Dr. Geoffrey J. Goodhill

Associate Professor

Queensland Brain Institute & School of Mathematics and Physics
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Education & Training

B.Sc. (1983-1986) Joint Honours Mathematics and Physics, University of Bristol.

M.Sc. (1987-1988) Artificial Intelligence, University of Edinburgh. Thesis supervised by Professor David J. Willshaw: “Application of the Elastic Net Algorithm to the Formation of Ocular Dominance Stripes”.

Ph.D. (1988-1992) Cognitive Science, University of Sussex. Thesis supervised by Professor Harry G. Barrow: “Correlations, Competition and Optimality: Modelling the Development of Topography and Ocular Dominance”.

Postdoc (1992-1994) Cognitive Science / Neuroscience, University of Edinburgh. Theoretical work with Professor David J. Willshaw, experimental work with Dr. David J. Price.

Postdoc (1994-1995) Neuroscience, Baylor College of Medicine, with Professor P. Read Montague.

Postdoc (1995-1996) Neuroscience, Salk Institute (Sloan Center for Theoretical Neurobiology). Theoretical work with Professor Terry J. Sejnowski, experimental work with Professor Dennis D.M. O’Leary.

Professional Experience

Assistant Professor (1996-1999) Georgetown Institute for Cognitive and Computational Sciences / Department of Neurology, Georgetown University Medical Center.

Assistant Professor (1999-2001) Department of Neuroscience, Georgetown University Medical Center.

Associate Professor (2001-2004) Department of Neuroscience, Georgetown University Medical Center.

Associate Professor (2005-present) Queensland Brain Institute & School of Mathematics and Physics, The University of Queensland.

Honours and Awards

1988 Rank Xerox Prize for best M.Sc. thesis in School of Information Technology at Edinburgh University (out of approximately 100 students).

1992-1994 Medical Research Council (UK) Postdoctoral Training Fellowship.

1999 Nominated by Georgetown University for Howard Hughes Investigator position in Computational Biology.

2004 Nominated by Georgetown University for Howard Hughes Investigator position.

Editorial responsibilities

2005-present Editor-in-Chief of *Network: Computation in Neural Systems* (Informa).

2006-2008: Editorial Board member for *Debates in Neuroscience* (Springer).

Research Grants

Current

ARC grant DP0878939, “A new theory for retinotectal map formation”, AU$230,000 (1/08 - 12/10). CI: Geoffrey Goodhill.

NHMRC grant 456003, “ The dynamics of gradient sensing by growth cones: timelapse imaging and mathematical modelling”, AU$468,000 (1/07 - 12/09). CI: Geoffrey Goodhill.

NHMRC grant 525459, “ Studying development of the visual brain”, AU$468,000 (1/09 - 12/11). co-CI (CI: Michael Ibbotson).

HFSP grant RPG0029/2008-C, “Self-organized wiring of the cerebral cortex through thalamocortical growth cones: an integrated approach”, US$1.3M (9/08 - 8/10). co-CI (CI: Guillermina Lopez-Bendito).

ARC/NHMRC grant TS0669699, “Thinking Systems: Navigating Through Real and Conceptual Spaces”, AU$3.3M (7/06 - 6/11). co-CI (CI: Janet Wiles).

ARC/NHMRC grant TS0669860, “Optimizing autonomous system control with brain-like hierarchical control systems”, AU$3.3M (7/06 - 6/11). co-CI (CI: Michael Breakspear).

Previous

ARC grant DP0666126, “Wiring up the nervous system: how do axons detect molecular gradients?”, AU$450,000 (1/06 - 12/08). CI: Geoffrey Goodhill.

NIH grant R01 MH073357, subcontract, “Spontaneous activity, lateral interactions and cortical maps”, approx US$1.5M total (7/04 - 6/08). co-PI (PI: Kwabena Boahan).

NIH grant R03 EY014555, “Mechanisms of retinotectal map development”, US$349,200 total (3/03 - 1/05). PI: Geoffrey Goodhill.

NIH grant R01 NS046059, “Mechanisms of axonal gradient detection”, US$714,798 total (9/02 - 8/05) PI: Geoffrey Goodhill.

NSF grant BITS 0130822, “Epigenetic computers: an in vitro, in abstractio, and in silico study”, approx. US$1.0M total (10/01 - 9/04, 5% effort). co-PI (PI: Kwabena Boahan).

