Jonathan Cornford

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Originally an experimental and computational neuroscientist, now working with artificial neural networks to investigate principles of intelligence by integrating neuroscience and AI.

Education

University College London (London, UK) — Sept. 2012 - Dec. 2017
PhD Neuroscience, Supervisors: Prof. Dimitri Kullmann, Prof. Michael Häusser
Awards: Brain Research Trust PhD Scholarship, Bogue Research Fellowship

University of Oxford (Oxford, UK) — Sept. 2008 - June 2011
Bachelor of Arts (Hons.) Physiological Sciences. Finals subjects: Neuroscience, Cell Signalling
Awards: British Physiological Society undergraduate prize for dissertation project excellence

Postgraduate Experience

MILA, McGill University (Montreal, Canada) — Nov. 2019 - Present
Postdoctoral Research Associate, Blake Richard's Laboratory
- Investigating biologically motivated neural network architectures and learning algorithms.
- Determined how to build ANNs with seperate excitatory and inhibitory units that have the same performance as standard ANNs ([ref](#)).

University College London (London, UK) — Dec. 2017 - Nov. 2019
Postdoctoral Research Associate, Prof. Dimitri Kullmann's Laboratory
- Finalised and drove the completion of collaborations and work initiated during PhD.
- Led the development and main author of [PyECoG](#), a python module and GUI for the annotation and offline classification of epilpetic seizures in rodent electrocorticographic recordings using ML.
- Built models for online detection of epileptiform activity using ANNs.

Unbound (London, UK) — Dec. 2017 - Nov. 2018
Consultant, Data Science
[Unbound](#) is the online name of United Authors Publishing Ltd, a crowdfunding publishing company
- Analysed social networks and built predictive models for book crowdfunding probability.

University College London (London, UK) — Sept. 2012 - Dec. 2017
PhD Candidate, Prof. Dimitri Kullmann's & Prof. Michael Häusser's Laboratories
Thesis title: *Computational aspects of fast-spiking PV+ interneuron signalling*
- Discovered dendritic integration of excitatory inputs onto PV+ interneurons is different for local or external inputs, and investigated the resulting network-level functions. Main results published [here](#).
- Main computational and experimental approaches used: two-photon glutamate uncaging, whole-cell patch clamp, multicompartmental NEURON models, and spiking neural network simulations.
- Awarded the Bogue Research Fellowship (2015) to fund collaborative visits to the Allen Brain Institute and Stanford University to set up Array Tomography at UCL. Combined ultramicroscopy and immunohistochemistry with [automated](#) microscope control for high-throughput imaging.
- Experience with a range of experimental neuroscience techniques during rotational 1st year, including two-photon and confocal microscopy, calcium imaging, FM-dye experiments, extracellular recordings

University of Oxford (Oxford, UK) — Sept. 2011 - Jan. 2012
Research Assistant, Prof. Nigel Emptage's Laboratory
- Investigated homeostatic plasticity in organotypic slice cultures using sharp and patch-clamp microelectrode recording techniques.

Teaching experience and community roles

MILA (Montreal, Canada)   2020
Teaching assistant: IFT6135 Representation Learning, A. Courville.

University College London (London, UK)   2016, 2017
Teaching assistant: Scientific programming in Python graduate course.

University College London (London, UK)   2014
Queen Square Committee Co-Chair
–   Co-led a postgraduate committee to organise the Queen Square Symposium. Organised social
    events and communicated student feedback to academic steering committees.

University of Oxford (Oxford, UK)   2010
Physiological Society President
–   Led the student society's committee to organise evening speakers and social events.

Selected Courses and Workshops

–   *CIFAR Deep Learning and Reinforcement Learning Summer School, Montreal*   2020
–   *Advanced course in computational neuroscience*, Frankfurt   2016
    -   4 week residential course including research project. Awarded travel scholarship
–   *Microelectrode Techniques for Cell Physiology*, Marine Biological Association, Plymouth   2013
    -   2 week residential course for training in electrophysiological and optical techniques
–   *MITx - 6.431x Probability*, J. Tsitsiklis, Edx   2019
–   *Algorithms 1: Design and Analysis*, T. Roughgarden, Stanford Online Lagunita   2018
–   *Neural Networks for machine learning*, G. Hinton, Coursera   2018
–   *Mathematics for Machine Learning*, Coursera   2018
–   *Statistical Learning*, T. Hastie & R. Tibshirani, Stanford Online Lagunita   2016

Publications

Cornford J, Kalajdzievski D, Leite M, Lamarquette A, Kullmann DM, Richards B. (2021). Learning to live with Dale's principle: ANNs with separate excitatory and inhibitory units. *International Conference on Learning Representations*.

Ghosh A, **Cornford J**, Richards B. (2020). BP2T2: Moving towards Biologically-Plausible BackPropagation Through Time. *NeurIPS Workshop - Beyond Backpropagation : Novel Ideas for Training Neural Architectures*.

Colasante G, Qiu Y, Massimino L, Di Berardino C, **Cornford J**, Snowball A, Weston M, Jones SP, Giannelli S, Lieb A, Schorge S, Kullmann DM, Broccoli V, Lignani G. (2020) In vivo CRISPRa decreases seizures and rescues cognitive deficits in a rodent model of epilepsy. *Brain*.

Cornford J, Mercier MS, Leite M, Magloire V, Häusser M, Kullmann DM. (2019). Dendritic NMDA receptors in parvalbumin neurons enable strong and stable neuronal assemblies. *Elife*.

Magloire V, **Cornford J**, Lieb A, Kullmann DM, Pavlov I. (2019). KCC2 overexpression prevents the paradoxical seizure-promoting action of somatic inhibition. *Nature Communications*.

Mercier MS, Magloire V, **Cornford J**, Kullmann DM. (2019). Long-term synaptic plasticity in hippocampal neurogliaform interneurons. *BioRxiv*.

Snowball A, Chabrol E, Wykes RC, Shekh-Ahmad T, **Cornford J**, Lieb A, Hughes MP, Massaro G, Rahim AA, Hashemi KS, Kullmann DM, Walker MC, Schorge S. (2019). Epilepsy Gene Therapy Using an Engineered Potassium Channel. *J Neurosci*.