Lea Duncker, PhD

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Wu Tsai Neurosciences Institute, Stanford University
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EDUCATION

Gatsby Computational Neuroscience Unit, UCL — London, UK
Ph.D. in Theoretical Neuroscience — 09/2016–03/2021
Thesis: Dynamical structure in neural population activity
Thesis Advisor: Maneesh Sahani

University College London — London, UK
MSc in Computational Statistics and Machine Learning, Distinction — 09/2014–09/2015
Thesis: Spectral Methods for Mixtures of Dynamics
Thesis Advisor: Maneesh Sahani

University College London — London, UK
BSc in Natural Sciences, First Class Honours — 09/2011–06/2014
Thesis: Dopamine and the Vigour of Instrumental Responding
Thesis Advisor: Peter Dayan

PUBLICATIONS

Pre-prints

– DJ O'Shea *, **L Duncker***, W Goo, X Sun, S Vyas, I Diester, C Ramakrishnan, K Deisseroth, M Sahani**, KV Shenoy**. Direct neural perturbations reveal a dynamical mechanism for robust computation. *in prep.*

– **L Duncker**, KM Ruda, GD Field, JW Pillow. Scalable variational inference for low-rank spatio-temporal receptive fields. bioRxiv. 2022.

Invited journal articles

– LN Driscoll, **L Duncker**, CD Harvey. Representational Drift: Emerging Theories for Continual Learning and Experimental Future Directions. Current Opinion in Neurobiology. 2022.

– **L Duncker**, M Sahani. Dynamics on the manifold: Identifying computational dynamical activity from neural population recordings. Current Opinion in Neurobiology. 2021.

Conference Proceedings

– JC Costacurta, **L Duncker** , B Sheffer, AH Williams, W Gillis, C Weinreb, JE Markowitz, SR Datta, SW Linderman. Distinguishing discrete and continuous behavioral variability using warped autoregressive HMMs. 36th Conference on Advances in Neural Information Processing Systems (NeurIPS). New Orleans, 2022.

– **L Duncker***, LN Driscoll*, KV Shenoy, M Sahani**, D Sussillo**. Organizing recurrent network dynamics by task-computation to enable continual learning. 34th Conference on Advances in Neural Information Processing Systems (NeurIPS). Vancouver, 2020.

– **L Duncker**, G Bohner, J Boussard, M Sahani. Learning interpretable continuous-time models of latent stochastic dynamical systems. 36th International Conference on Machine Learning (ICML). Long Beach, 2019.

- **L Duncker**, M Sahani. Temporal alignment and latent Gaussian process factor inference in population spike trains. 32nd Conference on Advances in Neural Information Processing Systems (NeurIPS). Montreal, 2018.

Selected Conference Presentations

- **L Duncker***, DJ O'Shea*, M Sahani , KV Shenoy. The population dynamics of perturbations in motor cortex. Wu Tsai Neurosciences Institute Retreat. Santa Cruz, 2022. (talk)
- DJ O'Shea*, **L Duncker***, S Vyas, X Sun, M Sahani , KV Shenoy. Electrical but not optogenetic stimulation drives nonlinear contraction of neural states. Computational and Systems Neuroscience (Cosyne). Lisbon, 2022. (poster)
- **L Duncker**, DJ O'Shea, KV Shenoy, M Sahani. A dynamical model with E/I balance explains robustness to optogenetic stimulation in motor cortex. Computational and Systems Neuroscience (Cosyne). Denver, 2020. (poster)
- **L Duncker**, G Bohner, J Boussard, M Sahani. Inferring interpretable nonlinear stochastic dynamics from population spike trains. Computational and Systems Neuroscience (Cosyne). Lisbon, 2019. (poster)
- **L Duncker**, M Sahani. Disentangling neural population variability using time-warped point-process GPFA. Computational and Systems Neuroscience (Cosyne). Denver, 2018. (poster)
- **L Duncker**, DJ O'Shea, W Goo, KV Shenoy, M Sahani. Low-rank non-stationary population dynamics can account for robustness to optogenetic stimulation. Computational and Systems Neuroscience (Cosyne). Salt Lake City, 2017. (talk)

RESEARCH EXPERIENCE

Stanford University	Stanford, CA, USA
Research Associate, Howard Hughes Medical Institutes	05/2021–present
Co-Advisors: Krishna Shenoy and Scott Linderman	

Princeton University	Princeton, NJ, USA
Research Specialist, Princeton Neuroscience Institute	01/2016–09/2016
Advisor: Jonathan Pillow	

UCL Ear Institute	London, UK
Undergraduate Research Intern, Action on Hearingloss UK Studentship	01/2013–09/2013
Advisor: Nicolas Lesica	

Max Planck Institute for Cognitive and Brain Sciences	Leipzig, Germany
Undergraduate Research Intern	01/2012–09/2012
Advisor: Joshua Grant	

SELECTED INVITED TALKS

- Direct neural perturbations reveal a dynamical mechanism for robust computation
  Zuckerman Institute, Columbia University. Invited Seminar. — New York, 2022
- Direct neural perturbations reveal a dynamical mechanism for robust computation
  Sainsbury Wellcome Center, University College London. Invited Seminar. — London, 2022
- The population dynamics of robustness to optogenetic stimulation in motor cortex
  COSYNE Conference Workshop talk — Lisbon, 2022
- Organizing recurrent network dynamics for multi-task computation
  Bernstein Conference Workshop talk — Berlin, 2021

