Curriculum Vitae: Dr Ben D. Fulcher

CONTACT INFORMATION

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EDUCATION

2008–2012	D.Phil., School of Physics, University of Oxford.
2008	M.Sc., School of Physics, University of Sydney.
2004–2007	B.Sc. (Adv.) (Hons.) with a University Medal, University of Sydney. Majors: Physics, Nanoscience and Technology.

EMPLOYMENT

2017–now	Lecturer in Brain Dynamics and Neurophysics, School of Physics, University of Sydney.
2015–2018	NHMRC Early Career Fellow, Brain and Mental Health Laboratory, School of Psychological Sciences, Monash University. Project title: *From brain maps to mechanisms: modeling the pathophysiology of schizophrenia.*
2013–2014	Research Fellow (Computational and Experimental Neuroscience), Brain and Mental Health Laboratory, School of Psychological Sciences, Monash University. Analysis of time series and networks derived from human brain imaging data.
2013	Academic visitor to Mathematics Department, Imperial College, London. Developing a code repository and online collaborative platform for scientific time-series analysis.
2012–2013	Researcher on physiologically-based modeling of sleep dynamics with orexin, Complex Systems Group, School of Physics, University of Sydney.
2008	Postgraduate Teaching Fellow, School of Physics, University of Sydney.

GRANTS

2017	School of Psychology Staff Travel Grant: **B. D. Fulcher**. Total awarded: $1 800.
2016	Monash Institute of Cognitive and Clinical Neurosciences Research Development Grant – Seed Funding: **B. D. Fulcher**. Total awarded: $10 000.
2016	CASS Foundation Travel Award to attend *25th Annual Computational Neuroscience Meeting, CNS 2016*: **B. D. Fulcher**. Total awarded: $2 000.
2016	Deakin Faculty Research Development Grant, *An investigation of neuroplasticity in autism spectrum disorder (ASD) using brain stimulation and neuroimaging*: M. Kirkovski (chief investigator, CI), P. Enticott (champion, C), M. Berk (associate investigator, AI), P. Fitzgerald (AI), N. Rogasch (AI), A. Fornito (AI), **B. D. Fulcher** (AI), and L. Oberman (AI). Total awarded: $19 991.50.
2016	Monash University, School of Psychological Sciences 2016 Staff Travel Grant: **B. D. Fulcher**. Total awarded: $1 500.
2015	Monash University, Psychology Research Initiative Fund, *An innovative app-based platform for real-world health and behavior monitoring*: **B. D. Fulcher**, M. Yücel, A. Fornito, A. Carter, and G. Youssef. Total awarded: $11 121.

2015 Deakin Faculty Research Development Grant, *Understanding the social brain through functional neuroimaging and brain stimulation*: M. Kirkovski (chief investigator, CI), P. Enticott (champion, C), M. Berk (associate investigator, AI), P. Fitzgerald (AI), A. Fornito (AI), N. Rogasch (AI), **B. D. Fulcher** (AI). Total awarded: $10 000.

2014 NHMRC Early Career Fellowship (for 2015–2018), *From brain maps to mechanisms: modeling the pathophysiology of schizophrenia*: **B. D. Fulcher**. Total awarded: $309 436.

Scientific Initiatives

2013 Developed an online collaborative scientific platform for time-series analysis at `www.comp-engine.org/timeseries`. The web resource opens up years of work to the scientific community, which involved collecting and synthesizing tens of thousands of time series, and thousands of existing and newly-developed methods for measuring structure in time series. Over 60 000 views have been recorded since launching the website in February 2014.

2010–2011 Founded the *Interdisciplinary Perspectives on Time Series* project, a weekly interdisciplinary seminar series on time-series analysis, Balliol Interdisciplinary Institute, Balliol College, University of Oxford.