Whitaker Foundation grant, “The generation of precisely controlled chemical gradients for axon guidance”, US$239,725 total (12/00 - 11/03). PI: Jeffrey Urbach.

NIH grant R21 NS39354, “Precisely controlled gradients for axon guidance”, US$228,744 total (2/00 - 1/03). PI: Geoffrey Goodhill.

NIH grant R01 EY12544, “The Development and Structure of Visual Cortical Maps”, US$529,164 total (10/99 - 9/04) PI: Geoffrey Goodhill.

NIH grant R55RR13342, “Precisely controlled gradients for axon guidance”, US$100,000 total (10/98 - 1/00). PI: Geoffrey Goodhill.

NSF grant IBN-9808364, “The Development and Structure of Visual Cortical Maps”, US$66,298 total (1/98 - 9/99). PI: Geoffrey Goodhill.

DoD grant DAMD17-93-V-3018, “Georgetown Institute for Cognitive and Computational Sciences” (10/96 - 9/01). Institutional PI: Alan I. Faden.

Publications

Original papers and reviews in refereed journals

38. Hunt, J.J., Giacomantonio, C.E., Tang, H., Mortimer, D., Jaffer, S., Vorobyov, V., Ericksson, G., Sengpiel, F. & Goodhill, G.J. (2008). Abnormal visual input during development does not alter the co-circularity statistics of orientation maps in visual cortex. *Neuroimage*, in press.

37. Rosoff, W.J., McAllister, R.G., Goodhill, G.J. & Urbach, J.S. (2009). Quantitative Studies of Neuronal Chemotaxis in 3D. *Methods in Molecular Biology*, in press.

36. Simpson, H., Mortimer, D. & Goodhill, G.J. (2009). Theoretical models of neural circuit development. *Current Topics in Developmental Biology*, in press.

35. Pujic, Z., Mortimer, D., Feldner, J. & Goodhill, G.J. (2009). Assays for Eukaryotic Cell Chemotaxis. *Combinatorial Chemistry and High-throughput Screening*, in press.

34. Pujic, Z., Giacomantonio, C.E., Unni, D., Rosoff, W.J. & Goodhill, G.J. (2008). Analysis of the growth cone turning assay for studying axon guidance. *J. Neurosci. Meth.*, **170**, 220-228.

33. Mortimer, D., Fothergill, T., Pujic, Z., Richards, L.J. & Goodhill, G.J. (2008). Growth cone chemotaxis. *Trends Neurosci.*, **31**, 90-98.

32. Goodhill, G.J. (2007). Contributions of theoretical modelling to the understanding of neural map development. *Neuron*, **56**, 301-311.

31. Giacomantonio, C.E. & Goodhill, G.J. (2007). The Effect of Angioscotomas on Map Structure in Primary Visual Cortex. *J. Neurosci.*, **27**, 4935-4946.

30. Goodhill, G.J. & Xu, J. (2005). The development of retinotectal maps: a review of models based on molecular gradients. *Network*, **16**, 5-34.

29. Xu, J., Rosoff, W.J., Urbach, J,S. & Goodhill, G.J. (2005). Adaptation is not required to explain the long-term response of axons to molecular gradients. *Development*, **132**, 4545-4552.

28. Rosoff, W.J, McAllister, R.G., Esrick, M.A., Goodhill, G.J. & Urbach, J.S. (2005). Generating controlled molecular gradients in 3D gels. *Biotechnology and Bioengineering*, **91**, 754-759.

27. Carreira-Perpiñán, M. Á., Lister, R. & Goodhill, G.J. (2005). A computational model for the development of multiple maps in primary visual cortex. *Cerebral Cortex*, **15**, 1222-33.

26. Carreira-Perpiñán, M.Á. & Goodhill, G.J. (2004). The influence of lateral connections on the structure of cortical maps. *Journal of Neurophysiology*, **92**, 2947-2959.

25. Goodhill, G.J., Gu, M. & Urbach, J.S. (2004). Predicting axonal response to molecular gradients with a computational model of filopodial dynamics. *Neural Computation*, **16**, 2221-2243.

24. Rosoff, W.J., Urbach, J.S., Esrick, M., McAllister, R.G., Richards, L.J. & Goodhill, G.J. (2004). A new chemotaxis assay shows the extreme sensitivity of axons to molecular gradients. *Nature Neuroscience*, **7**, 678-682.

