *et al.*, An introduction to the mathematical modelling of iPSCs. Submitted for Induced Pluripotent Stem Cells: Novel Concepts, Elsevier (2020).

  A chapter conveying the importance and usefulness of mathematical modelling as a tool to achieve a deeper understanding of stem cell biology, introducing key mathematical concepts (random walk theory, differential equations and agent-based modelling) for non-mathematical readers.

- L. E. Wadkin *et al.*, The recent advances in the mathematical modelling of human pluripotent stem cells. SN Applied Sciences 2, 276 (2020).

  A review of the recent developments in the mathematical modelling of the key behaviours of pluripotent stem cells, suitable for both biologists and mathematicians.

- L. E. Wadkin *et al.*, Seeding hESCs to achieve optimal colony clonality, Sci. Rep. 9, 15299 (2019).

  A stochastic exponential growth model for colony formation is developed based on experimental data. The average time at which clonality is lost *in-vitro* for different initial seeding conditions is presented as a diagnostic tool for biologists.

- L. E. Wadkin *et al.*, Correlated random walks of human embryonic stem cells *in-vitro*, Phys. Biol. 15, 056006 (2018).

  The individual motions of single and pairs of cells from experimental data are analysed. The correlated random walks and super-diffusive behaviour of cells is presented.

  University press release, 'How stem cells move' (Jun 18).

- L. E. Wadkin *et al.*, Dynamics of single human embryonic stem cells and their pairs: a quantitative analysis, Sci. Rep. 7, 570 (2017).

  Important parameters of the movement of single and pairs of cells, such as velocities, diffusivity and correlation times are extracted from analysis of experimental data.

- S. Orozco-Fuentes, I. Neganova, L. E. Wadkin *et al.*, Quantification of the morphological characteristics of hESC colonies, Sci. Rep. 9, 17569 (2019).

  The morphological characteristics of cells within colonies of varying size are quantified, including their packing and size segregations.

TALKS

- Regenerative Medicine Research Group, 'Mathematical insights into OCT4 regulation'. Newcastle University (Jun 2020).
- British Applied Mathematics Colloquium, 'Mathematical modelling of hESCs to optimise clonality'. University of Bath (Apr 2019).
- British Young Mathematicians Colloquium, 'Mathematical modelling of hESCs to optimise clonality'. Birmingham University (Apr 2019).

· Applied Postgraduate Conference, 'Modelling hESC colony formation'. Newcastle University (Jun 2017, 18 and 19).

· Stem Cell Biology Research Group, 'Human stem cell colony formation: a mathematical modelling approach'. Institute for Genetic Medicine (Nov 16).

TEACHING

· PARTNERS Summer School lecturer (2019–2021).

Led lectures over two week summer school on Algebra and Functions for non-traditional UG offer holder students enrolled on the PARTNERS Scheme (widening participation entry route for local area students), aimed at bridging the gap between A-Levels and HE. Developed and delivered online materials for Summer 2020.

· Online Python demonstrator (MAS1803 and MAS2805) (Semester 1 20/21).

Supported online sessions for first and second year Python modules, providing demonstrations and Q&As.

· Lecturer for PHY1032 Introductory Algebra (Semester 1 19/20)

Led 5 weeks of lectures for an UG Physics module introducing algebraic concepts (5 contact hours/week including 1 office hour, 80 students). I designed and presented new lecture material to tailor the course to physicists, wrote the mid-semester test and contributed to the writing of the final exam.

Feedback from mid-semester questionnaire:
"Frequent examples, pace changes well with difficulty of the content, clear notes."
"Easy to understand, good handouts."
"This module section is taught with great clarity."

· Developed MRes mini-module PHY8005 Agent Based Modelling (2018–2021).

Led a computational research skills module for MRes Physicists (∼10 students). I developed the material based on my academic research (computational agent based modelling), wrote the lecture notes, delivered the material across several 3 hour interactive workshops, and wrote and marked the final summative assignment. Transferred online for Semester 1 20/21.

· Assistant in MAS1801 Problem Solving (Semester 1 19/20).

Assisted in interactive problem solving sessions (4 hours/week for 5 weeks) in which first year UG students worked at solving interesting mathematics problems in groups. As an assistant I facilitated their discussions and encouraged their creative thinking skills.

· Led MAS2802 Differential Equations problems classes and office hours (Semester 2, 18/19).

Led problems class and tutorial lectures (5 hours) for the second year differential equations maths module, 285 students. I also provided email and office hour support (1 hour/week).

· Demonstrating/marking for the school of Mathematics, Statistics and Physics (2016–present).

A variety of marking for mathematics modules (including differential equations, fluid dynamics and algebra) and demonstrating in computer labs (for MATLAB, Python and R).

EDI AND OUTREACH

- Silver grade STEM ambassador undertaking outreach activities in local schools (2016–2019).

  Volunteering through the STEM Ambassador program I have undertaken a variety of outreach activities in both primary and secondary schools. The activities include: careers talks, mock interviews, assisting in science days and promoting women working in STEM.

- Speaker at WISDOM event for Y9/10 students encouraging women in STEM (2017–present).

  The annual Women In Science Doing Outstanding Mathematics event is for Y9 and Y10 students, showcasing mathematics careers for women. Each year I have participated, presenting a careers talk on my PhD research and attending the networking event.

- Outreach committee member (2017–present).
- Organised Applied Postgraduate Conference (2019).

POSTER PRESENTATIONS

- 'Optimising stem cell clonality' presented at LMS Research School: PDEs in Mathematical Biology (ICMS Edinburgh 2019) and ABTA Doctoral Researcher Awards (University College London 2019).
- 'Human embryonic stem cell colony formation' presented at LMS Women In Mathematics Day. Prize for best poster (Newcastle University 2018).
- 'Modelling stem cell colony formation' presented at the UK Conference on Multiscale Biology (Nottingham University 2018), and the Collective dynamics and self-organisation in biological sciences workshop (ICMS Edinburgh 2018).
- 'Mathematical modelling of stem cell colonies' at STEM for BRITAIN competition, presented to MPs in the House of Commons. Won Silver prize (2017).

COURSES

- Evidencing Learning and Teaching Skills: D1, Newcastle University, (Semester 2 19/20).
- ACTION for Impact Training, Newcastle/Durham Universities, 3 day residential (July 2019).
- The Introduction to Learning & Teaching in Higher Education programme, full day course, Newcastle University (Sep 2017).
- The Academy for PhD Training in Statistics:
  Cambridge week: Statistical Inference and Computing (Dec 2016).
  Oxford week: Applied Stochastic Processes and Statistical Modelling (Mar 2017).
- Hands-on Introduction to HPC, ARCHER, two day course (Dec 2016).

REFERENCES

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