Curriculum Vitae: Dr Ben D. Fulcher

CONTACT INFORMATION

Dr Ben D. Fulcher
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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.

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 (MAJOR)

2018 NHMRC Project Grant: *A dimensional approach to mapping the risk mechanisms of mental illness* (2018–2022). CIs: A. Fornito, M. Bellgrove, M. Yücel, **B. D. Fulcher**, Z. Hawi. Grant #1146292. Total awarded: $1 654 808.

2015 NHMRC Early Career Fellowship (2015–2018), *From brain maps to mechanisms: modeling the pathophysiology of schizophrenia*: **B. D. Fulcher**. Grant #1089718. Total awarded: $309 436.

GRANTS (MINOR)

2018 University of Sydney Centre for Complex Systems' Emerging Aspirations Funding Scheme: Complex systems perspectives on dementia: population modelling, networks and information processing. CIs: B.D. Fulcher, J.M. Shine, J. Lizier. Total awarded: $12 500.

2018 Sydney Nanoscience Grand Challenge: Molecular nano-robotics for health: navigating the body to diagnose and treat early disease. CIs: Shelley Wickham and Anna Waterhouse. Total awarded: $300 000.

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.

2010 Balliol Interdisciplinary Institute Grant for founding the *Interdisciplinary Perspectives on Time Series* project, a weekly interdisciplinary seminar series on time-series analysis, Balliol College, University of Oxford. Total awarded: £850.

Conference Organization and Other Scientific Initiatives

2018 Local Organizing Committee for the *11th Australasian Workshop on Neuro-Engineering and Computational Neuroscience*, *NeuroEng 2018*: A 3-day conference hosted at the University of Sydney (27-29 November).

2018 Launched a new interactive website, `www.comp-engine.org`, that allows users to upload their own data to contribute towards a living library of time-series data.

2013 Developed an online collaborative scientific platform for time-series analysis that 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 66 000 views have been recorded since launching the website in February 2014.

Publications

(Note: publications in submission are shown in gray).

A. Arnatkevičiūtė, **B. D. Fulcher**, A. Fornito. Uncovering the transcriptional signatures of hub connectivity in neural networks (submitted). [preprint: `https://psyarxiv.com/7j4s2/`]

S. Oldham, **B. D. Fulcher**, L. Parkes, A. Arnatkevičiūtė, C. Suo, A. Fornito. Consistency and differences between centrality metrics across distinct classes of networks (submitted) [preprint: `arxiv.org/abs/1805.02375`].

M. Markicevic, **B.D. Fulcher**, C. Lewis, F. Helmchen, M. Rudin, V. Zerbi, and N. Wenderoth. Cortical excitation : inhibition imbalance causes network-specific functional hypoconnectivity: a DREADD-fMRI study (submitted). [preprint: `https://www.biorxiv.org/content/early/2018/12/10/492108`].]

B. D. Fulcher, J. D. Murray, V. Zerbi, X.-J. Wang. Multimodal gradients across mouse cortex. *PNAS* (2019, accepted).

A. Arnatkevičiūtė, **B. D. Fulcher**, A. Fornito. A practical guide to linking brain-wide gene expression and neuroimaging data. *NeuroImage* (2019, accepted).

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. Differentiating responders and non-responders to rTMS treatment for depression after one week using resting EEG connectivity measures. *Journal of Affective Disorders* **242**: 68 (2019).

A. Fornito, A. Arnatkevičiūtė, **B. D. Fulcher**. Bridging the gap between connectome and transcriptome. *Trends in Cognitive Sciences* (2018, in press).

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. *Clinical Neurophysiology* **129**(6): 1230 (2018).

E. M. Seabrook, M. L. Kern, **B. D. Fulcher**, N. S. Rickard. Predicting depression from language-based emotion dynamics: Longitudinal analysis of Facebook and Twitter status updates. *Journal of Medical Internet Research* **20**(5): e168 (2018).

