

JOHN DAVID GRIFFITHS, PHD

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RESEARCH INTERESTS

The use of neurophysiological modelling and neuroimaging to study dynamics and functional organization of cognition and its pathologies:

- Large-scale brain network modelling of neuroimaging and neurophysiology data
- Computational and systems neuroscience integrative & multi-scale approaches
- Brain stimulation - mechanisms, models, applications
- Neural and cognitive effects of ageing, neurological, & neuropsychiatric disease
- Neuroimaging methods - brain connectivity, brain dynamics, atlases, neuroinformatics
- Neural plasticity and functional reorganization
- Cognitive neuroscience of language and attention

EDUCATION

Doctor of Philosophy (PhD) Cognitive Neuroimaging University of Cambridge, UK	2010-2014
Master of Science (MSc) Cognitive Neuroscience University of York, UK	2006 - 2007
Batchelor of Science (BSc) Psychology & Philosophy (Joint Honours) University of Warwick, UK	2003 - 2006

POSITIONS HELD

Independent Scientist Lead, Whole Brain Modelling Group Krembil Centre for Neuroinformatics, Centre for Addiction and Mental Health Toronto, Canada	2019-
Postdoctoral Fellow Lefebvre (Sync) Lab Krembil Research Institute, Toronto Western Hospital Toronto, Canada	2018-
Postdoctoral Fellow McIntosh Lab Rotman Research Institute, Baycrest Health Sciences	2014-2017

Toronto, Canada

Honorary Associate

School of Physics, University of Sydney
Sydney, Australia

2015-

Visiting Research Fellow (Endeavour Scholar)

Centre for Complex Systems
School of Physics, University of Sydney
Sydney, Australia

2014-2015

Research Assistant

Centre for Speech, Language, & The Brain
Department of Psychology, University of Cambridge
Cambridge, UK

2007-2009

INVITED TALKS

(Video recordings + slides at johndavidgriffiths.strikingly.com)

*Computational modelling of brain rhythms and brain stimulation at the meso-scale:
overview and applications in neurology and neuropsychiatry*

Neuroimaging Rounds
Hospital for Sick Children, Toronto

Nov 2018

Connectome-based white matter atlases for virtual lesion studies

Neuroimaging Rounds
CAMH, Toronto

May 2018

Functional gradients and connectome eigenmodes

Workshop on Large-Scale Trends in Cortical Organization
Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig

Dec 2017

Analysis of functional magnetic resonance imaging data: principles and techniques

Workshop on Neural Signal and Image Processing
Canadian Neuroscience Association (CAN) Meeting, Montreal

May 2017

Modelling brain dynamics at rest: practical tools and theoretic perspectives

Computational Neuroscience events series
Krembil Research Institute, Toronto

Apr 2017

Introduction to neuroimaging for algebraic topologists

Workshop on Topological Data Analysis in Neuroscience
Banff International Research Station (BIRS), Alberta

Mar 2017

Working with neuroimaging data (for algebraic topologists)

Workshop on Topological Data Analysis in Neuroscience
Banff International Research Station (BIRS), Alberta

Mar 2017

<i>Large-scale brain network modelling</i> Undergraduate course in computational neuroscience (guest lecturer) Department of Mathematics, University of Toronto	Jun 2016
<i>Anatomical and physiological connectivity in neurocognitive ageing and the neurophysiology of sleep disorders</i> Woolcock Institute of Medical Sleep Research, University of Sydney	Jan 2015
<i>Damage to dorsal and ventral frontotemporal white matter pathways impairs syntactic aspects of language comprehension</i> Organization for Human Brain Mapping (OHBM) Annual Meeting, San Francisco	Jun 2009

TEACHING

(Video recordings + slides at johndavidgriffiths.strikingly.com)