Publications

(Note: publications in submission are shown in gray)

A. Arnatkevičiūtė*, **B. D. Fulcher***, A. Fornito. Hub connectivity, neuronal diversity, and gene expression in the *C. elegans* connectome (submitted). *bioRxiv* 207134 (2017).

L. Parkes, **B. D. Fulcher**, M. Yücel, A. Fornito. An evaluation of the efficacy, reliability, and sensitivity of motion correction strategies for resting-state functional MRI (submitted). *bioRxiv* 156380 (2017).

M. T. Wilson, **B. D Fulcher**, P. K. Fung, P. A. Robinson, A. Fornito, N. C. Rogasch. Biophysical modeling of neural plasticity induced by transcranial magnetic stimulation (submitted). *bioRxiv* 175893 (2017).

E. M. Seabrook, M. L. Kern, **B. D. Fulcher**, N. S. Rickard. Negative word instability on Facebook predicts depression: A proof of concept study (submitted).

B. D. Fulcher*, S. Cohen*, S. M. W. Rajaratnam, R. Conduit, J. P. Sullivan, M. A. St Hilaire, A. J. K. Phillips, T. Loddenkemper, S. V. Kothare, K. McConnell, P. Braga-Kenyon, A. Shlesinger, J. Potter, F. Bird, W. Ahearn, K. M. Cornish, S. W. Lockley. Challenging behavioral events predicted from prior sleep patterns in individuals with low-functioning autism. *Journal of Autism Research* (2017, in press) [DOI: 10.1002/aur.1899].

N. W. Bailey, K. E. Hoy, N. C. Rogasch, R. H. Thomson, S. McQueen, D. Elliot, C. M. Sullivan, **B. D. Fulcher**, Z. J. Daskalakis, P. B. Fitzgerald. Responders to rTMS for depression show increased fronto-midline theta and theta connectivity compared to non-responders. *Brain Stimulation* (2017, in press).

S. Cohen, **B. D. Fulcher**, S. M. W. Rajaratnam, R. Conduit, J. P. Sullivan, M. A. St Hilaire, A. J. K. Phillips, T. Loddenkemper, S. V. Kothare, K. McConnell, P. Braga-Kenyon, A. Shlesinger, J. Potter, F. Bird, W. Ahearn, K. M. Cornish, S. W. Lockley. Behaviorally-determined sleep phenotypes are robustly associated with adaptive functioning in individuals with low functioning autism. *Scientific Reports*: **7** 14228 (2017).

B. D. Fulcher, N. S. Jones. *hctsa*: A computational framework for automated time-series phenotyping using massive feature extraction. *Cell Systems* (2017, in press).

L. Parkes, **B. D. Fulcher**, M. Yücel, A. Fornito. Transcriptional signatures of connectomic subregions of the human striatum. *Genes, Brain & Behavior* **25**: 1176 (2017).

S. S. Sethi*, V. Zerbi*, N. Wenderoth, A. Fornito, **B. D. Fulcher**. Structural connectome topology relates to regional BOLD signal dynamics in the mouse brain. *Chaos* **27**: 047405 (2017).

B. D. Fulcher and A. Fornito. A transcriptional signature of hub connectivity in the mouse connectome. *Proc. Natl. Acad. Sci. USA* **113**: 1435 (2016).

S. T. E. Baker, Dan I. Lubman, M. Yücel, N. B. Allen, S. Whittle, **B. D. Fulcher**, A. Zalesky, A. Fornito. Developmental changes in brain network hub connectivity in late adolescence. *J. Neurosci.* **35**: 9078 (2015).

B. D. Fulcher, N. S. Jones. Highly comparative feature-based time-series classification. *IEEE Trans. Knowl. Data Eng.* **26**: 3026 (2014).

B. D. Fulcher, A. J. K. Phillips, S. Postnova, P. A. Robinson. A physiologically based model of orexinergic stabilization of sleep and wake. *PLoS ONE* **9**: e91982 (2014).

