

# CLIFF C. KERR

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Address: 44/24 Council St,  
Bondi Junction, NSW 2022, Australia  
Phone: +61-412-038-402  
Email: [cliff@thekerrlab.com](mailto:cliff@thekerrlab.com)

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## BIOSKETCH

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- ❖ I am currently an Australian Research Council Discovery Early Career Research Award Fellow in computational neuroscience at the University of Sydney, and a board member and team leader of the Optima Consortium for Decision Science.
- ❖ Previously I was a postdoctoral fellow at the State University of New York Downstate Medical Center, working on a neuroprosthetics project for the Defense Advanced Research Projects Agency, and was a co-director of Cingulate Consulting, a data analytics firm.
- ❖ I completed a Ph.D. in theoretical physics at the University of Sydney (2006 – 2010).
- ❖ I have 30 peer-reviewed papers, including in *The Lancet Global Health* (2014, 2015), *The Lancet HIV* (2015), and *NeuroImage* (2011); four contributed book chapters; 13 technical reports; and nearly 60 conference presentations, including invited talks on both HIV epidemiology and neuroscience. My publications have 423 citations, and my *h*-index is 12.
- ❖ I have been an investigator on six competitive grants (totaling over US\$10 million), including a fellowship grant, a teaching grant, and four research grants.
- ❖ I am the lecturer and course coordinator for the *Introduction to Computational Science* unit at the University of Sydney (2012, 2015, and 2016), and have taught at numerous workshops on both neuroscience and HIV. My supervisory experience includes two Ph.D. students and seven undergraduate research students.
- ❖ Further details are available from my website ([www.thekerrlab.com](http://www.thekerrlab.com)).

## PERSONAL STATEMENT

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I am interested in using detailed, large-scale models to expand our understanding of how complex systems behave. In neuroscience, this entails using biomimetic network models to explain the computations performed by the sensorimotor system. In epidemiology, it involves using models of HIV and other diseases to estimate the optimal allocation of resources for prevention and treatment. In addition to modeling, I am interested in developing new mathematical and computational methods, such as optimization algorithms.

## ACADEMIC AND INDUSTRY EXPERIENCE

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- ❖ **Discovery Early Career Research Fellow, University of Sydney School of Physics (2014 – present)**
  - I am investigating how large-scale brain rhythms influence and facilitate information processing, particularly motor control, among small networks of individual neurons. The research questions will be addressed by combining detailed computer simulations with data-driven analyses of empirical human and monkey brain dynamics. The outcomes of this project will provide a richer understanding of how our brains encode and process information, leading to practical benefits such as improved control of artificial limbs. Further details are available from [www.thekerrlab.com](http://www.thekerrlab.com).
- ❖ **Board Member and Team Leader, Optima Consortium for Decision Science (2016 – present); Senior Research Associate, Burnet Institute (2016) and Kirby Institute (2010 – 2015)**
  - I am the lead software developer for the group, responsible for overseeing the development of models of HIV transmission and disease progression, new statistical methodologies, and software for cost-effectiveness and health economic analyses. The deliverables of these projects typically consist of reports and graphical software interfaces designed to client specifications. Current and past clients include the World Health Organization, the World Bank, UNAIDS, UNDP, PEPFAR, CDC, and national ministries of health across Africa, Europe, Asia, and South America. Further details are available from [www.optimamodel.com](http://www.optimamodel.com).
- ❖ **Co-Director and Analyst, Cingulate Consulting (2011 – 2015)**
  - I founded Cingulate Consulting to analyze private-sector datasets using detailed process models, data mining approaches, and other statistical methods. Our clients have included several major Australian retailers and finance companies. In addition to data analysis and report writing, I managed a team of five other analysts. Further details are available from [www.cingulate.com.au](http://www.cingulate.com.au).
- ❖ **Postdoctoral Fellow, Neurosimulation Laboratory, State University of New York Downstate Medical Center (2010 – 2014)**
  - I worked on large-scale spiking neuron models as part of the Defense Advanced Research Project Agency’s \$15 million “Reorganization and Plasticity to Accelerate Injury Recovery” (REPAIR) project. I collaborated with experimentalists in primate electrophysiology and optogenetics, whose data were used to both build the model and test its predictions. The overall aim was to create a functional human neuroprosthesis: a computer model of the sensorimotor system that engages in bidirectional communication with the brain, thereby restoring lost function. Further details are available from [www.neurosimlab.org](http://www.neurosimlab.org).
- ❖ **Research Associate, Complex Systems Group, University of Sydney School of Physics (2010 – 2014)**
  - This position involved research student supervision and the application of neural field models to human EEG data, including the analysis of age trends and evoked potentials. It was a continuation of my doctoral work.

❖ **Scientific Consultant, Brain Resource Ltd. (2010)**

- For this project, I analyzed a large dataset of structural, physiological, and behavioral measures of age trends in human subjects. It culminated in the design and production of two summary posters that have since been used in demonstrations of Brain Resource's capabilities to prospective clients.

## ACADEMIC QUALIFICATIONS

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- ❖ **Doctor of Philosophy** in Complex Systems, School of Physics, University of Sydney (2006–2010)
  - Thesis title: “Modeling and Quantification of Auditory Evoked Potentials”; available from [www.neurosimlab.org/cliffk/thesis.pdf](http://www.neurosimlab.org/cliffk/thesis.pdf).
- ❖ **Bachelor of Science in Physics with Honours** (First Class), University of Sydney (2005)
  - Thesis title: “Physiology-Based Modeling of Evoked Response Potentials”.
- ❖ **Bachelor of Science in Neuroscience/Biophysics**, University of Queensland (2002–2004)

