

DENIS PATTERSON



High Meadows Environmental Institute,
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Research Interests

Applied Analysis Functional differential equations, stochastic processes & dynamical systems

Mathematical Biology Ecology (vegetation models), biological development & epidemiology

Academic Career

- Nov. 2020–present **Postdoctoral Research Associate**, Princeton University
High Meadows Environmental Institute
Mentor: Prof. Simon A. Levin
- July 2018–Oct. 2020 **Postdoctoral Research Associate**, Brandeis University
Department of Mathematics
Mentor: Prof. Jonathan D. Touboul
- May 2017–May 2018 **Assistant Professor**, Dublin City University
School of Mathematical Sciences
- Oct. 2013–Apr. 2018 **PhD in Applied Mathematics**, Dublin City University
Thesis: *Asymptotic Growth in Nonlinear Stochastic and Deterministic
Functional Differential Equations*
Advisor: Prof. John A. D. Appleby
- 2009–2013 **BSc in Actuarial Mathematics**, Dublin City University
First class honours – graduated first in class

Publications

† alphabetical authorship, * joint first authors

Journal Articles

- [J11] J. Feng*, W. H. Hsu*, **D. D. Patterson**, C. S. Tseng, Z. H. Zhuang, H. W. Hsin, Y.T. Huang, A. Faedo, J. L. Rubenstein, J. D. Touboul and S.J. Chou, *COUP-TFI specifies the medial entorhinal cortex identity and induces differential cell adhesion to determine the integrity of its boundary with neocortex*, Science Advances, Vol. 7, No. 27 (2021), eabf6808.
- [J10] L. Xu, **D. D. Patterson**, A. C. Staver, S. A. Levin, J. Wang, *Unifying deterministic and stochastic ecological dynamics via a landscape-flux approach*, Proceedings of the National Academy of Sciences, Vol. 118, No. 24 (2021), e2103779118.
- [J9] J. A. D. Appleby and **D. D. Patterson**[†], *Growth and fluctuation in perturbed nonlinear Volterra equations*, Applied Mathematics and Computation, Vol. 396, (2021) 125938.
- [J8] **D. D. Patterson**, S. A. Levin, A. C. Staver, J. D. Touboul, *Probabilistic foundations of spatial mean-field models in ecology and applications*, SIAM Journal on Applied Dynamical Systems, Vol. 19, No. 4 (2020), 2682–2719.
- [J7] J. A. D. Appleby and **D. D. Patterson**[†], *Blow-up and superexponential growth in superlinear Volterra equations*, Discrete & Continuous Dynamical Systems Series A, Vol. 38, No. 8 (2018), 3993–4017.

- [J6] J. A. D. Appleby and **D. D. Patterson**[†], *Growth rates of sublinear functional and Volterra differential equations*, SIAM Journal on Mathematical Analysis, Vol. 50, No. 2 (2018), 2086–2110.
- [J5] J. A. D. Appleby and **D. D. Patterson**[†], *Memory dependent growth in sublinear Volterra differential equations*, Journal of Integral Equations and Applications, Vol. 29, No. 4 (2017), 531–584.
- [J4] J. A. D. Appleby and **D. D. Patterson**[†], *Large fluctuations and growth rates of linear Volterra summation equations*, Journal of Difference Equations and Applications, Vol. 23, No. 6 (2017), 1047–1080.
- [J3] J. A. D. Appleby and **D. D. Patterson**[†], *Growth rates of solutions of superlinear ordinary differential equations*, Applied Mathematics Letters, Vol. 71 (2017), 30–37.
- [J2] J. A. D. Appleby and **D. D. Patterson**[†], *Hartman–Wintner growth results for sublinear functional differential equations*, Electronic Journal of Differential Equations, Vol. 2017, No. 21 (2017), 1–45.
- [J1] J. A. D. Appleby and **D. D. Patterson**[†], *On the admissibility of unboundedness properties of forced deterministic and stochastic sublinear Volterra summation equations*, Electronic Journal of Qualitative Theory of Differential Equations, No. 63 (2016), 1–44.

Conference Papers

- [C3] J. A. D. Appleby and **D. D. Patterson**[†], *Classification of convergence rates of solutions of perturbed ordinary differential equations with regularly varying nonlinearity*, Electronic Journal of Qualitative Theory of Differential Equations, Proceedings of the 10th Colloquium on the Qualitative Theory of Differential Equations, No. 3 (2016), 1–38.
- [C2] J. A. D. Appleby and **D. D. Patterson**[†], *Subexponential growth rates in functional differential equations*, Discrete and Continuous Dynamical Systems Supplement (2015), 56–65.
- [C1] J. A. D. Appleby and **D. D. Patterson**[†], *On necessary and sufficient conditions for preserving convergence rates to equilibrium in deterministically and stochastically perturbed differential equations with regularly varying nonlinearity*, Recent Advances in Delay Differential and Difference Equations, Springer Proceedings in Mathematics & Statistics 94 (2014), 1–85.