A. J. K. Phillips, **B. D. Fulcher**, P. A. Robinson, E. B. Klerman. Mammalian rest/activity patterns explained by physiologically based modeling. *PLoS Comp. Biol.* **9**: e1003213 (2013).

B. D. Fulcher, M. A. Little, N. S. Jones. Highly comparative time-series analysis: the empirical structure of time series and their methods. *J. Roy. Soc. Interface* **10**: 20130048 (2013).

B. D. Fulcher, X. Y. Cui, B. Delley, C. Stampfl. Hardness analysis of cubic metal mononitrides from first principles. *Phys. Rev. B* **85**: 184106 (2012).

P. A. Robinson, A. J. K. Phillips, **B. D. Fulcher**, M. Puckeridge, J. A. Roberts. Quantitative modelling of sleep dynamics. *Philos. Trans. Roy. Soc. A* **369**: 3840 (2011).

M. Puckeridge, **B. D. Fulcher**, A. J. K. Phillips, P. A. Robinson. Incorporation of caffeine into a quantitative model of fatigue and sleep. *J. Theor. Biol.* **273**: 44 (2011).

B. D. Fulcher, A. J. K. Phillips, P. A. Robinson. Quantitative physiologically based modeling of subjective fatigue during sleep deprivation. *J. Theor. Biol.* **264**: 407 (2010).

B. D. Fulcher, A. J. K. Phillips, P. A. Robinson. Modeling the impact of impulsive stimuli on sleep-wake dynamics. *Phys. Rev. E* **78**: 051920 (2008).

Refereed Conference Proceedings

L. Parkes, **B. D. Fulcher**, M. Yücel, A. Fornito. Comprehensive comparison of head motion correction strategies in resting-state functional magnetic resonance imaging. *International Symposium on Biomedical Imaging (ISBI'17)*, Melbourne, Australia (2017).

A. Arnatkevičiūtė, **B. D. Fulcher**, A. Fornito. Hub connectivity and gene expression in a neuronal connectome. *International Symposium on Biomedical Imaging (ISBI'17)*, Melbourne, Australia (2017).

B. D. Fulcher, A. E. Georgieva, C. W. G. Redman, N. S. Jones. Highly comparative fetal heart rate analysis. *34th Annual International Conference of the IEEE EMBS* (2012).

Book Chapters

B. D. Fulcher. Feature-based time-series analysis. In *Feature Engineering* (CRC Press, 2017) [preprint: *arXiv*, 1709.08055].

P. A. Robinson, S. Postnova, R. G. Abeysuriya, J. W. Kim, J. A. Roberts, L. McKenzie-Sell, A. Karanjai, C. C. Kerr, F. Fung, R. Anderson, M. J. Breakspear, P. M. Drysdale, **B. D. Fulcher**, A. J. K. Phillips, C. J. Rennie, G. Yin. A Multiscale "Working Brain" Model. In *Validating Neuro-Computational Models of Neurological and Psychiatric Disorders* (eds. B. S. Bhattacharya

and F. N. Chowdhury) pp 107–140 (Springer, 2015).

P. A. Robinson, A. J. K. Phillips, **B. D. Fulcher**, M. Puckeridge, J. A. Roberts, C. J. Rennie. Quantitative modeling of sleep dynamics. In *Sleep and Anesthesia: Neural Correlates in Theory and Experiment* (ed. A. Hutt) pp 45–68 (Springer, 2011).

Other

B. D. Fulcher. Highly comparable time-series analysis in Nitime, *GigaScience Database* (2016). doi: 10.5524/100225

Awards

2017 Australian representative for 9th Annual HOPE Meeting with Nobel Laureates (one of six Australians; Tokyo, 2017).

2014 2nd place in *HealthHack* for our entry, *GIRROR: Tracking your emotions and gambling behavior*. George Youssef and I pitched the idea to the hackathon audience, and guided the team over a weekend to produce two functioning apps (iOS and Android) that measure the Problem Gambling Severitiy Index (PGSI) of users, and track their mood, location, and gambling behavior over time using surveys.

