Richard Creswell

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Oxford, England

Research Interests

- Statistical inference for challenging time series models.
- Epidemiology and computational biology of infectious diseases.
- Efficient inference for applied Bayesian nonparametrics.

Education

Doctor of Philosophy, **Computer Science** (in progress; anticipated Q2, 2023)
University of Oxford, Oxford, England

Master of Science, **Applied Mathematics**
Columbia University, New York, New York

Bachelor of Science, **Applied Physics *summa cum laude***
Columbia University, New York, New York

Research Positions

Doctoral Student 2019 Oct.–present
University of Oxford, Oxford, England

- Supervisor: Professor David Gavaghan.
- Co-supervisors: Ben Lambert, Simon Tavener, Martin Robinson, Chon Lok Lei.
- Statistical inference for time series models, particularly differential equation models arising in computational biology, and deterministic and stochastic models of the spread of infectious diseases.

Research Associate 2017 July–2019 Sep.
Massachusetts Host-Microbiome Center, Brigham & Women's Hospital,
Harvard Medical School, Boston, Massachusetts

- Supervisor: Professor Georg Gerber.
- Machine learning and Bayesian nonparametric models for time series of the gut microbiome.
- Bioinformatic analysis of metagenomic data.

Undergraduate Research Assistant 2014 May–2015 Jan.
Columbia University, New York, New York

- Supervisor: Professor Irving Herman.
- Time-dependent properties of luminescent nanoparticles passivated by graphene.

Teaching Experience

Teaching Demonstrator 2020 Oct.–present
University of Oxford, Oxford, England

- I worked as a teaching assistant on the following modules:
  - SABS Software engineering (2020–2021, 2021–2022, 2022–2023).
  - SABS Mathematical modelling (Michaelmas 2020).
  - SABS Scientific computing (Hilary 2021).

- SABS Simulated data and reproducible data analysis (Summer 2021).
- UNIQ+ Machine Learning and Bayesian Inference training session (Summer 2021).

- Two of the years that I worked on the software engineering module, I led the students in extending their open source software assignments into publishable research projects.

Mentorship 2021 Apr.–present
University of Oxford, Oxford, England

- Co-supervisor for the following postgraduate students in Professor Gavaghan's research group:
  - Kit Gallagher (rotation, 2022).
  - Katherine Shepherd (rotation and PhD, 2022–).
  - Ioana Bouros (rotation and PhD, 2021–).

Other Experience

Statistical Consultant 2022 Aug.–
Oxford University Innovation UKHSA COVID-19 Testing Evaluation

- I worked as a statistical consultant for Oxford University Innovation (OUI) in a collaboration with Ernst & Young (EY) to conduct an impartial retrospective analysis of the COVID-19 testing program in England, commissioned by the UK Health Security Agency (UKHSA).
- Using techniques from causal inference and economic-epidemiological modelling, we evaluated the effects of testing activities on the transmission of COVID-19 from March 2020 to February 2022 and the cost-effectiveness of each aspect of the testing program.

Co-founder of Oxford Statistical Epidemiology Reading Group 2022 Oct.–

- I co-founded and organized the Oxford Statistical Epidemiology Reading Group, a biweekly journal club covering epidemiology, statistics, modelling, and related fields.

CoMo-DTC COVID-19 Collaboration Organizing Team 2020 Oct.–2022 Mar.

- I joined the organizing team for the collaboration between Oxford's and Cornell's COVID-19 International Modelling Consortium (CoMo) and the Doctoral Training Centre (DTC) at Oxford.
- Our work included investigating the development of high-quality software for CoMo's model of COVID-19 transmission, and implementing a hierarchy of compartmental transmission models for purposes of model comparison.
- A particular focus of our work was developing software, a web app, and pedagogical notebooks to help introduce newcomers to the field of epidemiological modelling.

Bioinference Conference Organizing Committee 2021 Sep.–

- I worked on the organizing committees for the conferences "Inference for Expensive Systems in Mathematical Biology" held at Oxford on May 23–24, 2022, and its successor to be held at Oxford in Summer 2023.
- To fund the conferences, the committee raised funds from from the London Mathematical Society, the Heilbronn Institute, and the Oxford Computer Science department.

Co-founder of Shakespeare Appreciaton Society 2022 Oct.–

- I assisted in the founding and operation of the Shakespeare Society at the University of Munich, which runs regular virtual screenings and discussions of Shakespeare's plays and other relevant literature.

Skills

Programming: Python, C, C++, R, MATLAB, Stan.
Other computing: MPI, Unix/Linux, SQL, Git, LSF, Slurm, AWS EC2, object-oriented programming, software testing, continuous integration.
Design and web: LaTeX, Blender, Illustrator, Inkscape, matplotlib, Plotly Dash, Flask.
Other: Office for National Statistics (ONS) Full accredited researcher.

Honors, Awards, and Funding

- EPSRC Doctoral Prize (2022)—**£27,221** funding to continue research at Oxford after finishing my DPhil.
- Invited one-week research visit to Colorado State University, Fort Collins (2022).
- Computer Science Scholarship (Oxford Department of Computer Science, 2019).
- EPSRC Doctoral Training Partnership (2019).
- Applied Physics Faculty Award (Columbia University, 2016).
- C. Prescott Davis Scholar (Columbia University, 2016).