23. Goodhill, G.J. (2003) A theoretical model of axon guidance by the robo code. *Neural Computation*, **15**, 549-564.

22. Carreira-Perpiñán, M. Á. & Goodhill, G.J. (2002). Are visual cortex maps optimized for coverage? *Neural Computation*, **14**, 1545-1560.

21. Haese, K. & Goodhill, G.J. (2001). Auto-SOM: Recursive parameter estimation for guidance of self-organizing feature maps. *Neural Computation*, **13**, 595-619.

20. Goodhill, G.J. & Cimponeriu, A. (2000). Analysis of the elastic net model applied to the formation of ocular dominance and orientation columns. *Network*, **11**, 153-168.

19. Goodhill, G.J. (2000). Dating behavior of the retinal ganglion cell. *Neuron*, **25**, 501-503.

18. Cimponeriu, A. & Goodhill, G.J. (2000). Dynamics of cortical map development in the elastic net model. *Neurocomputing*, **32**, 83-90.

17. Goodhill, G.J. & Richards, L.J. (1999). Retinotectal maps: molecules, models, and misplaced data. *Trends in Neurosciences*, **22**, 529-534.

16. Goodhill, G.J. & Urbach, J.S. (1999). Theoretical analysis of gradient detection by growth cones. *Journal of Neurobiology*, **41**, 230-241.

15. Urbach, J.S. & Goodhill, G.J. (1999). Limitations on detection of gradients of diffusible chemicals by axons. *Neurocomputing*, **26-27**, 39-43.

14. Goodhill, G.J. (1998). The influence of neural activity and intracortical interactions on the periodicity of ocular dominance stripes. *Network*, **9**, 419-432.

13. Goodhill, G.J. (1998). Mathematical guidance for axons. *Trends in Neurosciences*, **21**, 226-231.

12. Goodhill, G.J. & Baier, H. (1998). Axon guidance: stretching gradients to the limit. *Neural Computation*, **10**, 521-527.

11. Goodhill, G.J. (1997). Stimulating issues in cortical map development. *Trends in Neurosciences*, **20**, 375-376.

10. Goodhill, G.J. & Sejnowski, T.J. (1997). A unifying objective function for topographic mappings. *Neural Computation*, **9**, 1291-1304.

9. Goodhill, G.J. (1997). Diffusion in axon guidance. *European Journal of Neuroscience*, **9**, 1414-1421.

8. Goodhill, G.J., Bates, K.R. & Montague, P.R. (1997). Influences on the global structure of cortical maps. *Proceedings of the Royal Society, Series B*, **264**, 649-655.

7. Goodhill, G.J. & Löwel, S. (1995). Theory meets experiment: correlated neural activity helps determine ocular dominance column periodicity. *Trends in Neurosciences*, **18**, 437-439.

6. Goodhill, G.J., Simmen, M., & Willshaw, D.J. (1995). An evaluation of the use of Multidimensional Scaling for understanding brain connectivity. *Phil. Trans. Roy. Soc. Lond. B*, **348**, 265-280.

5. Simmen, M., Goodhill, G.J. & Willshaw, D.J. (1994). Scaling and brain connectivity. *Nature*, **369**, 448-450.

4. Goodhill, G.J. & Willshaw, D.J. (1994). Elastic net model of ocular dominance: Overall stripe pattern and monocular deprivation. *Neural Computation*, **6**, 615-621.

3. Goodhill, G.J. & Barrow, H.G. (1994). The role of weight normalization in competitive learning. *Neural Computation*, **6**, 255-269.

2. Goodhill, G.J. (1993). Topography and ocular dominance: a model exploring positive correlations. *Biological Cybernetics*, **69**, 109-118.

1. Goodhill, G.J. & Willshaw, D.J. (1990). Application of the elastic net algorithm to the formation of ocular dominance stripes. *Network*, **1**, 41-59.

Book Chapters

8. Mortimer D. & Goodhill, G.J. (2009). Axonal Pathfinding. In: Squire LR (ed.) *Encyclopedia of Neuroscience*, **1**, 1133-1138. Oxford: Academic Press.

7. Goodhill, G.J. & Urbach, J.S. (2003). Axon guidance and gradient detection by growth cones. In "Modeling Neural Development", ed. Arjen Van Ooyen, MIT Press, 95-109.

6. Goodhill, G.J. (2002). Development of retinotectal maps, in "The Handbook of Brain Theory and Neural Networks", 2nd edition, ed. Michael Arbib, MIT Press, 335-339.

