

William Duncan Martinson
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Education

University of Oxford, Balliol College Oxford, UK Graduated August 2022

D.Phil. in Mathematics

Thesis title: Follow the leader: collective cell migration in cancer and developmental biology.

Supervisors: Philip K. Maini, Helen M. Byrne

Brown University Providence, RI, USA Graduated May 2018

Honors Sc.B. in Applied Mathematics-Biology, magna cum laude (highest honors awarded), Phi Beta Kappa, GPA: 4.0/4

Senior honors thesis title: Long-time integration of reaction transport and application to coagulation kinetics.

Supervisors: Martin R. Maxey, Alireza Yazdani.

Research Experience

Postdoctoral Research Associate, Oxford University

Oxford, UK January 2022 – January 2024

Analyse mathematical frameworks called integro-differential equations to model long-range interactions between cells during collective cell migration and pattern formation. Develop novel numerical algorithms for simulating their solutions. Apply Bayesian inference to identify model parameters from experimental and synthetic data. Collaborate with experimental biologists in Spain and the United States to explain their results with mathematical modelling.

D.Phil. Research, Mathematical Institute, Oxford University

Oxford, UK October 2018 – December 2021

Investigated mathematical models for collective cell migration within the contexts of embryonic development and tumour-induced angiogenesis (blood vessel formation). Demonstrated an equivalence between microscopic individual-based models (IBMs) and macroscopic population-level models for angiogenesis. Collaborated with theoreticians and experimentalists to create a new IBM for neural crest stem cell migration within a changing microenvironment. Identified dominant mechanisms for collective cell migration and guided *in vivo* experimental design.

Senior Undergraduate Thesis, Brown University

Providence, RI February 2017 – June 2018

Developed and simulated a mathematical model for blood clotting (thrombosis) in a two-dimensional vessel experiencing blood flow. This project aimed to help physicians better analyse the development of blood clots over long time periods by making simulations of their onset more efficient and accurate.

University of Michigan, Summer Undergraduate Research Fellow

Ann Arbor, MI May 2017 – August 2017

Conducted genetic and biochemical screens for blood clotting (thrombosis) under the supervision of Dr. Jordan Shavit, a hematologist/oncologist, in a zebrafish animal model. Assisted in the development of new methods for identifying genetic and biochemical modifiers of thrombosis.

Peer-reviewed Publications

Martinson W.D., Baker R.E., Byrne H.M., Davidson L.A., Kulesa P.M., Maini P.K. (2022, submitted). Dynamic fibronectin remodeling prevents collective cell jamming in a cell-based mathematical model. arXiv:2209.07794

Martinson W.D., Ninomiya H., Byrne H.M., Maini P.K. (2021). Comparative analysis of continuum angiogenesis models. *Journal of Mathematical Biology* 82 (21), online. DOI: 10.1007/s00285-021-01570-w

Martinson W.D., Byrne H.M., Maini P.K. (2020). Evaluating snail-trail frameworks for leader-follower behavior with agent-based modeling. *Physical Review E* 102 (6), 062417. DOI: 10.1103/PhysRevE.102.062417

Martinson W.D., Byrne H.M., Maini P.K. (2019). Multiscale modeling and simulation of traveling waves in biology: A review. *Rendiconti di Matematica e delle sue Applicazioni* 40 (7), 191-216.

Shea, K.G., **Martinson W.D.**, Cannamela P.C., Richmond C.G., Fabricant P.D., Anderson A.F., Polousky J.D., Ganley T. J. (2018). Variation in the medial patellofemoral ligament origin in the skeletally immature knee: An anatomic study. *The American journal of sports medicine*, 46 (2), 363-369. DOI: 10.1177/0363546517738002

Richmond C.G., Green D.W., Cannamela P.C., **Martinson W.D.**, Shea K.G. (2018). The distance between the hamstring grafts and the physis and apophysis of the proximal tibia – implications for pediatric ACL reconstruction and physeal arrest. *Journal of ISAKOS: Joint Disorders & Orthopaedic Sports Medicine*, 3 (6), 318-322. DOI: 10.1136/jisakos-2018-000222

Other Publications

Martinson W.D. (November 2022). “From sandcastles to economics and artificial intelligence: optimal transport through the years”. *The Oxford Scientist*, Michaelmas Term 2022 volume, pp. 28-29.

Martinson W.D. (March 2022). “Mathematical modelling for regenerative medicine: dream or reality?”. *The Oxford Scientist*, Hilary Term 2022 volume, pp. 26-27. <https://oxsci.org/mathematical-modelling-for-regenerative-medicine/>

Conferences and Talks

Joint Mathematics Meetings 2023 (Boston, MA, USA) January 2023
Invited talk: “Extracellular matrix remodeling by neural crest cells provides a robust signal for collective migration”.

2022 European Conference for Mathematical and Theoretical Biology (Heidelberg, Germany) September 2022
Invited mini-symposium talk: “Extracellular matrix remodelling by neural crest cells provides a robust signal for collective migration”. Co-organiser of two mini-symposia with Dr. Sara Bernardi (“Insights on collective migration using agent-based modeling”, “Non-local mathematical models for collective migration: insights from analytical methods”).

Mathematical Models for Biomedical Sciences Summer School (Lake Como, Italy) June 2022
Poster presentation: “Extracellular matrix remodelling by neural crest cells provides a robust signal for collective migration.”