Academic Honours & Awards

2017	Outstanding Graduate Researcher Award , Dublin City University
2013–2017	Government of Ireland Postgraduate Scholarship , Irish Research Council
2013	Student Actuary Prize , Society of Actuaries in Ireland
2012	Hamilton Award for Mathematics , Royal Irish Academy

Academic Talks

* postponed or canceled due to the Covid-19 pandemic

Jan. 2022	Joint Mathematics Meeting , Seattle, USA (forthcoming, invited)
Nov. 2021	Applied & Computational Math Seminar , Princeton University, USA (invited)
June 2021	Society for Mathematical Biology Annual Meeting , online (CDEV Contributed Talk Prize)
May 2021	SIAM Conference on Applications of Dynamical Systems , online
Apr. 2021	Fourth Northeast Regional Conference on Complex Systems , online
Aug. 2020	Swartz Foundation Meeting , Seattle, USA* (invited)
Mar. 2020	SIAM Life Sciences Conference , California, USA*
Mar. 2020	SIAM Mathematics of Planet Earth , California, USA*
Mar. 2020	AMS Eastern Sectional Meeting , Tufts University, USA* (invited)

Oct. 2019	International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems (ICMA) VII , Arizona State University, USA
Sep. 2019	Dynamical Systems Seminar , Boston University, USA (invited)
May. 2019	SIAM Conference on Applications of Dynamical Systems , Snowbird, Utah, USA
Apr. 2019	Mathematics and Statistics Seminar , University of Limerick, Ireland (invited)
Mar. 2019	Mathematics Everytopic Seminar , Brandeis University, USA (invited)
July 2017	Equadiff 2017 , Slovak University of Technology in Bratislava, Slovakia
May 2017	SIAM UK and Ireland Student Chapter Conference , National University of Ireland Galway (Best Talk Prize)
Apr. 2017	British Applied Mathematics Colloquium , University of Surrey, UK
Mar. 2017	Mathematics and Statistics Seminar , University of Limerick, Ireland (invited)
July 2016	11th AIMS Conference on Dynamical Systems, Differential Equations and Applications , Orlando, Florida, USA
July 2015	International Conference on Difference Equations and Applications 2015 , Bialystok University of Technology, Poland
July 2015	10th Colloquium on the Qualitative Theory of Differential Equations , Bolyai Institute, University of Szeged, Hungary
Dec. 2014	Irish SIAM Student Chapter Conference , National University of Ireland Galway
July 2014	10th AIMS Conference on Dynamical Systems, Differential Equations and Applications , Universidad Autonoma de Madrid, Spain (invited)

Teaching Experience

Courses (primary instructor)

Summer 2020	Differential Equations, Brandeis University (fully online)
Fall 2019	Probability, Brandeis University
Spring 2019	Multivariate Calculus, Brandeis University
Winter 2017	Simulation for Finance (graduate course), Dublin City University <i>Theory and simulation of stochastic processes with financial applications</i>

Undergraduate Research Projects supervised

Fall 2021	Oliver Liang (Applied Math, Brandeis), “Collective dynamics of mobile particles”
Fall 2020	Jingman Li & Yuning Liu (Applied Math, Brandeis), “Network epidemic models”
Spring 2020	Hange Zhu* (Applied Math, Brandeis), “Pattern formation in heterogeneous domains”
Summer 2019	Hanyu Song (Applied Math, Brandeis), “Mathematical models of somitogenesis”

*awarded the Arnold Shapiro Prize in Mathematics for her research and coursework

Programming/Software

General	C++, Python, R, Hive, SQL, VBA
Math specific	MATLAB, Mathematica, XPP/Auto, Matcont, FreeFEM++, GeoGebra, L ^A T _E X

Professional Activities & Affiliations

Recent Workshops/Short Courses

- Selected participant in the AMS Mathematical Research Community “Dynamics of Infectious Diseases” (2020-2021)
- AMS short course on Mathematical and Computational Methods for Complex Social Systems (Jan. 2021)
- Banff workshop on the Mathematics of Human Environmental Systems (Jan. 2021)
- Hausdorff School on Diffusive Systems: Pattern Formation, Bifurcations, and Biological Applications (Apr. 2021)

Service & Activities

- Postdoctoral representative on the *Diversity & Inclusion Climate Committee* and *Outreach Subcommittee* member (Princeton University), Fall 2021
- Reviewer for:
 - *Applied Mathematics and Computation*,
 - *Applied Mathematical Modelling*,
 - *Bulletin of Mathematical Biology*,
 - *Chaos: An Interdisciplinary Journal of Nonlinear Science*,
 - *Electronic Journal of the Qualitative Theory of Differential Equations*,
 - *Journal of Difference Equations and Applications*,
 - *Mathematical Biosciences*
- Minisymposium organizer: “Stochastic Networks in Neuroscience and Ecology” at the SIAM Conference on Applications of Dynamical Systems (DS21)
- Organized the Brandeis Mathematical Biology Seminar series (2018–2019)
- Organized the DCU Mathematical Sciences Postgraduate Seminar series (2014–2017)

Outreach

- Speaker for the “MRSEC Pizza Talks” science outreach program at Waltham High School (2020)
- Judge for SCUDEM 2020 and 2021 (high school/undergraduate mathematical modeling competition)
- University coordinator for the BITE/DCU Voluntary Math Tuition programme 2017/2018 (math outreach to disadvantaged schools to promote university access through tutoring and mentorship)
- DCU Access Service tutor 2015/2016 (academic support for disadvantaged university students)

Professional Memberships

- American Mathematical Society (AMS)
- Society for Industrial and Applied Mathematics (SIAM)
- Society for Mathematical Biology (SMB)
- American Association for the Advancement of Science (AAAS)