5. Goodhill, G.J. (2002). Axonal path finding, in "The Handbook of Brain Theory and Neural Networks", 2nd edition, ed. Michael Arbib, MIT Press, 140-143.

4. Goodhill, G.J. & Carreira-Perpiñán, M. Á. (2002). Cortical columns. *Encyclopedia of Cognitive Science*, Macmillan, **1**, 845-851.

3. Goodhill, G.J. (2002). Models of neural development. *Encyclopedia of Cognitive Science*, Macmillan, **3**, 261-267.

2. Goodhill, G.J. (2002). Neural development: mechanisms and models. *International Encyclopedia of the Social and Behavioral Sciences*, Elsevier, 10522-10526.

1. Goodhill, G.J. & Carreira-Perpiñán, M. Á. (2002). Development of columnar structure in primary visual cortex. In "Computational Neuroanatomy: Methods and Principles", ed. Georgio Ascoli, Humana Press, 337-357.

Refereed Conference Proceedings Papers

13. Carreira-Perpiñán, M.Á, Dayan, P. & Goodhill, G.J. (2005). Differential priors for elastic nets. M. Gallagher, J. Hogan, F. Maire (Eds.): IDEAL 2005, Lecture Notes in Computer Science 3578, 335-342, 2005.

12. Goodhill, G.J. (1998). Gradients for retinotectal mapping. *Advances in Neural Information Processing Systems*, **10**, M.I. Jordan, M.J. Kearns & S.A. Solla, eds, MIT Press, 152-158.

11. Goodhill, G.J. (1998). A mathematical model of axon guidance by diffusible factors. *Advances in Neural Information Processing Systems*, **10**, M.I. Jordan, M.J. Kearns & S.A. Solla, eds, MIT Press, 159-165.

10. Goodhill, G.J. & Sejnowski, T.J. (1997). Objective functions for topography: a comparison of optimal maps. In *Proceedings of the Fourth Neural Computation and Psychology Workshop: Connectionist Representations*, eds. John A. Bullinaria, David G. Glasspool & George Houghton (1997). London: Springer-Verlag.

9. Goodhill, G.J. and Sejnowski, T.J. (1996) Quantifying neighbourhood preservation in topographic mappings. In: *Proceedings of the 3rd Joint Symposium on Neural Computation*, University of California, San Diego and California Institute of Technology, Vol. 6, Pasadena, CA: California Institute of Technology, 61-82.

8. Goodhill, G.J., Finch, S. & Sejnowski, T.J. (1996). Optimizing cortical mappings. *Advances in Neural Information Processing Systems*, **8**, eds. David S. Touretzky, Michael C. Mozer & Michael E. Hasselmo, MIT Press: Cambridge, MA, 330-336.

7. Goodhill, G.J., Finch, S., & Sejnowski, T.J. (1995). A unifying measure for neighbourhood preservation in topographic mappings. In: *Proceedings of the 2nd Joint Symposium on Neural Computation*, University of California, San Diego, and California Institute of Technology, Vol. 5, 191-202, Institute for Neural Computation, La Jolla, CA.

6. Zamora-Ramos, C. & Goodhill, G.J. (1994). A neural computation: spatial to temporal transformation. In *Information Processing Underlying Gaze Control*, eds. J.M. Delgado-Garcia, E. Godaux and P.-P. Vidal, 125-137, Pergamon.

5. Aguilar-Chongtay, R., Goodhill, G.J. & Hayes, G. (1993). Exploración empírica de un modelo de desarrollo de columnas de dominancia ocular. *Memorias de Reunión Nacional de Inteligencia Artificial, México, 1993*.

4. Goodhill, G.J. (1993). Topography and Ocular Dominance with Positive Correlations. *Advances in Neural Information Processing Systems*, **5**, eds. C.L. Giles, S.J. Hanson and J.D. Cowan, Morgan Kaufman, San Mateo, CA.

3. Dayan, P.S. & Goodhill, G.J. (1992). Perturbing Hebbian rules. *Advances Neural Information Processing Systems*, **4**, 19-26, eds. J.E. Moody, S.J. Hanson and R.P. Lippman, Morgan Kaufman, San Mateo, CA.

2. Goodhill, G.J. (1991). Topography and ocular dominance can arise from distributed patterns of activity. *Proceedings of the International Joint Conference on Neural Networks, Seattle, 1991*, **II**, 623-627.