<i>Introduction to neuroimaging</i> Rotman Research Institute at Baycrest, Toronto	Nov 2018
<i>Modelling resting state dynamics</i> The Virtual Brain Workshop (Node #7) INCF Annual Meeting, Montreal	Aug 2018
<i>Reproducible research workflows and hosting a technical blog</i> UofT Coders, University of Toronto	Feb 2018
<i>Architecture of The Virtual Brain (TVB)</i> <i>Interacting with TVB using the GUI and Python interfaces</i> <i>Guide to the TVB code base</i> <i>Modelling resting state network dynamics in fMRI</i> <i>Modelling brain stimulation</i> <i>Modelling epilepsy and surgical interventions</i> The Virtual Brain Workshop Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig	Dec 2017
<i>Introduction to diffusion MRI</i> <i>Intermediate Matlab</i> <i>EEG analysis methods</i> (several multi-session specialist technical workshops) Rotman Research Institute at Baycrest, Toronto	2017-2018
<i>Modelling brain dynamics at rest</i> The Virtual Brain Workshop (Node #5) Rotman Research Institute at Baycrest, Toronto	Mar 2017
<i>Building a brain network model</i> Workshop on multimodal neurophysiological modeling with The Virtual Brain (TVB) and Dynamic Causal Modelling (DCM) UCL, London	Apr 2016
<i>Building a brain network model</i> The Virtual Brain Workshop (Node #3) Society for Neuroscience Annual Meeting, Chicago	Nov 2015

PEER REVIEW

Review articles regularly for Cerebral Cortex, Biological Psychiatry, Neuroimage, Network Neuroscience, Royal Society Interface, Journal of Open Source Software

HONOURS AND AWARDS

Australia Endeavour Awards Research Fellowship Value 26,000 AUD (25,000 CAD)	2015-2016
BBSRC PhD Studentship Biotechnology & Biological Sciences Research Council (BBSRC), UK Value 60,000 GBP (90,000 CAD)	2010-2014
Gurantors of Brain Travel Grant Value 2,000 GBP (3,300 CAD)	2011

TECHNICAL SKILLS

Scientific programming	Python, Matlab (advanced); R, C++, bash (intermediate); Julia, java
Neuroimaging software	SPM, FSL, Freesurfer, Nipy, Nipype, Dipy, Camino, MRTrix, MNE,
Neurophysiological modelling software	TVB, Brian, NEURON, SPM DCM, In-house

EDUCATION & OUTREACH

LabNotebook johngriffiths.github.io/LabNotebook/about-the-notebook

An open, online, digital Lab Notebook technical blog. Posts contain code, theory, ideas, and general notes regarding simulation and data analysis questions/problems/answers. Posts are generate directly from jupyter notebook files, and hosted on github's gh-pages. Both the format and the content of the LabNotebook have received considerable interest from readers around the world.

NeuroBRITE May-Dec 2018

CIHR-funded outreach program run by the Rotman Research Institute at Baycrest's Research Training Centre (acronym stands for Baycrest Rotman Innovation & Technology Education). NeuroBRITE will introduce final year high school students to cognitive neuroscience and scientific computing, giving them the opportunity to design, conduct, and analyze EEG-based psychological experiments on the theme of cognitive ageing. I am working closely with developers at InterAxon, Avertus, and elsewhere on the materials for this course, which include several substantial novel technical developments in the deployment and application of MUSE portable EEG technology.

Consultant - Backyard Brains 2017-
NeuroRobotics + Computational Neuroscience program

This US-based project is aimed introducing high school children to neuroscience, robotics, and scientific computing using a brain-based neurorobot: a (cute) autonomous four-wheeled, two-eyed device controlled by a basic simulated vertebrate nervous system, which displays and learns simple behaviours. I provide technical support and advice concerning computational models, theory, implementations, and curriculum design.

Organizer - Innovative Perspectives 2016-2017
in Neuroscience (IPN) Conference rotman-baycrest.on.ca/sp/index.php/ipn-2017

Conference aimed at exposing graduate students to non-academic science-based career options in industry, government, and not-for-profit sectors.