## TEACHING EXPERIENCE

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- ❖ Lecturer, *Introduction to Computational Science* first-year course (COSCI001/1003 and COSCI901/1903), University of Sydney (2012, 2015, and 2016)
  - I received an overall feedback score of 4.4/5 from the course evaluation; sample student comments: “Cliff is a fantastic lecturer – very clear & easy to follow. Very interactive & lots of demonstration. Thanks!”; “Supremely clear, intuitive explanations. Connected content to genuine applications, made the material seem relevant and interesting. Showed a genuine interest in the material himself. These are the best lectures I’ve yet attended, I can’t think of what to improve.”
- ❖ Ph.D. student co-supervision:
  - Salim Zobaer, University of Sydney, in brain dynamics (2014–present)
  - Amy Kwon, University of New South Wales, in epidemiology (2011–2014)
- ❖ *Optima* tutor and lecturer, *Improving Efficiency in Health* conference, Washington D.C. (2016)
- ❖ Talented Student Program supervisor, University of Sydney, in neuroscience (2015–present)
- ❖ Complex Systems Scholarship student supervisor, University of Sydney, in neuroscience (2015–present)
- ❖ *NEURON* tutor, *Computational Neuroscience* conference tutorial, Quebec City, Canada (2014)
- ❖ *NEURON* tutor, *Advanced Course in Computational Neuroscience*, Będlewo, Poland (2013)
- ❖ Faculty of Science mentor for new tutors, University of Sydney (2011–2013)
- ❖ Honours (fourth-year) student co-supervisor, University of Sydney, in brain dynamics (2012)
- ❖ Guest lecturer, *Neurodynamics* Honours course, University of Sydney (2011)
- ❖ Instructor for postgraduate *Computation and Image Processing* lab, University of Sydney (2010)
- ❖ Supervisor for first-year physics tutorials, University of Sydney (2006–2010)
- ❖ Demonstrator for second-year physics labs, University of Sydney (2006–2010)
- ❖ Supervisor for first-year physics labs, University of Sydney (2008)
- ❖ Tutor for first-year physics tutorials, University of Sydney (2005–2006)
- ❖ Tutor for first-year biology, biochemistry, and physics, University of Queensland (2003–2004)

## PUBLICATIONS

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### PEER-REVIEWED PAPERS

1. Dura-Bernal S, Neymotin SA, **Kerr CC**, Sivagnanam S, Majumdar A, Francis JT, Lytton WW. Evolutionary algorithm optimization of biological learning parameters in a biomimetic neuroprosthesis (in press). *IBM Journal of Research and Development*.
2. Grantham KL, **Kerr CC**, Wilson DP (2016). Local responses to local epidemics for national impact need advanced spatially explicit tools. *AIDS* **30**(9):1481–2.
3. Kelly SL, Shattock AJ, **Kerr CC**, Stuart RM, Papoyan A, Grigoryan T, Hovhannisyanyan R, Grigoryan S, Benedikt C, Wilson DP (2016). Optimizing HIV/AIDS resources in Armenia: increasing ART investment and examining HIV programmes for seasonal migrant labourers. *Journal of the International AIDS Society* **19**(1):20772.
4. Shattock AJ, **Kerr CC**, Stuart RM, Masaki E, Fraser N, Benedikt C, Gorgens M, Wilson DP, Gray RT (2016). In the interests of time: improving HIV allocative efficiency modelling via optimal time-varying allocations. *Journal of the International AIDS Society* **19**(1):20627.
5. Wilson DW, **Kerr CC** (2015). Can we know in advance whether models will 'get it right'? *The Lancet Global Health* **3**(10): e577–8.
6. Pham QD, Wilson DP, **Kerr CC**, Shattock AJ, Do HM, Duong AT, Nguyen LT, Zhang L (2015). Estimating the cost-effectiveness of HIV prevention programmes in Vietnam, 2006–2010: A modelling study. *PLOS ONE* **10**:e0133171.
7. Jansson J, **Kerr CC**, Mallitt K-A, Wu J, Gray RT, Wilson DP (2015). Inferring HIV incidence from case surveillance with CD4 counts. *AIDS* **29**(12):1517–25.
8. Zhang L, Phanuphak N, Henderson H, Nonenoy S, Srikaew S, Shattock A, **Kerr CC**, Omune B, van Griensven F, Osornprasop S, Oelrichs R, Ananworanich J, Wilson DP (2015). Scaling up HIV treatment for MSM in Bangkok: what does it take? — a modelling and costing study. *The Lancet HIV* **2**(5):e200–7.
9. **Kerr CC**, Stuart RM, Gray RT, Shattock A, Fraser-Hurt N, Benedikt C, Haacker M, Berdnikov M, Mahmood AM, Jaber SA, Gorgens M, Wilson DP (2015). Optima: a model for HIV epidemic analysis, program prioritization, and resource optimization. *Journal of Acquired Immune Deficiency Syndromes* **69**(3):365–76.
10. Fraser N, **Kerr CC**, Harouna Z, Alhousseini Z, Cheikh N, Gray RT, Shattock A, Wilson DP, Haacker M, Shubber Z, Masaki E, Karamoko D, Gorgens M (2015). Reorienting the HIV response in Niger towards sex work interventions: from better evidence to targeted and expanded practice. *Journal of Acquired Immune Deficiency Syndromes* **68**:S213–20.
11. Lytton WW, Neymotin SA, **Kerr CC** (2014). Multiscale modeling for clinical translation in neuropsychiatric disease. *Journal of Computational Surgery* **1**:7.
12. Chadderdon GL, Mohan A, Suter BA, Neymotin SA, **Kerr CC**, Francis JT, Shepherd GMG, Lytton WW (2014). Motor cortex microcircuit simulation based on brain activity mapping. *Neural Computation* **26**(7): 1239–62.
13. Jansson JA, **Kerr CC**, Wilson DP (2014). Predicting the population impact of increased HIV testing and treatment in Australia. *Sexual Health* **11**(2):146–154. [NB: discussed in *Science* **345** (6193):157.]
14. Eaton JW, Menzies NA, Stover J, Cambiano V, Chindelevitch L, Cori A, Hontelez JAC, Humair S, **Kerr CC**, Klein DJ, Mishra S, Mitchell KM, Nichols BE, Vickerman P,