1. Goodhill, G.J. (1990). The development of topography and ocular dominance. *Proceedings of the 1990 Connectionist Models Summer School*, 338-349, eds. D.S. Touretzky, J.L. Elman, T.J. Sejnowski, and G.E. Hinton, Morgan Kaufman, San Mateo, CA.

Book Reviews

6. Goodhill, G.J. (2006). Review of "Computational Maps in the Visual Cortex" by R. Miikkulainen, J.A. Bednar, Y. Choe & J. Sirosh, Springer, 2005. *IEEE Computational Intelligence Magazine*, **1**, 54-55.

5. Goodhill, G.J. (2006). Review of "Computational Maps in the Visual Cortex" by R. Miikkulainen, J.A. Bednar, Y. Choe & J. Sirosh, Springer, 2005. *Clinical and Experimental Ophthalmology*, **34**, 705-706.

4. Chitnis, A. & Goodhill, G.J. (2001). Molecules, magnets and mathematics. Review of "Signs of Life: How Complexity Pervades Biology" by R. V. Sole & B. Goodwin, Basic Books, 2001. *Cell*, **105**, 328-329.

3. Richards, L.J. & Goodhill, G.J. (2001). Cortical construction: from molecules to models. Review of "Mechanisms of Cortical Development" by D.J. Price & D.J. Willshaw, Oxford, 2000. *Nature Neuroscience*, **4**, 13.

2. Goodhill, G.J. (1998). Integrating neural functions. Review of "Neural Organization: Structure, Function and Dynamics" by M.A. Arbib, P. Érdi & J. Szentágothai, MIT Press, 1998. *Neuron*, **20**, 833-834.

1. Goodhill, G.J. (1996). Review of "How we learn; how we remember: towards an understanding of brain and neural systems. Selected papers of Leon N. Cooper", World Scientific Publishing Co Ltd, 1995. *Journal of Chemical Neuroanatomy*, **11**, 284-285.

Technical Reports

3. Goodhill, G.J., Finch, S. & Sejnowski, T.J. (1995). Quantifying neighbourhood preservation in topographic mappings. Institute for Neural Computation Technical Report Series, No. INC-9505, November 1995.

2. Goodhill, G.J., Simmen, M., & Willshaw, D.J. (1994). An evaluation of the use of Multidimensional Scaling for understanding brain connectivity. Edinburgh University Centre for Cognitive Science Research Paper EUCCS / RP-63.

1. Goodhill, G.J. (1992). Correlations, Competition and Optimality: Modelling the Development of Topography and Ocular Dominance. Cognitive Science Research Paper CSRP 226, University of Sussex.

Abstracts

23. Mortimer, D., Dayan, P., Burrage, K. & Goodhill, G.J. (2009). A Bayesian model of chemotaxis. *ANZIAM 45th Applied Mathematics Conference*, Caloundra, QLD, February 2009.

22. Hunt, J.J., Giacomantonio, C.E., Tang, H., Mortimer, D., Jaffer, S., Vorobyov, V., Ericksson, G., Sengpiel, F. & Goodhill, G.J. (2008). Abnormal visual input during development does not alter the co-circularity statistics of orientation maps in visual cortex. *Society for Neuroscience abstracts*, Program No. 724.12.

21. Vaughan, T., Mortimer, D., Feldner, J., Vetter, I., Pujic, Z., Rosoff, W.J., Burrage, K., Dayan, P., Richards, L.J. & Goodhill, G.J. (2008). Signal-to-noise ratio is a key determinant of the response of axons to molecular gradients. *Society for Neuroscience abstracts*, Program No. 26.1.

20. Pujic, Z., Giacomantonio, C.E., Unni, D., Rosoff, W.J. & Goodhill, G.J. (2007). Analysis of the growth cone turning assay for studying axon guidance. *Society for Neuroscience abstracts*, Program No. 33.11.

19. Hunt, J.J., Smith, D.H., Mortimer, D., Giacomantonio, C.E., Tang, H., Ericksson, G., Sengpiel, F. & Goodhill, G.J. (2007). The influence of natural scene statistics on the structure of orientation maps. *Vision Down Under*, Palm Cove, QLD, Australia, July 2007.

18. Mortimer, D., Dayan, P., Burrage, K. & Goodhill, G.J. (2007). A Bayesian model of growth cone gradient detection. *Society for Neuroscience abstracts*, Program No. 33.5.

