

William Dorrell

Ex-physicist doing theory for neuroscience (and machine learning)

06/2018

BA, Physics, 1st - 80%

Emmanuel College, Cambridge

RESEARCH

PhD, Gatsby Unit, Advisors: Tim Behrens & Peter Latham

09/2020 - Present

i) Normative theories of neural representations, especially internal models. Developed theory of 'actionable' representations, applied to grid cells. Studied disentangled representations, applying ideas to frontal cortex, led to experiments. *Talks: Ganguli, Pehlevan, Pouget, Fiete, Parietal labs; ELLIS Meeting; UCL NeuroAI*

ii) Developing and using tools to understand circuits via induced inductive bias. Designed tool to flexibly extract inductive bias. *M Yuffa: [neuromatch](#) & Simons.* Normatively interpret connectivity of cerebellar-like circuits. *Talk: Schaefer Lab.*

iii) Bayesian & Point Process analysis to discover, with collaborators, replay in neural recordings from Dorsolateral Striatum. *Talk: Linderman Lab.*

Stanford University

01/2023 – 03/2023

With Chelsea Finn: internal models in RL agents & structure in representations.

Okinawa Institute of Science and Technology

02/2020 – 08/2020

With Erik de Schutter:
Designed a biologically plausible hierarchical reinforcement learning agent.

Harvard University

04/2019 – 12/2019

With Cengiz Pehlevan: Modelling & analysis demonstrated structured connections in olfactory cortex using Venkatesh Murthy's data. *Poster: COSYNE 2020.*

08/2018 – 03/2019

With Jennifer Hoffman: replicated van der Waals behaviour in acoustic metamaterials, led to variety of ongoing projects. *Talk: APS March Meeting 2019.*

AWARDS

2022/23

Bogue Fellowship - £5,350 for a research stay at Stanford

2018/19

Herchel Smith Scholarship - \$80,000 to attend Harvard for a year

2017

Davies Senior Scholarship & Mainhood Prize

2017

Summer research fellowship – Harvard PRISE programme

2016

Davies Scholarship & Mainhood Prize – for university exam performance

2015

British Chemistry Olympiad Roentgenium Award – highest performance

Teaching

09/2021 – 09/2022	Mentored undergraduate through Simons program, Maria Yuffa, for a year, teaching Neuro and ML, and pursuing research together that was published.
09/2021 – 04/2022	Teaching Fellow: Machine Learning, Theoretical & Systems Neuro for PhD students Crafted new course to give requisites for many backgrounds (cell bio to maths)
09/2019 – 12/2019	Teaching Fellow, Applied Maths: Neural Computation for 20 graduate students
10/2016 – 05/2017	Volunteer teacher in local Cambridge School for GCSE Science
06/2016 – 08/2016	Private tutor for key stage 3 science in Worcester, UK.

Other

10/2021	Attendent, CIMER Entering Mentoring Training, a mentorship training programme.
01/2020	Attendant, Imbizo Computational Neuroscience Summer School.
06/2019 – 08/2019	Proctor, Harvard University Summer Research Program.
09/2017 – 06/2018	Founded and ran a weekly discussion club: the Big Thinks' Club
Computer	Python, MATLAB, some Julia, some app & website development
Contributor	Minor contribution to openly available Point Process Model of Neural Sequences
Languages	English (native), French (B2)
Reviewer	Neurocomputing (2022), Neureps workshop at Neurips (2022)

PUBLICATIONS

- “Actionable Neural Representations: Grid Cells from Minimal Constraints”,
W Dorrell, P Latham, T Behrens, J Whittington, [Arxiv](#), ICLR (2023).
- “Meta-Learning the Inductive Biases of Simple Neural Circuits”,
W Dorrell, M Yuffa, P Latham, [Arxiv](#), (2022).
- “Disentangling with Biological Constraints: A Theory of Functional Cell Types”,
J Whittington, **W Dorrell**, S Ganguli, T Behrens, [Arxiv](#), ICLR (2023).
- “Bilateral Alignment of receptive fields in the olfactory cortex points to non-random connectivity”,
J Grimaud, **W Dorrell**, C Pehlevan, V Murthy, [biorXiv:2020.02.24.960922](#) (2020).
- “A Differential Hebbian Framework for Biologically-Plausible Motor Control”.
S Verduzco-Flores, **W Dorrell**, E De Schutter, [Arxiv](#), [Neural Networks](#), (2022).
- “Simulating twistrionics in acoustic metamaterials”,
S. Gardezi, H. Pirie, S. Carr, **W. Dorrell**, J. Hoffman, [Arxiv](#), [2D Materials](#), (2021).
- “van der Waals metamaterials”,
W Dorrell, H. Pirie, S. Gardezi, N. Drucker, J. Hoffman, [Arxiv](#), [Phys. Rev. B](#), (2020).