- Bärnighausen T, Bershteyn A, Bloom DE, Boily M-C, Chang ST, Cohen T, Dodd PJ, Fraser C, Gopalappa C, Lundgren J, Martin NK, Mountain E, Pham QD, Pickles M, Phillips A, Platt L, Pretorius C, Prudden HJ, Salomon JA, van de Vijver DAMC, Wagner BG, White RG, Wilson DP, Zhang L, Bandford J, Meyer-Rath G, Remme M, Revill P, Sangrujee N, Terris-Prestholt F, Doherty M, Easterbrook P, Hirschall G, Hallett TB (2014). Health benefits, costs, and cost-effectiveness of earlier eligibility for adult antiretroviral therapy and expanded treatment coverage: a combined analysis of 12 mathematical models. *The Lancet Global Health* 2:e23–34.
15. Neymotin SA, Chadderdon GL, **Kerr CC**, Francis JT, Lytton WW (2013). Reinforcement learning of 2-joint virtual arm reaching in a computer model of sensorimotor cortex. *Neural Computation* 25(12):3263–93.
  16. **Kerr CC**, van Albada SJ, Neymotin SA, Chadderdon GL, Robinson PA, Lytton WW (2013). Cortical information flow in Parkinson’s disease: a composite network/field model. *Frontiers in Computational Neuroscience* 7(39):1–14.
  17. Song W, **Kerr CC**, Lytton WW, Francis JT (2013). Cortical plasticity induced by spike-triggered microstimulation in primate somatosensory cortex. *PLOS ONE* 8(3):e57453.
  18. Kwon JA, Anderson J, **Kerr CC**, Thein H-H, Zhang L, Iversen J, Dore GJ, Kaldor JM, Law MG, Maher L, Wilson DP (2012). Estimating the cost-effectiveness of needle-syringe programs in Australia. *AIDS* 26(17):2201–10.
  19. Chadderdon GL, Neymotin SA, **Kerr CC**, Lytton WW (2012). Reinforcement learning of targeted movement in a spiking neuronal model of motor cortex. *PLOS ONE* 7(10):e47251.
  20. **Kerr CC**, Neymotin SA, Chadderdon GL, Fietkiewicz CT, Francis JT, Lytton WW (2012). Electrostimulation as a prosthesis for repair of information flow in a computer model of neocortex. *IEEE Transactions on Neural Systems & Rehabilitation Engineering* 20(2):153–60.
  21. Neymotin SA, **Kerr CC**, Francis JT, Lytton WW (2011). Training oscillatory dynamics with spike-timing-dependent plasticity in a computer model of neocortex. *IEEE Signal Processing in Medicine and Biology Symposium* 1–6.
  22. Schneider K, **Kerr CC**, Hoare A, Wilson DP (2011). Expected epidemiological impacts of introducing an HIV vaccine in Thailand: a model-based analysis. *Vaccine* 29(36): 6086–91.
  23. Chiang AK, Rennie CJ, Robinson PA, van Albada SJ, **Kerr CC** (2011). Age trends and sex differences of alpha rhythms including split alpha peaks. *Clinical Neurophysiology* 122(8):1505–17.
  24. **Kerr CC**, Rennie CJ, Robinson PA (2011). Model-based analysis and quantification of auditory evoked potential age trends. *Clinical Neurophysiology* 122(1):134–47.
  25. **Kerr CC**, Kemp AH, Rennie CJ, Robinson PA (2011). Thalamocortical changes in clinical depression probed by deconvolution and physiology-based modeling. *NeuroImage* 54(4):2672–82.
  26. **Kerr CC**, van Albada SJ, Rennie CJ, Robinson PA (2010). Age trends in auditory evoked potentials via component scoring and deconvolution. *Clinical Neurophysiology* 121(6):962–76.
  27. Van Albada SJ, **Kerr CC**, Chiang AK, Rennie CJ, Robinson PA (2010). Neurophysiological changes with age probed by inverse modeling of EEG spectra. *Clinical Neurophysiology* 121(1):21–38.
  28. **Kerr CC**, Rennie CJ, Robinson PA (2009). Deconvolution analysis of target evoked potentials. *Journal of Neuroscience Methods* 179(1):101–110.

29. Clearwater JC, **Kerr CC**, Rennie CJ, Robinson PA (2008). The neural mechanisms of ERP change: combining insights from electrophysiology and mathematical modeling. *Journal of Integrative Neuroscience* 7(4):529–50.
30. **Kerr CC**, Rennie CJ, Robinson PA (2008). Physiology-based modeling of cortical auditory evoked potentials. *Biological Cybernetics* 98(2):171–84.

## BOOKS AND BOOK CHAPTERS

1. Robinson PA, Posnotva S, Abeysuriya RG, Kim JW, Roberts JA, McKenzie-Sell L, Karanjai A, **Kerr CC**, Fung F, Anderson R, Breakspear MJ, Drysdale PM, Fulcher B, Phillips AJK, Rennie CJ, Yin G (2015). A Multiscale “Working Brain” Model. In Brette R, Destexhe A (eds.), *Springer Series in Computational Neuroscience*. Berlin: Springer Verlag.
2. Lytton WW, **Kerr CC** (2013). Computational neuroscience of synapses and neurons. In Pfaff D (ed.), *Neuroscience in the 21<sup>st</sup> Century*. Berlin: Springer Verlag.
3. Neymotin SA, Mathew A, **Kerr CC**, Lytton WW (2013). Computational neuroscience of neural networks. In Pfaff D (ed.), *Neuroscience in the 21<sup>st</sup> Century*. Berlin: Springer Verlag.
4. Wilson DP, Riono P, **Kerr CC**, Kwon JA, Zhang L, Kaldor J, Sutrisna A, Farid MN, Hadi N (2011). *The HIV in Indonesia Model (HIM)*. Jakarta: University of Indonesia Press.