17. A computational model of the effect of angiosocotomas on visual cortical maps. Giacomantonio, C.E. & Goodhill, G.J. (2006). *Proceedings of the 26th Australian Neuroscience Society Annual Meeting*, ORAL-09-02.

16. Pujic, Z. Rosoff, W.J., Mortimer, D., Unni, D. & Goodhill, G.J. (2006). The long-term response of axons to stable molecular gradients: attraction versus repulsion. *Proceedings of the 26th Australian Neuroscience Society Annual Meeting*, ORAL-08-06.

15. Mortimer, D., Dayan, P., Burrage, K. & Goodhill, G.J. (2006). Bayesian analysis of cone gradient detection. *Proceedings of the 26th Australian Neuroscience Society Annual Meeting*, ORAL-08-03.

14. Mortimer, D., Dayan, P. & Goodhill, G.J. (2005). Growth cone gradient detection: a Bayesian analysis. *Society for Neuroscience abstracts*, Program No. 146.12.

13. Rosoff, W.J., Ashari, P., McAllister, R.G., Esrick, M.A., Richards, L.J., Urbach, J.S. & Goodhill, G.J. (2004). Response of drg neurites to very shallow Sema3A gradients using a new chemotaxis assay. *Axon Guidance & Neural Plasticity* meeting, Cold Spring Harbor.

12. Xu, J., Urbach, J.S. & Goodhill, G.J. (2004). Predicting the spatial and temporal scales required for the signal transduction networks underlying growth cone chemotaxis. *Axon Guidance & Neural Plasticity* meeting, Cold Spring Harbor.

11. Rosoff, W.J., Urbach, J.S., Esrick, M.A., Richards, L.J. & Goodhill, G.J. (2003). A novel chemotaxis assay reveals the extreme sensitivity of axons to molecular gradients. *Formation and Function of Neuronal Circuits* meeting, Ascona, Switzerland.

10. Rosoff, W.J., Urbach, J.S., Esrick, M.A., Richards, L.J. & Goodhill, G.J. (2003). A novel chemotaxis assay reveals the extreme sensitivity of axons to molecular gradients. *Society for Neuroscience abstracts*, **29**, Program No. 884.5.

9. Goodhill, G.J., Gu, M. & Urbach, J.S. (2002). The contribution of growth cone filopodia to gradient sensing and movement: a computational model. *Axon Guidance & Neural Plasticity* meeting, Cold Spring Harbor.

8. Rosoff, W.J., Esrick, M.A., Gardner, D., Savich, J., Richards, L.J., Urbach, J.S. & Goodhill, G.J. (2001). A novel method for establishing defined gradients in gels. *Society for Neuroscience abstracts*, **27**, Program No. 795.1.

7. Carreira-Perpiñán, M. Á. & Goodhill, G.J. (2001). The effect of variable elastic topologies on the structure of ocular dominance and orientation maps. *Society for Neuroscience abstracts*, **27**, Program No. 475.21.

6. Goodhill, G.J. & Cimponeriu, A. (1999). Staging of orientation and ocular dominance column development in primary visual cortex and its consequences for map structure. *Society for Neuroscience abstracts*, **25**, 2264.

5. Goodhill, G.J. & Urbach, J.S. (1998). Physical constraints on axonal gradient detection. *Society for Neuroscience abstracts*, **24**, 30.

4. Goodhill, G.J. (1997). Theoretical model of axon guidance by a target-derived diffusible factor. *Society for Neuroscience abstracts*, **23**, 1957.

3. Goodhill, G.J. (1997). Axon guidance by diffusible factors: mathematical constraints. *Brain Research Association abstracts*, **14**, 44.

2. Goodhill, G.J. (1996). Optimization principles for cortical mappings: ocular dominance columns. *Society for Neuroscience abstracts*, **22**, 645.

1. Bates, K., Goodhill, G.J., Assad, J. & Montague, P.R. (1995). A theoretical study of the influence of correlated activity on the global structure of ocular dominance stripes. *Society for Neuroscience abstracts*, **21**, 392.