2011 *Nicholas Kurti Prize* for distinguished work as third year postgraduate student in Condensed Matter Physics, Department of Physics, University of Oxford.

2010 *David Ryan Prize* for distinguished work by a second year research student in Condensed Matter Physics, Department of Physics, University of Oxford.

2008 First Prize in the Poster Competition, Imperial College London, Institute of Systems and Synthetic Biology: Autumn Symposium.

2008 *Commonwealth Scholarship* to read for a D.Phil. at the University of Oxford.

2008 *Oxford Australia Scholarship* to read for a D.Phil. at the University of Oxford.

2008 *Science Centenary Fund Scholarship* for the highest ranked student over four years who proceeds to a postgraduate research degree in the Faculty of Science, University of Sydney.

Teaching

2016-2017 Lecturer for Computational Neuroscience, School of Psychological Sciences, Monash University.

2010 Guest lecturer in Machine Learning for Systems Biology Doctoral Training Center, University of Oxford.

2008–2010 Lecturer, demonstrator, and co-developer of a two-day *Research in Mathematical Biology* course for MSc Biology students, University of Oxford.

2009 Demonstrator for the first year electromagnetism physics laboratory, University of Oxford.

2008 Postgraduate Teaching Fellow, School of Physics, University of Sydney.

2007–2008 Supervisor and tutor for first year advanced physics tutorials and laboratories, School of Physics, University of Sydney.

2004–2008 Demonstrator and presenter for the Kickstart Program, School of Physics, University of Sydney.

Supervision

2017 Supervisor of Honours student, John Fallon, School of Psychological Sciences, Monash University, Melbourne, Australia.

2016 Co-supervisor of PhD student, Sarab Sethi (with Nick Jones), Department of Mathematics, Imperial College London, London, UK.

2016 Co-supervisor of PhD student, Stuart Oldham (with Alex Fornito), School of Psychological Sciences, Monash University, Melbourne, Australia.

2015 Co-supervisor of PhD student, Aurina Arnatkevičiūtė (with Alex Fornito), School of Psychological Sciences, Monash University, Melbourne, Australia.

2015 Co-supervisor of PhD student, Linden Parkes (with Alex Fornito and Murat Yücel), School of Psychological Sciences, Monash University, Melbourne, Australia.

2015 Co-supervisor of PhD student, Leah Braganza (with Murat Yücel, Ben Harrison, Carsten Murawski and Valentina Lorenzetti), Melbourne University, Melbourne, Australia.

2015 Co-supervisor of PhD student, Elizabeth Seabrook (with Nikki Rickard and Peggy Kern), School of Psychological Sciences, Monash University, Melbourne, Australia.

2015 Co-supervisor of Honours students, Patricia Tran and Stuart Oldham (with Alex Fornito), School of Psychological Sciences, Monash University, Melbourne, Australia.

2014 Co-supervisor of PhD student, Simonne Cohen [completed 2016] (with Kim Cornish, Russell Conduit, Steven Lockley, Shanthakumar Rajaratnam), School of Psychological Sciences, Monash University, Melbourne, Australia.

2014 Co-supervisor of winter students Rannee Lee and Brandon Lim (with Alex Fornito), Monash University, Melbourne, Australia.

2013 Co-supervisor of summer student, Krishna Vysyaraju, in the project *Highly comparative feature-based inference* (with Nick Jones), Department of Mathematics, Imperial College London.

2011 Co-supervisor of summer student, Alex Gibberd, in the project *Pre-processing methods for predicting epileptic seizures* (with Nick Jones), Department of Physics, University of Oxford.

2010 Co-supervisor of fourth year M.Phil. Physics student Oliver Britton in project *Structure in symbolic strings* (with Nick Jones), Department of Physics, University of Oxford.