## TECHNICAL REPORTS

1. Kelly S, Shattock A, **Kerr CC**, Gama T, Nhlabatsi N, Zagatti G, Harimurti P, Wilson DP, Gorgens M (2015). *HIV mathematical modelling to support Swaziland's development of its HIV investment case*. The World Bank.
2. Masaki E, Fraser N, Haacker M, Obst M, Wootton R, Sunkutu R, Gorgens M, Gray RT, Shattock A, **Kerr CC**, Wilson DP (2015). *Zambia's HIV response: Prioritised and strategic allocation of HIV resources for impact and sustainability*. The World Bank.
3. Fraser N, Benedikt C, Obst M, Masaki E, Gorgens M, Stuart R, Shattock A, Gray RT, **Kerr CC**, Wilson DP (2014). *Sudan's HIV Response: Value for Money in a Low-Level HIV Epidemic*. The World Bank.
4. Fraser N, Cheikh N, Haacker M, Masaki E, Karamoko D, Gorgens M, Frescura L, Konan C, **Kerr CC**, Gray RT, Shattock A, Wilson DP (2014). *Niger's HIV Response: Targeted Investments for a Healthy Future*. The World Bank.
5. Naning H, **Kerr CC**, Kamarulzaman, Dahlui AM, Ng CW, Wilson DP (2014). *Return on Investment and Cost-Effectiveness of Harm Reduction Programmes in Malaysia*. The World Bank.
6. **Kerr CC**, Wilson DP. (2014). *HIV Investment in Armenia: Analysis & Recommendations*. UNAIDS.
7. Diric P, Hammelmann C, Wilson DP, **Kerr CC** (2014). *HIV Resource Needs, Efficient Allocation and Resource Mobilization for Uzbekistan*. UNDP.
8. Diric P, Hammelmann C, Wilson DP, **Kerr CC** (2014). *HIV Resource Needs, Efficient Allocation and Resource Mobilization for Tajikistan*. UNDP.
9. Wilson DP, Yakusik A, **Kerr CC**, Avila C (2013). *HIV Resource Needs, Efficient Allocation and Resource Mobilization for the Republic of Belarus*. UNAIDS.
10. Wilson DP, Reyes J, **Kerr CC**, Gray RT (2013). *Return on Investment of Needle-Syringe Programs in the Philippines*. The World Bank.

11. Zhang L, Pham QD, Do MH, **Kerr CC**, Wilson DP (2012). *Return on Investment of HIV Prevention in Vietnam: Technical Report*. The World Bank/Vietnam Administration for AIDS Control.
12. Wilson DP, Gray RT, Razali K, Hoare A, Cheah J, **Kerr CC**, Jamaludin A (2012). *Determining Cost-Effective and Efficient Allocation of HIV Resources for the Republic of Armenia*. The World Bank.
13. Wilson DP, Zhang L, **Kerr CC**, Uusküla A, Kwon JA, Hoare A, Sharapka AK, Balabayev T, Yakusik A, Gvozdeva E, Ionascu, Otiashvili GD, Grigoryan T, Soliev A, Williams-Sherlock M, Avila C (2012). *The Cost-Effectiveness of Needle-Syringe Exchange Programs in Eastern Europe and Central Asia: Costing, Data Synthesis, Modeling and Economics for Eight Case Study Countries*. UNAIDS.

## CONFERENCES AND CONFERENCE PROCEEDINGS

1. **Kerr CC**, Dura-Bernal S, Menzies RJ, McLauchlan C, van Albada SJ, Kedziora DJ, Neymotin S, Lytton WW (2016). Computational capacity as a function of network size. *Society for Neuroscience* (poster).
2. McLauchlan C, Kedziora DJ, Menzies R, Dura-Bernal S, **Kerr CC** (2016). Effect of network size on task learning performance. *NeuroEng: Australasian Workshop on Neuro-Engineering and Computational Neuroscience* (poster).
3. Sweeney Z, Kedziora DJ, Dura-Bernal S, **Kerr CC** (2016). Influence of microstimulation on firing rate variability within asynchronous neural networks. *NeuroEng: Australasian Workshop on Neuro-Engineering and Computational Neuroscience* (poster).
4. Dura-Bernal S, Menzies R, McLauchlan C, van Albada SJ, Kedziora D, Neymotin S, Lytton WW, **Kerr CC** (2016). Effect of network size on computational capacity. *Computational Neuroscience* (poster).
5. Dura-Bernal S, Suter BA, Neymotin S, **Kerr CC**, Quintana A, Gleeson P, Shepherd GMG, Lytton WW (2016). NetPyNE: a Python package for NEURON to facilitate development and parallel simulation of biological neuronal networks. *Computational Neuroscience* (poster).
6. Zobaer MS, **Kerr CC**, Robinson PA (2015). Modeling K-complexes and sleep spindles as evoked responses using physiologically based neural field theory. *Worldsleep* (poster).
7. Stuart RM, Turner KF, **Kerr CC** (2015). Function follows form: Relating brain anatomy and physiology to cognition and psychology. *Society for Neuroscience* (poster).
8. **Kerr CC**, Stuart RM, Shattock AT, Kelly SL, Reporter I, Fraser N, Benedikt C, Gorgens M, Wilson DP (2015). Achieving maximal health impact with available resources: balancing the science, economics, and politics of HIV. *World STI & HIV Congress* (talk).
9. Kelly SL, Shattock AJ, **Kerr CC**, Wilson DP, Gama T, Ceesay N, Gorgens M (2015). Optimization HIV investment in Swaziland: Modelling high-impact interventions. *World STI & HIV Congress* (poster).
10. Choi JS, Menzies R, Dura-Bernal S, Francis JT, Lytton WW, **Kerr CC** (2015). Spiking network modeling of neuronal dynamics in individual rats. *Computational Neuroscience* (poster).
11. Dura-Bernal S, **Kerr CC**, Neymotin SA, Suter B, Shepherd G (2015). Large-scale M1 microcircuit model with plastic input connections from biological PMd neurons used for prosthetic arm control. *Computational Neuroscience* (poster).