Ad-hoc Reviewing

- **Granting agencies:**
  - Australian Research Council
  - National Health and Medical Research Council (Australia)
  - Civilian Research and Development Foundation (USA).
  - CRCNS Review Panel Member (Collaborative Research in Computational Neuroscience, jointly sponsored by NSF/NIH, USA).
  - NSF (Integrative Biology and Neuroscience, USA).
  - American Paralysis Association

  - NSERC (Canada)
  - Wellcome Trust (UK)
  - BBSRC (Biotechnology and Biological Sciences Research Council, UK)
  - EPSRC (Engineering and Physical Sciences Research Council, UK)
  - NWO (Netherlands Organization for Scientific Research)
  - Neurological Foundation of New Zealand
  - Raine Medical Research Foundation (Australia)
- **Publishers:**
  - MIT Press
- **Journals:**
  - Biological Cybernetics
  - Biomaterials
  - Biophysical Journal
  - BMC Neuroscience
  - Bulletin of Mathematical Biology
  - Cell
  - Cerebral Cortex
  - Cognitive Science
  - Development
  - European Journal of Neuroscience
  - Hippocampus
  - IEEE Transactions on Neural Networks
  - IET Systems Biology
  - International Journal of Neural Systems
  - Journal of Cognitive Neuroscience
  - Journal of Computational Neuroscience
  - Journal of Mathematical Biology
  - Journal of Neurophysiology
  - Journal of Neuroscience
  - Journal of Theoretical Biology
  - Mathematical Medicine and Biology
  - Mechanisms of Development
  - Nature
  - Nature Neuroscience
  - Nature Physics
  - Network: Computation in Neural Systems
  - Neural Computation
  - Neural Networks
  - Neurocomputing
  - Neuron
  - Neuroscience

  - Physical Review Letters
  - PLoS (Public Library of Science) Biology
  - PLoS (Public Library of Science) Computational Biology
  - PLoS (Public Library of Science) One
  - PNAS
  - Proceedings of the Royal Society, Series B
  - Science
  - Swarm Intelligence
  - Vision Research
  - Visual Neuroscience
- **Conferences:**
  - Neural Information Processing Systems (NIPS) conference (1998, 1999, 2005).

Teaching

University of Queensland

Course Coordinator: MATH2200, Scientific Computing (2006 - present).

Course Coordinator: MATH3104, Mathematical Biology (2007 - present).

Lecturer: MATH3104, Mathematical Biology (2005 - present).

Lecturer: PHYS3170, Biophysics (2007 - present).

PhD Students:

- Duncan Mortimer (2005 - present)
- Jonathan Hunt (2007 - present)
- Hugh Simpson (2007 - present)
- Clare Giacomantonio (2008 - present)

Undergraduate/Masters students

- **Physics MSc Students:** Wataru Suzuki (2008 - present).
- **Advanced Studies Students:** Jennifer Burley (2006), Joshua Bartlett (2006), Mark Drager (2007), Tim Lamberton (2008).

Postdocs:

- Zac Pujic (2005 - present).
- Tim Vaughan (2007 - 2008).
- David Smith (2007 - 2008).
- Julia Feldner (2007 - 2008).
- Irina Vetter (2007 - 2008).
- William Rosoff (2005 - 2007).
- Huajin Tang (2006 - 2007).

Georgetown University

Course Director: Medical Neuroscience Laboratory (2004).

Course Director: NSCI-501, Graduate course in Developmental Neuroscience (1997 - 2004). *Overall rating 4.4/5.0.*

Course Director: NSCI-526, Graduate course in Computational Neuroscience (1998 - 2004).

Lecturer: Medical Neuroscience course (2001 - 2004). *Overall rating 3.9/5.0 = "Excellent" based on feedback from 250 students; feedback for the ≈ 20 other lecturers in this course was in the range 2.9-3.7.*

Lecturer: Medical Embryology course (1999 - 2001).

Lecturer: MICB-505, Interdisciplinary Research Survey Course (1998 - 2004).

Lecturer: PHYS-220, Research Frontiers in Biophysics (1997 - 2004).

Lecturer: Neuroscience survey course (1997 - 2004).

Students:

- **Thesis Committees:** Hugh Moulding (1998-2000), Liza Bundersen (1999-2003), Peter Turkeltaub (2000-2003).
- **Graduate students:** Carolyn Greene (rotation 1997); Dan Gardner (rotation 1998); Brent Richards (rotation 2000), Brek Eaton (rotation 2003), Yi Zhang (rotation 2003).
- **Undergraduate students:** Jeff Brogan (1997); Darren Fiore (1998); Steve Pesanti (2000); Jason Savich (2000 - 2004); Michael Kwon (2001 - 2002); Sumeet Mitter (2001 - 2004); Ming Gu (2002); David Swartz (2002); Doug Bemis (2002); Sumeet Mittar (2002-2003), Richard Arevalo (2003).