References

- David Gavaghan (Professor of Computational Biology, University of Oxford).
  david.gavaghan@dtc.ox.ac.uk
- Ben Lambert (Senior Lecturer of Mathematics, University of Exeter).
  ben.c.lambert@gmail.com
- Simon Tavener (Professor of Mathematics, Colorado State University).
  tavener@math.colostate.edu

Publications and Presentations

Journal papers

- B. Lambert, C. L. Lei, M. Robinson, M. Clerx, **R. Creswell,** S. Ghosh, S. Tavener, and D. J. Gavaghan: "The impact of autocorrelated measurement processes on inference for ordinary differential equation models," *Journal of the Royal Society Interface* (2023).
- **R. Creswell,** M. Robinson, D. Gavaghan, K. V. Parag, C. L. Lei, and B. Lambert: "A Bayesian nonparametric method for detecting rapid changes in disease transmission," *Journal of Theoretical Biology*, vol. 558 (2023).
- **R. Creswell,**† D. Augustin,† I. Bouros,† H. J. Farm,† S. Miao,† A. Ahern,† M. Robinson, A. Lemenuel-Diot, D. Gavaghan, B. Lambert, and R. N. Thompson: "Heterogeneity in the onwards transmission risk between local and imported cases affects practical estimates of the time-dependent reproduction number," *Philosophical Transactions of the Royal Society, A,* vol. 380 (2022).
- S. A. van der Vegt,† L. Dai,† I. Bouros,† H. J. Farm,† **R. Creswell,**† O. Dimdore-Miles,† I. Cazimoglu, S. Bajaj, L. Hopkins, D. Seiferth, F. Cooper, C. L. Lei, D. Gavaghan, and B. Lambert: "Learning transmission dynamics modelling of COVID-19 using comomodels," *Mathematical Biosciences,* vol. 349 (2022).
- **R. Creswell,**† J. Tan,† J. W. Leff, B. Brooks, M. A. Mahowald, R. Thieroff-Ekerdt, and G. K. Gerber: "High resolution temporal profiling of the human gut microbiome reveals consistent and cascading alterations in response to dietary glycans," *Genome Medicine,* vol. 12 (2020).

- E. Bogart, **R. Creswell,** and G. K. Gerber: "MITRE: inferring features from microbiota time-series data linked to host status," *Genome Biology,* vol. 20 (2019).
- D. Zhang, D. Z.-R. Wang, **R. Creswell,** C. Lu, J. Liou, and I. P. Herman: "Passivation of CdSe Quantum Dots by Graphene and MoS_2 Monolayer Encapsulation," *Chemistry of Materials,* vol. 27, no. 14, pp. 5032–5039 (2015).

(†= joint first authorship.)

Conference and workshop papers

- **R. Creswell,** M. K. Gibson, T. E. Gibson, J. W. Leff, and G. K. Gerber: "A multi-level Bayesian nonparametric model of longitudinal responses of the human microbiota to dietary interventions," *ICML and IJCAI Workshop on Computational Biology*, Stockholm, Sweden (2018).

Preprints

- R. Naidoo, B. Andersen-Waine, P. Dahal, S. Dickinson, B. Lambert, M. C. Mills, C. Molyneux, E. Rowe, S. Pinto-Duschinsky, K. Stepniewska, R. Shretta, M. Voysey, M. Wanat, G. Yenidogan, L. J. White, **and the EY-Oxford Health Analytics Consortium:** "A multistage mixed-methods evaluation of the UKHSA testing response during the COVID-19 pandemic in England," medRxiv (2022).
- K. Gallagher,† I. Bouros,† N. Fan,† E. Hayman,† L. Heirene,† P. Lamirande,† A. Lemenuel-Diot, B. Lambert, D. J. Gavaghan, **and R. Creswell:** "Epidemiological Agent-Based Modelling Software (Epiabm)," arXiv (2022).
- **R. Creswell,** B. Lambert, C. L. Lei, M. Robinson, and D. Gavaghan: "Using flexible noise models to avoid noise model misspecification in inference of differential equation time series models," arXiv:1410.5093 (2020).

Talks

- Inference for Expensive Systems in Mathematical Biology, Oxford, England (2022).
- Microbiome Mini-Symposium (on the event of the visit of the Wageningen University Microbiology Laboratory to Harvard Medical School), Boston, Massachusetts (2019).
- Forum for Advanced Biomedical Computation, Boston, Massachusetts (2018).
- MIT-Harvard Microbiome Symposium, Cambridge, Massachusetts (2018).

Poster presentations

- The Royal Society, Modelling the Covid-19 Pandemic: Achievements and Lessons, London, England (2022).
- Brigham & Women's Hospital Pathology Research Celebration, Boston, USA (2019).
- MIT-Harvard Microbiome Symposium, Cambridge, USA (2019).
- ICML and IJCAI Workshop on Computational Biology, Stockholm, Sweden (2018).
- Harvard Medical School Pathology Research Retreat, Boston, USA (2018).
- MIT-Harvard Microbiome Symposium, Cambridge, USA (2018).
- Computational Aspects of Biological Information, Microsoft Research New England, Cambridge, USA (2018).