12. **Kerr CC**, Choi JS, Dura-Bernal S, Francis JT, Lytton WW (2014). One size does not fit all: calibrating microstimulation to individual subjects using spiking network models. *Society for Neuroscience* (poster).
13. Dura-Bernal S, Li K, Brockmeier A, **Kerr CC**, Neymotin SA, Principe JC, Francis JT, Lytton WW (2014). Repairing lesions via microstimulation in a spiking network model driving a virtual arm. *Society for Neuroscience* (poster).
14. **Kerr CC**, Choi JS, Dura-Bernal S, Francis JT, Lytton WW (2014). One size does not fit all: calibrating microstimulation to individual subjects using spiking network models. *Interagency Modeling and Analysis Group Multiscale Modeling Consortium Meeting* (poster).
15. **Kerr CC**, O'Shea DJ, Goo W, Dura-Bernal S, Francis JT, Diester I, Kalanithi P, Deisseroth K, Shenoy K, Lytton WW (2014). Network-level effects of optogenetic stimulation in a computer model of macaque primary motor cortex. *Computational Neuroscience* (poster).
16. **Kerr CC**, Wilson DP, Yakusik A, Avila C (2014). HIV resource needs case studies: Belarus and Armenia. *UNAIDS Induction Workshop on the Investment Approach and Investment Cases for National AIDS Responses in Central Asia and Eastern Europe* (**invited talk**).
17. **Kerr CC**, Wilson DP (2014). Using Optima to optimize resource allocations. *UNAIDS Induction Workshop on the Investment Approach and Investment Cases for National AIDS Responses in Central Asia and Eastern Europe* (**invited talk**).
18. **Kerr CC**, O'Shea DJ, Goo W, Dura-Bernal S, Francis JT, Diester I, Kalanithi P, Deisseroth K, Shenoy K, Lytton WW (2014). Information flow in optogenetically stimulated macaque motor cortex: simulation and experiment. *Neural Control of Movement* (talk).
19. Francis JT, Iordanou J, **Kerr CC**, Lytton WW, von Kraus L (2014). Erasing sensorimotor memories II: The role of PKMzeta dependent LTP in S1 receptive fields and behavior in the experimentally naive rat and primate. *Neural Control of Movement* (talk).
20. **Kerr CC**, O'Shea DJ, Goo W, Dura-Bernal S, Francis JT, Diester I, Kalanithi P, Deisseroth K, Shenoy K, Lytton WW (2014). Network-level effects of optogenetic stimulation: experiment and simulation. *SUNY Downstate Medical Center Research Day* (talk).
21. **Kerr CC**, Pachitariu M, Iordanou J, Francis J, Sahani M, Lytton WW (2014). Low-dimensional dynamics of somatosensory cortex: experiment and simulation. *Computational and Systems Neuroscience* (poster).
22. Dura-Bernal S, Fox C, de Kamps M, Neymotin SA, **Kerr CC**, Francis JT, Shepherd GMG, Lytton WW (2014). Multiscale modeling of cortical microcircuits. *Intelligence Advanced Research Projects Agency (IARPA) Machine Intelligence from Cortical Networks (MICrONS)*.
23. **Kerr CC**, von Kraus L, Iordanou I, Neymotin SA, Francis JT, Lytton WW (2013). Receptive field formation and erasure in somatosensory cortex. *Society for Neuroscience* (poster).
24. **Kerr CC**, van Albada SJ, Neymotin SA, Chadderdon G, Robinson PA, Lytton WW (2013). Multiscale modeling of cortical information flow in Parkinson's disease. *Computational Neuroscience*.
25. Naning H, **Kerr CC**, Kamarulzaman A, Dahlui M, Ng CW, Wilson DP (2013). Return on Investment of HIV Harm Reduction Programmes for Injecting Drug Users in Malaysia. *International AIDS Society*.
26. Eaton JW, Menzies NA, Stover J, Cambiano V, Chindelevitch L, Cori A, Hontelez JAC, Humair S, **Kerr CC**, Klein DJ, Mishra S, Mitchell KM, Nichols BE, Vickerman P, Bärnighausen T, Bershteyn A, Bloom DE, Boily M-C, Chang ST, Cohen T, Dodd PJ, Fraser



- C, Gopalappa C, Lundgren J, Martin NK, Mountain E, Pham QD, Pickles M, Phillips A, Platt L, Pretorius C, Prudden HJ, Salomon JA, van de Vijver DAMC, Wagner BG, White RG, Wilson DP, Zhang L, Bandford J, Meyer-Rath G, Remme M, Revill P, Sangrujee N, Terris-Prestholt F, Doherty M, Easterbrook P, Hirschall G, Hallett TB, on behalf of the HIV Modelling Consortium ART Eligibility Guidelines Working Group (2013). The epidemiological impact and cost-effectiveness of expanded eligibility for and access to adult antiretroviral therapy in South Africa, Zambia, India, and Vietnam: a twelve model analysis. *International AIDS Society*.
27. **Kerr CC**, van Albada SJ, Neymotin SA, Chadderdon G, Robinson PA, Lytton WW (2013). Multiscale modeling of cortical information flow in Parkinson's disease. *Information Processing in Cognition* (**invited talk**).
  28. **Kerr CC**, van Albada SJ, Neymotin SA, Chadderdon G, Robinson PA, Lytton WW (2013). How Parkinson's disease affects cortical information flow: a multiscale model. *NeuroEng: Australian Workshop on Computational Neuroscience* (talk).
  29. **Kerr CC**, van Albada SJ, Neymotin SA, Chadderdon G, Robinson PA, Lytton WW (2012). Wrong on so many levels: Parkinsonism in a multiscale network/field model. *BrainModes* (**invited talk**).
  30. Jansson J, **Kerr CC**, Mallitt KA, Wu J, Gray RT, Wilson DP (2012). Inferring HIV incidence from CD4 at diagnosis: filling the surveillance gap. *Australasian Society for HIV Medicine* (talk).
  31. Hoare A, Gray RT, Razali K, **Kerr CC**, Wilson DP (2012). Optimizing HIV budgets to maximize the impact of HIV prevention programs in an era of reduced funding. *Australasian Society for HIV Medicine* (talk).
  32. Popovic G, Ward J, Wilson DP, **Kerr CC**, Gray RT (2012). An escalating HIV epidemic in Aboriginal and Torres Strait Islander people is unlikely, but vigilance is required. *Australasian Society for HIV Medicine* (talk).
  33. **Kerr CC**, van Albada SJ, Neymotin SA, Chadderdon G, Robinson PA, Lytton WW (2012). Effects of basal ganglia on cortical computation: a hybrid network/neural field model. *Society for Neuroscience* (poster).
  34. Neymotin SA, Chadderdon G, **Kerr CC**, Francis JT, Lytton WW (2012). Reinforcement learning of 2-joint virtual arm reaching in computer model of sensory and motor cortex. *Society for Neuroscience* (poster).
  35. Chadderdon G, Neymotin SA, **Kerr CC**, Francis JT, Lytton WW (2012). Dopamine-based reinforcement learning of virtual arm reaching task in a spiking model of motor cortex. *Society for Neuroscience* (poster).
  36. Neymotin SA, Chadderdon G, **Kerr CC**, Francis JT, Lytton WW (2012). Reinforcement learning of 2-joint virtual arm reaching in motor cortex simulation. *Computational Neuroscience* (poster).
  37. Wilson DP, Zhang L, **Kerr CC**, Uusküla A, Kwon JA, Hoare A, et al. (2012). The cost-effectiveness of needle-syringe exchange programs in Eastern Europe and Central Asia: costing, data synthesis, modelling and economics for eight case study countries. *AIDS* (talk).
  38. Kwon JA, Anderson J, **Kerr CC**, Thein H-H, Zhang L, Iversen J, Dore GJ, Kaldor JM, Law MG, Maher L, Wilson DP (2012). Estimating the cost-effectiveness of needle-syringe programs in Australia. *AIDS* (poster).