Volunteer - Cambridge Pint of Science Festival

2012-2014

Outreach initiative; communicating scientific research to the public in a public house.

PUBLICATIONS

Papers and Book Chapters

Griffiths J D & McIntosh A R (in preparation). Connectome-based white matter atlases for virtual lesion studies.

Griffiths J D & Lefebvre J (in preparation). Estimating conduction delays from tractography and microstructure data: an uncertainty propagation analysis.

Griffiths J D, Lefebvre J, Aquino K M, McIntosh A R, & Robinson P A (in preparation). The spherical harmonic structure of the human connectome.

Griffiths J D & McIntosh A R (in preparation). Multiscale entropy, brain structure, and the factor structure of human cognitive abilities.

Griffiths J D & Lefebvre J (2018). Shaping brain rhythms: dynamic and control-theoretic perspectives on periodic brain stimulation for treatment of neurological disorders. (Chapter to appear in Vassilis et al. Eds. : "Handbook of Multi-Scale Models of Brain Disorders: From Microscopic to Macroscopic Assessment of Brain Dynamics. Springer. London.)

Park D, **Griffiths J D**, & Lefebvre J (2018). Persistent entrainment in non-linear neural networks with memory. (submitted to Journal of Applied Mathematics)

Hutt A, **Griffiths J D**, Herrmann C, & Lefebvre J (2018). Effect of Stimulation Waveform on the Nonlinear Entrainment of Cortical Alpha Oscillations. (Submitted to Frontiers in Computational Neuroscience)

Ryan J, Shen K, Kacollja A, Tian H, **Griffiths J D**, & McIntosh A R (2018). The functional reach of the hippocampal memory system to the oculomotor system. (Submitted to Neuroimage)

Zimmerman J, **Griffiths J D**, & McIntosh A R (2018). Subject-specificity of the correlation between large-scale structural and functional connectivity. Network Neuroscience 3.

Zimmerman J, **Griffiths J D**, & McIntosh (2018). Unique mapping of structural and functional connectivity on cognition. bioRxiv 296913; doi: <https://doi.org/10.1101/296913> (submitted to Journal of Neuroscience)

Robinson P A, Zhao X, Aquino K M, **Griffiths J D**, Sarkar S, & Panderjee, GM (2016). Eigenmodes of brain activity: neural field theory and comparison with experiment. Neuroimage 142: 79-98

Kievit R, Davis S W, **Griffiths J D**, Correia M M, Cam-CAN, & Henson R N (2016). A watershed model of individual differences in fluid intelligence. Neuropsychologia 91: 186-198

Griffiths J D (2015). Causal influence in neural systems: Reconciling mechanistic-reductionist and statistical perspectives. Physics of Life Reviews, 15:130132.

Griffiths, J D (2014). The white matter disconnection hypothesis of neurocognitive ageing: bridging the gaps. (PhD Thesis, University of Cambridge).

Griffiths J D, Marslen-Wilson W D, Stamatakis E A, & Tyler L K (2013). Functional organization of the neural language system: dorsal and ventral pathways are critical for syntax. *Cerebral Cortex*. 23(1):139-47

Papoutsi M, Stamatakis E A, **Griffiths J D**, Marslen-Wilson W D, & Tyler L K (2011) Is left fronto-temporal connectivity essential for syntax? Effective connectivity, tractography and performance in left-hemisphere damaged patients. *Neuroimage*. 58(2):656-64

Recent Conference Posters

Griffiths J D & Lefebvre J (2018). Influence of cortical network topology and delay structure on EEG rhythms in a whole-brain connectome-based thalamocortical neural mass model (Poster to be presented at OCNS Seattle 2018).

Ghahremani A, McIntosh A R, & **Griffiths J D** (2018). Role of the thalamus in connectome network topology: A Virtual Brain modelling study (Poster to be presented at Neuroinformatics 2018).