Inference for Expensive Systems in Mathematical Biology Conference May 2022
Poster: “Extracellular matrix remodelling by neural crest cells provides a robust signal for collective migration.”

2022 British Applied Mathematics Colloquium April 2022
Talk: “Extracellular matrix remodelling by neural crest cells provides a robust signal for collective migration.”

2021 Society for Mathematical Biology Annual Meeting June 2021 (online)
Talk: “Extracellular matrix remodelling by neural crest cells provides a robust mechanism for collective migration”.

Micro-to-Macro Modelling in Developmental Biology October 2020 (online)
Internal online symposium hosted by José Carrillo of the University of Oxford Mathematical Institute. Talk: “Comparative analysis of discrete and continuum leader-follower models.”

2020 Society for Mathematical Biology Annual Meeting August 2020 (online)
Poster: “Comparative analysis of continuum angiogenesis models.”

9th Annual Integrated Mathematical Oncology Workshop November 2019
Poster: “Traveling wave analysis of angiogenesis models and its implications.”

Philip Maini’s 60th Birthday Workshop September 2019
Poster: “Revisiting a classical continuum model of angiogenesis: Novel insights using *in silico* data.”

2019 Society for Mathematical Biology Annual Meeting July 2019
Poster: “Revisiting a classical continuum model of angiogenesis: Novel insights using *in silico* data.”

University of Michigan Cardiovascular Center Undergraduate Summer Symposium August 2017
Talk: “Establishing zebrafish as a model to screen genetic factors of hormone-induced thrombosis.”

Awards, Fellowships, and Honors

Associate Fellow, Higher Education Academy October 2021 – Present
Accredited by the Higher Education Academy of the U.K. as meeting professional standards for the teaching of undergraduate students. Learned and applied evidence-based approaches to improve my teaching practices and lesson plans for first-year mathematics students.

UCR Contributed Talk Award for Cell and Developmental Biology Awarded June 2021
Awarded at the 2021 Society for Mathematical Biology Annual Meeting in recognition of outstanding presentation.

University of Oxford Mathematical Institute Scholarship Awarded September 2020
Awarded a 1.5-year full scholarship with stipend by the University of Oxford Mathematical Institute to conclude my studies at the university, in recognition of my achievements as a scholar within the department.

Keasbey Fellowship Awarded December 2017
Awarded a 2-year full scholarship with stipend by the Keasbey Memorial Foundation to pursue graduate study at the University of Oxford, in recognition of my past achievements as a scholar and of my future leadership potential.

University of Michigan Cardiovascular Center Undergraduate Research Fellowship Awarded March 2017
Awarded a three-month fully paid opportunity to conduct research with faculty members at the University of Michigan Cardiovascular Center (FCVC), in recognition of my interest and potential career in biomedical research.

Phi Beta Kappa March 2017 – Present
Elected to the Rhode Island Alpha Chapter of Phi Beta Kappa in March 2017 during my junior year by my peers in recognition of outstanding academic achievement in studies spanning the liberal arts and sciences.

Associate Member, Sigma Xi April 2018 – Present
Elected to the Brown University chapter of the Sigma Xi scientific research honor society in recognition of sustained commitment to and excellence in scientific research during my undergraduate years.

Teaching Experience

Oxford University Mathematical Institute Tutor Oxford, UK October 2022 – Present
Lead biweekly problem classes for the following fourth year/graduate module: Perturbation Methods. Work up to 6 hours per week during term time.

Balliol College Graduate Teaching Assistant Oxford, UK October 2020 – June 2022
Assist senior fellows in the teaching and assessment of weekly problem classes for the following first-year mathematics modules: Probability, Introductory Calculus, Multivariable Calculus, and Statistics & Data Analysis. Work up to 20 hours per week during term time.

Oxford University Teaching Assistant Oxford, UK October 2018 – March 2020
Assessed student problem sheets and co-taught biweekly problem classes for the following third-year courses: Further Mathematical Biology, Numerical Solutions of Differential Equations I, Nonlinear Systems, and Mathematical Modelling. Worked up to 20 hours per week during term time.

Balliol College Graduate Mentor Oxford, UK November 2019 – June 2020
Led one-on-one tutoring sessions with a student in Balliol College for the following third-year classes in the Mathematical Institute: Further Mathematical Biology, Applied PDEs, and Nonlinear Systems. Worked 5 hours per week during term time.

Professional Society Memberships

Society for Mathematical Biology March 2019 – Present
Society for Industrial and Applied Mathematics October 2018 – Present
Phi Beta Kappa March 2017 – Present
Sigma Xi May 2018 – Present

Leadership Experiences

Student Representative, Consultative Committee for Graduate Students October 2019 – October 2022
Communicated with the administration of the Mathematical Institute to address issues affecting graduate students, such as funding or teaching. Designed and published a poster series at the Oxford University Mathematical Institute to highlight the historical contributions of women and non-binary mathematicians.

Balliol College MCR Committee, IT Officer June 2019 – June 2021
Member of the governing body for graduate students in Balliol College. Redesigned the Middle Common Room (MCR) website to improve accessibility for students. Managed the MCR website and mailing lists for graduate students.

Skills and Other Interests

Language: Native in English. Fluent in French.

Technical Skills: Proficient in MATLAB, Python, Julia, C++, Latex, Git/GitHub, Microsoft Office (Word, Excel, and Powerpoint). Experience in Maple and Mathematica.

Activities: Triathlon, swimming, running, piano

Interests: American history, French history, classic movies, history of science