39. Kwon JA, **Kerr CC**, Zhang L, Riono P, Farid MN, Sutrisna A, Hadi N, Wilson DP (2012). Estimating the population benefits of achieving universal coverage of antiretroviral therapy (ART) in Indonesia. *AIDS* (poster).
40. Chadderdon GL, Neymotin SA, **Kerr CC**, Francis JT, Lytton WW (2012). Dopamine-based reinforcement learning of virtual arm reaching task in a spiking model of motor cortex. *International Conference on Cognitive and Neural Systems 16* (poster).
41. Lytton WW, Neymotin SA, Chadderdon GL, **Kerr CC**, Francis JT (2012). Reinforcement learning of 2-joint virtual arm reaching in detailed cortex simulation. *Neural Control of Movement* (poster).
42. Schneider K, **Kerr CC**, Hoare A, Wilson DP (2011). Expected epidemiological impacts of introducing an HIV vaccine in Thailand: a model-based analysis. *Australasian Society for HIV Medicine* (poster).
43. **Kerr CC**, Neymotin SA, Mo J, Schroeder CE, Ding M, Lytton WW (2011). Interlaminar feedback connections dominate in macaque inferotemporal cortex: in vivo and in silico studies. *Society for Neuroscience* (poster).
44. Neymotin SA, **Kerr CC**, Francis JT, Lytton WW (2011). Attentional modulation of receptive fields in a computer model of the thalamocortical system. *Society for Neuroscience* (poster).
45. Neymotin SA, **Kerr CC**, Chadderdon G, Francis JT, Lytton WW (2011). Restoring physiological oscillations using neuroprosthetic spike-timing-dependent plasticity in computer model of neocortex. *Society for Neuroscience* (poster).
46. Schneider K, Hoare A, **Kerr CC**, Wilson DP (2011). Expected epidemiological impacts of introducing an HIV vaccine in Thailand: a model-based analysis. *10<sup>th</sup> International Congress on AIDS in Asia and the Pacific* (poster).
47. Neymotin SA, **Kerr CC**, Fietkiewicz CT, Chadderdon GL, Lytton WW (2011). Spike-timing-dependent plasticity and subcortical waves enhance alpha oscillations in a computer model of neocortex. *Neuroinformatics* (poster).
48. **Kerr CC**, Mo J, Neymotin SA, Ding M, Lytton WW (2011). Interlaminar Granger causality and alpha oscillations in a model of macaque cortex. *Computational Neuroscience* (poster).
49. **Kerr CC**, Fietkiewicz C, Chadderdon G, Neymotin SA, Lytton WW (2010). Development of In Silico Brain for DARPA REPAIR project. *DARPA Neural Science, Engineering, and Technology Meeting* (poster).
50. Robinson PA, Kim JW, **Kerr CC** (2010). Spatiotemporal characteristics of brain activity in attention-deficit hyperactivity children. *Human Brain Mapping* (poster).
51. **Kerr CC**, Kemp AH, Rennie CJ, Robinson PA (2010). Modeling evoked potentials in clinical depression. *Human Brain Mapping* (poster).
52. **Kerr CC**, Kemp AH, Rennie CJ, Robinson PA (2010). Thalamocortical changes in clinical depression probed by deconvolution and physiology-based modeling. *Computational and Systems Neuroscience* (poster)
53. **Kerr CC**, Rennie CJ, Robinson PA, Clearwater JC (2008). Physiology-based modeling and analysis of auditory evoked potentials. *Forum for European Neuroscience* (poster).
54. **Kerr CC** (2007). A novel method for analyzing target evoked potentials. *University of Sydney MedPhys* (talk).

55. **Kerr CC** (2006). Biophysical modeling of auditory evoked potentials. *University of Sydney MedPhys* (**invited talk**).
56. **Kerr CC**, Rennie CJ, Robinson PA (2006). Biophysical modeling of auditory evoked potentials. *Kolling Institute Annual Scientific Research Meeting* (poster).
57. **Kerr CC**, Rennie CJ, Robinson PA (2006). Physiology-based modeling and quantification of evoked response potentials. *Queensland Brain Institute Workshop on Mathematical and Computational Neuroscience* (poster).