- The dynamics of robustness in motor cortex
  Biomedical Engineering, Northwestern University. Invited Seminar.   Chicago, 2021
- Adding biological constraints to state space models can explain robustness to optogenetic stimulation in motor cortex
  COSYNE Conference Workshop talk   Breckenridge, 2020
- Inferring interpretable nonlinear stochastic dynamics from population spike trains
  Max Planck UCL Centre for Computational Psychiatry and Ageing Research. Invited Seminar.   London, 2019
- Inferring variability in timing and computation from population spike trains
  Society for Neuroscience (SfN) Minisymposium.   Chicago, 2019
- Inferring interpretable nonlinear stochastic dynamics from population spike trains
  Gatsby Tri-Centre Meeting   London, 2019
- Population dynamics as an account for robustness to optogenetic stimulation
  Bernstein Conference Workshop talk   Berlin, 2018
- Gaussian Process Methods for Manifold Discovery
  Simons Foundation Workshop on Manifold Discovery   New York, 2018

Teaching & Mentorship

- **Teaching Assistant** at Cold Spring Harbor Laboratory   July 2020
  Computational Neuroscience: Vision
- **Teaching Assistant** at Marine Biological Laboratory   August 2021
  Methods in Computational Neuroscience
- **Undergraduate thesis co-advisor** at Gatsby Computational Neuroscience Unit, UCL   2019–2020
  Harvey Scriven, now Investment Banking Associate at Lazard
- **Master's thesis co-advisor** at Gatsby Computational Neuroscience Unit, UCL   2019
  Francois-Xavier Aubet, now at Amazon Machine Learning research
- **Internship co-advisor** at Gatsby Computational Neuroscience Unit, UCL   2019
  Julien Boussard, now Ph.D. student at Columbia University
- **Teaching Assistant** at Cold Spring Harbor Laboratory   July 2018
  Computational Neuroscience: Vision
- **Teaching Assistant**   July 2019
  Machine Learning Summer School
- **Teaching Assistant** at University College London   2017–2018
  COMPGI18: Probabilistic and Unsupervised Learning (post-graduate, Computer Science)
  COMPGI16: Approximate Inference and Learning in Probabilistic Models (post-graduate, Computer Science)
  Systems & Theoretical Neuroscience (post-graduate, Sainsbury Wellcome Centre & Gatsby Unit)

Courses and Workshops

- **Workshop on Advanced Neural Data Analysis** at Zuckerman Institute, Columbia University   August 2019
- **Computational Neuroscience: Vision** at Cold Spring Harbor Laboratory   July 2016

Grants, Honors and Awards

- **Simons Collaboration on the Global Brain Transition to Independence Award**   2022
  $495,000 award received in support of establishing future independent research group
- **Gatsby Foundation PhD Studentship**   2016–2021
  Awarded in support of graduate studies at the Gatsby Computational Neuroscience Unit, UCL
- **ICML Travel Award**   2019

$1,300 grant awarded in support of conference travel

- **NeurIPS Travel Award** 2018
  $1,000 grant awarded in support of conference travel
- **COSYNE Travel Award** 2017, 2018
  $1,000 grant awarded in support of conference travel
- **Dean's List for Academic Excellence, Engineering Faculty** 2015
  In recognition of outstanding academic achievements at UCL
- **UCL Alumni Scholarship** 2014
  £10,000 scholarship awarded in support of postgraduate study at UCL
- **Dean's List for Academic Excellence, MAPS Faculty** 2014
  In recognition of outstanding academic achievements at UCL
- **Natural Sciences Sessional Prize** 2014
  Best student performance in year 3
- **Action on Hearing Loss Summer Studentship Grant** 2013
  £1,600 grant received in support of summer research work at UCL Ear Institute
- **Natural Sciences Sessional Prize** 2012
  Runner-up student performance in year 1

PROFESSIONAL ACTIVITIES

Event co-organizer

- Illuminating neural computation through perturbations and adaptive experimental designs
  COSYNE Conference Workshop   Lisbon, 2022
  *Organizers: DJ O'Shea, **L Duncker**, A Draelos, J Pearson*
- Modules in the brain: compartmentalized and distributed computation across cortical areas
  COSYNE Conference Workshop   Denver, 2020
  *Organizers: LN Driscoll, **L Duncker***
- Can state-space models form a bridge between theory and data?
  Cognitive Computational Neuroscience, Cross-collaboration Breakouts   Berlin, 2019
  *Organizers: SW Linderman, LN Driscoll, **L Duncker***
- Data, Dynamics and Computation: using data-driven methods to ground mechanistic theory
  COSYNE Conference Workshop   Lisbon, 2019
  *Organizers: JA Menendez, **L Duncker***

Reviewer

- Computational and Systems Neuroscience (COSYNE)
- Advances in Neural Information Processing Systems (NeurIPS)
- Cognitive Computational Neuroscience (CCN)
- Neural Computation

Outreach & Volunteering

- In2Science UK summer program mentor   2020
- Personal Statement Checking Service, The Social Mobility Foundation UK   2020

Committees

- Wu Tsai Neurosciences Insitute DIBEJ committee, Stanford University   2022–present
- Athena Swan Self-Assessment Team, Gatsby Unit, UCL   2019-2021