B. D. Fulcher*, A. Arnatkevičiūtė*, R. Pocock, A. Fornito. Hub connectivity, neuronal diversity, and gene expression in the *C. elegans* connectome. *PLoS Compututational Biology* **14**(2): e1005989 (2018).

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. *NeuroImage* **171**: 415 (2018).

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. Sleep patterns predictive of daytime challenging behavior in individuals with low-functioning autism. *Autism Research* **11**: 391 (2018).

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* **11**(1): 190 (2018).

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* **5**(5): 527 (2017).

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).

Peer-Reviewed Full Conference Papers

C.H. Lubba, **B.D. Fulcher**, S.R. Schultz, N.S. Jones. Efficient peripheral nerve firing characterisation through massive feature extraction. *9th International IEEE EMBS Neural Engineering Conference* (2018). `https://doi.org/10.1101/508341`.

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).

Conference Proceedings

A. Arnatkevičiūtė, **B. D. Fulcher**, A. Fornito. Methodological considerations in relating brain-wide transcriptomic and neuroimaging data. *OHBM* (2018).

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).

Book Chapters

B. D. Fulcher. Feature-based time-series analysis. In *Feature Engineering for Machine Learning and Data Analytics*, 87–116 (CRC Press, 2018). `https://arxiv.org/abs/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 Melbourne-based medical hackathon *HealthHack* for our entry, *GIRROR: Tracking your emotions and gambling behavior*.

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

2018–2019 Course Coordinator: PHYS3888, University of Sydney.

2018 Guest lecture on machine learning methods for data visualization for Information Visualisation Design Studio (DECO3100), University of Sydney.

2018 Supervisor of PHYS1001 Tutorials, University of Sydney.

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, UK.

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

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

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.

PhD Supervision

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

	2016	Co-supervisor of Stuart Oldham (with Alex Fornito), School of Psychological Sciences, Monash University.
	2015	Co-supervisor of Aurina Arnatkevičiūtė (with Alex Fornito), School of Psychological Sciences, Monash University.
	2015	Co-supervisor of Linden Parkes (with Alex Fornito and Murat Yücel), School of Psychological Sciences, Monash University.
	2015	Co-supervisor of Leah Braganza (with Murat Yücel, Ben Harrison, Carsten Murawski and Valentina Lorenzetti), University of Melbourne.
	2015	Co-supervisor of Elizabeth Seabrook [completed 2018] (with Nikki Rickard and Peggy Kern), School of Psychological Sciences, Monash University.
	2014	Co-supervisor of Simonne Cohen [completed 2016] (with Kim Cornish, Russell Conduit, Steven Lockley, Shanthakumar Rajaratnam), School of Psychological Sciences, Monash University.
Honours Supervision	**2017**	Primary supervisor of John Fallon, School of Psychological Sciences, Monash University.
	2015	Co-supervisor of Patricia Tran (with Alex Fornito), School of Psychological Sciences, Monash University.
	2015	Co-supervisor of Stuart Oldham (with Alex Fornito), School of Psychological Sciences, Monash University.
Other Supervision	**2018/2019**	Primary supervisor of Denison Scholar Adithya Vignaraja, University of Sydney.
	2018	Primary supervisor of SSP students Brendan Harris and Xavier Morris (with Leonardo Gollo), University of Sydney.
	2014	Co-supervisor of winter students Rannee Lee and Brandon Lim (with Alex Fornito), Monash University.
	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, UK.
	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, UK.
	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, UK.
Invited Talks & Presentations	**July 2019**	'Highly comparative time-series analysis as statistical learning across a massive interdisciplinary feature library'. IMS Invited Session: 'Complex Time Series Analysis', Joint Statistical Meeting (JSM), Denver, Colorado.
	February 2018	'Feature-based time-series analysis', NII Shonan Meeting: *Analysing large collections of time series.* Shonan Village, Japan.

December 2017	'Automating biomedical time-series analysis using massive feature extraction', Complexity, Criticality and Computation (C^3) International Biannual Symposium. Sydney, Australia.
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.