## NON-CONFERENCE INVITED TALKS

1. School of Physics, University of Sydney (“Colloquium”, May 2016)
2. Kirby Institute, University of New South Wales (“Seminar Series”, February 2012)
3. Woolcock Institute of Medical Research (July 2010)
4. School of Physics, University of Sydney (“Complex Systems Seminar”, June 2010)
5. University of Sydney High Achievers’ Afternoon Tea (January 2010)
6. Brain Dynamics Centre, Westmead Hospital (June 2007, April 2008)
7. School of Physics, University of Sydney (“Colloquium”, August 2007)

## COMPETITIVE GRANTS

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1. **Kerr CC** (2014–2018). *The forest and the trees: How global brain rhythms facilitate local information processing*. Australian Research Council (ARC) Discovery Early Career Research Fellowship DE140101375 (AU\$570,360 total, including AU\$395,220 from the ARC and AU\$175,140 from the University of Sydney).
  - This is the most competitive support scheme for early-career researchers in Australia, with a success rate of 13.6%; it has been described by one Australian academic as “some of the toughest money to win – worldwide” (<http://theconversation.com/centuries-wasted-applying-for-grants-13111>).
2. Murphy T, Wheatland M, O’Byrne J, **Kerr CC** (2016–2017). *Introduction to Numerical Computing: Stock market crashes, rocket explosions and other catastrophes*. University of Sydney Open Learning Environment Strategic Education Grant 16042 (AU\$11,600).
  - The aim of this small grant is to develop a new online teaching module for the University of Sydney. As the current course coordinator for COSC1003 *Introduction to Computational Science*, I advised on the content of this teaching module and will help guide its development.
3. Wilson DP, Gray RT, Zhang L, **Kerr CC** (2015–2017). *Optimizing the allocation of resources in response to HIV/AIDS epidemics*. National Health and Medical Research Council (NHMRC) Project Grant APP1086540 (AU\$702,353).
  - I developed the software and optimization algorithm that together form the technical basis of this project; my role is to provide the technical guidance for this project.

4. Wilson DP, McBryde E, **Kerr CC**, Marks G, Makrides M, Middleton P, Trauer J, Reporter I, Ford B, Wood J, Stuart RM, Abeysuriya R, Kedziora D, Killedar M, Petravic J, Kelly S, Shattock A, Lassi Z, Razali K, Grantham K, Hussein A, Scott N, Doan T, Denholm J (2015-2016). *Expanding the Optima Model to TB and Health, and for Applying the Model in Different Contexts*. World Bank Assignment (US\$583,798).
  - I led the technical and modeling component of this grant, which is an extension of the previous World Bank contract.
5. Wilson DP, Zhang L, Gray RT, **Kerr CC**, Hoare A, Reyes J, Schneider K, Pham Q, Razali K, Chow E, Kwon JA, Anh D, Heymer K, Zhuang X, Farr C, Tapia M (2011–2015). *Cost-effectiveness of HIV prevention responses in Asia*. World Bank Assignment 1045478 (US\$3,488,404).
  - I had the lead role developing the modeling component of this contract (roughly 30% of the total).
6. State University of New York Downstate Medical Center (2012–2014). *Creating the synthetic brain through hybrid computational and biological systems: repairing and replacing neural networks*. Defense Advanced Research Projects Agency (DARPA) Contract N66001-10-C-2008 Phase II (US\$6,063,148).
  - No investigators were explicitly named on this contract, but I had the lead role in developing and writing the biomimetic modeling component (roughly 10% of the total), so I would likely have been listed as a co-investigator if any had been named.

## PERSONAL GRANTS, SCHOLARSHIPS, AND AWARDS

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- ❖ Winner, BRAINnet Challenge (2010)
  - Prize awarded for “the most innovative or pragmatic analysis method for evoked potential data from subjects with attention-deficit hyperactivity disorder”; the method received national media attention, including from the *Sydney Morning Herald* and Channel Ten’s *7PM Project*.
- ❖ Westmead Millennium Foundation Stipend Enhancement Grant (2008–2009)
- ❖ Forum for European Neuroscience Travel Grant (2008)
- ❖ Denison Award (2008)
- ❖ Postgraduate Research Support Scheme Travel Grant (2006, 2008)
- ❖ Australian Postgraduate Award (2006–2009)
- ❖ University of Queensland Dean’s Commendation for Academic Excellence for every semester (i.e., semesters 1 and 2 of 2002, 2003, and 2004)
- ❖ International House Academic Achievement Award (2003)

## IT EXPERIENCE

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- ❖ Lead developer, *Optima* (2014–present)
  - Python- and JavaScript-based software package for forecasting and analyzing HIV epidemics, along with optimally allocating HIV resources; further details available from [www.optimamodel.com](http://www.optimamodel.com).

- ❖ Lead developer, *HIV in Indonesia Model* (2010–2012), *Cambodian HIV Evaluation Model* (2011), and *Prevtool* (2012–2014)
  - Interactive, MATLAB-based software packages for analyzing, forecasting, and visualizing HIV epidemics in Indonesia, Cambodia, and Eurasia, respectively.
- ❖ Languages: Python and MATLAB (including parallel computing and graphical user interface design in each), C/C++ (familiar, but not expert level), NEURON, IDL, shell scripting
- ❖ Web design and hosting: HTML, PHP, CSS, and JavaScript (example designs include [www.cliffkerr.com](http://www.cliffkerr.com), [www.thekerrlab.com](http://www.thekerrlab.com), [www.cingulate.com.au](http://www.cingulate.com.au), and [www.optimamodel.com](http://www.optimamodel.com)); Apache and FTP server setup and administration
- ❖ Operating systems: Linux and Windows (plus basic familiarity with Apple)
- ❖ Programs: LaTeX, Emacs, version control (Mercurial, Git), Message Passing Interface (MPI), Microsoft Office (Word, Excel, PowerPoint), image and sound editing software (Photoshop, Illustrator, Inkscape, Goldwave, and others)

## ACADEMIC SERVICE

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- ❖ Reviewer for the following journals: *AIDS*, *Brain Research*, *Communications in Nonlinear Science and Numerical Simulation*, *Epilepsy Research*, *Journal of Neural Engineering*, *Journal of the International AIDS Society*, *Journal of Neurophysiology*, *Journal of Neuroscience Methods*, *The Lancet Global Health*, *Mathematical Biosciences*, *Physical Review E*, *PLOS Computational Biology*, *PLOS ONE*
- ❖ Reviewer for the Wellcome Trust (2016–present)
- ❖ Reviewer for the Australian Research Council (2015–present)
- ❖ Member, Physics Equity and Access Committee, University of Sydney (2014–present)
- ❖ Abstract reviewer for the *Computational Neuroscience* conference (2013–present)
- ❖ Program Committee member, *Workshop on Information Processing in Cognition*, Sydney (2013)