Invited Talks & Presentations

March 2017 'Gene transcriptional signatures of structural connectivity in the mouse', Weekly Seminar Series, The Florey, Melbourne, Australia.

March 2017 'Structural connectome topology relates to regional BOLD signal dynamics', Connectomics Keystone Symposium, Santa Fe, New Mexico, US.

November 2016 'Structural connectome topology relates to regional BOLD signal dynamics in the mouse brain', NeuroEng, Brisbane, Australia.

November 2016 'Gene expression, axonal connectivity, and resting state dynamics in the mouse', 2016 Workshop on Rodent Neuroscience, Suzhou, China.

October 2016 'Gene expression, brain connectivity, and rs-fMRI dynamics in the mouse', Med-X Research Institute, Shanghai Jiaotong University, China.

September 2016	'Automated time-series phenotyping', Centre of Excellence for the Dynamics of Language, University of Queensland, Australia.
August 2016	'MICCN SurveyKit: Opening up app-based monitoring to researchers', Global Ideas Labs: Mental health and technology, Monash University, Melbourne, Australia.
August 2016	'The road to MICCN SurveyKit', Melbourne Mobile Meetup, Melbourne, Australia.
July 2016	'Gene expression and neural activity in the connectome', 25th Annual Computational Neuroscience Meeting (Connectome: Structure and large-scale dynamics workshop), Jeju Island, South Korea.
May 2016	'Brain connectivity and dynamics: Highly comparative time-series analysis of neuroscience data, and gene expression patterns of brain connectivity', as Australia Node Representative at Advances in Neuroinformatics IV. AINI 2016 and International Neuroinformatics Coordinating Facility (INCF) Nodes Workshop Abstract: Oral Session IV-1, RIKEN, Saitama, Japan, DOI:10.14931/aini2016.osiv.1
November 2015	'Highly comparative time-series analysis', Paris School of Economics, Paris, France.
September 2015	Invited Speaker at BioMelbourne Network's BioBriefing at Carlton Connect Initiative, Melbourne, Australia: 'Why Hack'.
August 2015	'Highly comparative time-series analysis', School of Mathematics and Statistics, University of Melbourne, Australia.
June 2015	Invited campus-wide seminar: 'A highly comparative time-series analysis engine'. Research Institute of Molecular Pathology (IMP), Vienna, Austria.
June 2014	'Highly comparative time-series analysis for brain imaging', Integrative Brain Function Workshop, Monash Brain Imaging Facility, Monash University, Melbourne, Australia.
Feb 2014	'Physiologically based sleep modeling', Sleep and Circadian Medicine Laboratory, Monash University, Melbourne, Australia.
July 2013	'Highly comparative time-series analysis for biological signal processing', Workshop on Biological Dynamics, Department of Mathematics, University of Surrey, UK.
June 2013	'Quantitative, physiologically-based sleep modeling', Biomathematics Seminar Series, Imperial College, London, UK.
August 2012	'Highly comparative fetal heart rate analysis', 34th Annual International Conference of the IEEE EMBS, San Diego, USA.
March 2012	'Highly comparative time-series analysis', Royal Society satellite meeting: Signal processing for the physical sciences, The Kavli Royal Society International Centre, UK.
October 2011	'Highly comparative time-series analysis', Atmospheric, Oceanic & Planetary Physics Seminar, Department of Physics, University of Oxford, UK.
October 2011	'Highly comparative time-series analysis', Applied Dynamical Systems Seminar, Department of Mathematics, University of Oxford, UK.

May 2011	'An engine for comparative time-series analysis', Complex Agent-Based Dynamic Networks (CABDyN) Complexity Centre seminar, Saïd Business School, University of Oxford, UK.
November 2010	'Quantitative sleep modeling', Nonlinear Seminars, Department of Mathematics, University of Surrey, UK.
April 2010	'High throughput time-series analysis', *Signals Day*, University of Oxford, UK.