## MUSIC QUALIFICATIONS, AWARDS, AND EXPERIENCE

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*Recordings, scores, and further information available from [www.cliffkerr.com](http://www.cliffkerr.com).*

### QUALIFICATIONS

- ❖ **Diploma of Arts in Music** (with merit), Sydney Conservatorium of Music (2006–2008)
  - Courses included composition, classical and jazz piano performance, and conducting; teachers included Winsome Evans, Anne Boyd, and Damien Ricketson.
  - I received the highest possible mark (99/99) for Anne Boyd’s course MUSC2614, “Composition Workshop”; to my knowledge, this was the first time that mark was given.
- ❖ **Licentiate Diploma of Music** (piano), Australian Music Examinations Board (2003)
  - This is the second-highest qualification awarded by the Australian Music Examinations Board, and is considered to be roughly equivalent to a master’s degree in piano performance.
- ❖ **Associate Diploma of Music** (piano), Australian Music Examinations Board (2001)

## AWARDS

- ❖ Highly commended, Queensland Piano Competition (2003)
- ❖ First prize, Miriam Hyde Composer-Pianist Award (2002)
- ❖ Pi Beta Phi Award, Mackay Eisteddfod (2001)

## EXPERIENCE

- ❖ Composer and pianist, *Skulptoriui Vincui Grybui 125 metai*, Jurbarkas, Lithuania (2015)
  - I performed a program of my works and other contemporary music with the cellist Harry Buckoke at a conference held to celebrate the 125<sup>th</sup> anniversary of the birth of Vincas Grybas, Lithuania's most famous sculptor, who was my great-great uncle.
- ❖ Composer and pianist, *Spectrum Concert Series*, New York City (2014)
  - I was invited to perform a full-length concert of my compositions at Spectrum – according to the *New York Times*, “Next to Carnegie Hall, perhaps, there might be no finer public space in which to hear a piano recital in New York than Spectrum.”
- ❖ Artistic Director, Birubi Concert (2011–2013)
  - This position involved concert planning for a new organization dedicated to showcasing young classical performers; see [www.birubiconcert.org](http://www.birubiconcert.org) for more information.
- ❖ Composer, *When the Poet Met Music*, The Independent Theatre, Sydney (2013)
- ❖ Composer-in-Residence, Sydney Camerata Chamber Orchestra (2010)
  - For this position, I wrote a large-scale new work that was performed and later recorded by an 18-member string orchestra.
- ❖ Composer and pianist, *Cliff Kerr in Recital*; Sydney, Brisbane, and Mackay (2009–2010)
  - I performed a series of five piano recitals to raise money for various charitable causes, including the Cancer Council and World Animal Protection.
- ❖ Accompanist, Australian Youth Choir Performing Arts School, Sydney (2006–2007, 2010)
- ❖ Chorister and bass soloist, *John Dowland: Our Contemporary*, University of Sydney (two performances in 2010)
- ❖ Pianist and composer, *Music and the Cosmos*, Sydney Conservatorium of Music (2007) and the University of Sydney (2009)
- ❖ Conductor and composer, *Music Talks Peace*, University of Sydney (2006, 2008)
- ❖ President and conductor, Sydney University Madrigal Society (2007)
  - This position involved directing all financial, administrative, and artistic decisions, as well as conducting rehearsals and performances, for a choir of about 40 members.

## PERSONAL

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- ❖ Notable media appearances and interviews:
  - University of Sydney *World: USA and Canada* magazine (inaugural issue, 02/2011, p. 25)
  - Channel 10's *7PM Project* (national Australian TV; aired 30/06/2010)
  - *Sydney Morning Herald* (New South Wales' leading newspaper; 03/06/2010, p. 19)
  - University of Sydney *UniNews* (21/09/2007, cover story)
  - Channel 7's *Today Tonight* (national Australian TV; aired 02/07/2007)

- ❖ Acknowledged in the following papers:
  - Dura-Bernal S, Li K, Neymotin SA, Francis JT, Principe JC and Lytton WW (2016). Restoring behavior via inverse neurocontroller in a lesioned cortical spiking model driving a virtual arm. *Frontiers in Neuroscience (Neuroprosthetics)* **10**:28.
  - Dura-Bernal S, Zhou X, Neymotin SA, Przekwas A, Francis JT, Lytton WW (2015). Cortical spiking network interfaced with virtual musculoskeletal arm and robotic arm. *Frontiers in Neurobotics* **9**:13.
  - Blumson B (2015). Story size. *Philosophical Papers* **44**(2):121–137.
  - Blumson B (2014). A Never-Ending Story. *Croatian Journal of Philosophy* **16**:111–120.
  - Aquino KM, Robinson PA, Schira MM, Breakspear M (2014). Deconvolution of neural dynamics from fMRI data using a spatiotemporal hemodynamic response function, *NeuroImage* **14**:203–215.
  - Neymotin SA, Lee H, Park E, Fenton AA, Lytton WW (2011). Emergence of physiological oscillation frequencies in a computer model of neocortex. *Frontiers in Computational Neuroscience* **5**:19.
- ❖ Dual Australian-American citizen
- ❖ Hilariously elementary proficiency in Russian, Spanish, French, and Lithuanian (50–200 word vocabulary in each)
- ❖ Black belt in martial arts (Yun Jung Do)
- ❖ *h*-index: 12
- ❖ Erdős-Bacon number: 8 (me → Bill Lytton → Henry Markram → Wolfgang Maass → Noga Alon → Paul Erdős = 5; me → Andrew Rochford → Dave Hughes → Kevin Bacon = 3)

*Last updated: October 17<sup>th</sup>, 2016*