Postdocs:

- Shau-Ming Wu (1997 - 1998).
- Andrei Cimponeriu (1998 - 1999).
- Sarah Lesher (1999 - 2000).
- Miguel Carreira-Perpiñán (2000 - 2003).
- William Rosoff (2000 - 2004).
- Jun Xu (2003 - 2004).

Previous to Georgetown

Course Director: M.Sc. course in Computational Neuroscience at Stirling University (1993).

Lecturer: M.Sc. course in Neural Networks at Edinburgh University (1992 - 1994).

Lecturer: M.Sc. course in Neural Networks at Dundee University (1994).

Lecturer: Undergraduate course in Neural Development at Edinburgh University (1994).

Students:

- **M.Sc. students** at Edinburgh University: Rocio Aguilar-Chongtay (1992); Steven Carter (1993).
- **Rotation and Summer students** at the Salk Institute and Baylor College of Medicine: Kevin Franks (1994); Doug Rohde (1995).

Service

- **Member:** Planning committee for University of Queensland Computational Science dual major.
- **Member:** Georgetown University Medical Center Committee on Appointments and Promotions (2001 - 2004).
- **Member:** Georgetown University Taskforce on Bioinformatics, Statistics and Computing (2002).
- **Member:** Georgetown University Committee to establish a cross-campus graduate program in Bio-computing (2003).
- **Chair:** Neuroscience Department / GICCS Information Technology Committee (1998 - 2004).
- **Chair:** Neuroscience Department Environment Committee (2000 - 2004).
- **Member:** Neuroscience Department Faculty Search Committee (2002 - 2004).
- **Member:** Neuroscience Department Seminar Committee (2001 - 2004).
- **Member:** Neuroscience Department Executive Committee (1999 - 2001).
- **Member:** Curriculum Committee for the Interdisciplinary Graduate Program in Neuroscience (2000 - 2004).
- **Member:** Admissions Committee for the Interdisciplinary Graduate Program in Neuroscience (1998 - 2001).
- **Member:** GICCS Space Committee (1997-1998).
- **Member:** GICCS Executive Committee (1999).

Invited Lectures

- “The application of the elastic net algorithm to combinatorial optimization problems”. Applied Mathematics, Bristol University, 11/88.
- “The application of the elastic net algorithm to the formation of ocular dominance stripes”. Artificial Intelligence, Edinburgh University, 2/89.
- “Can neural networks refresh the parts other algorithms cannot reach?”. Logica Cambridge, 5/90.
- “The development of topography and ocular dominance in the visual system”. Cognitive Science, Edinburgh University, 9/90.
- “Ocular dominance: theories and experiments.” Physiology, Oxford University, 4/92.
- “The development of ocular dominance”. Philosophy/Psychology, Dundee University, 5/92.
- “The role of weight normalization in competitive learning”. Connectionist Research Group, Toronto University, 11/92.
- “The development of ocularly dominant cells in visual cortex”. Institute for Neural Computation, Salk Institute/UCSD, 11/92.
- “Models for the development of ocular dominance”. Electrical Engineering, Brunel University, 6/93.
- “Multidimensional scaling and brain connectivity”. Division of Neuroscience, Baylor College of Medicine, 10/93.
- “Computational models for ocular dominance: an overview”. British Society for Developmental Biology Meeting, Edinburgh, 4/94.
- “Functional segregation in the cortex”. Cognitive Science, Sussex University, 5/94.

- “Computational models for ocular dominance segregation”. Institut für Theoretische Physik, J.W. Goethe-Universität, Frankfurt, 9/94.
- “A new role for activity in cortical pattern formation”. Salk Institute, San Diego, 4/95.
- “Topographic mappings and brain development”. Neural Computing Group, Aston University, Birmingham, UK, 6/95.
- “Computational models of brain development”. Computer Science, Carnegie-Mellon University, Pittsburgh, 10/95.
- “Theoretical models of brain development”. Center for Neural Science, New York University, New York, 11/95.
- “A Unifying Measure for Topographic Mappings”, International Computer Science Institute, Berkeley, 4/96.
- “Understanding the structure of cortical maps”. NIH, Bethesda, 10/96.
- “Diffusion in Axon Guidance”, Brain Research Association annual conference, Liverpool, 4/97.
- ”Quantitative Approaches to Axon Guidance”, Biomedical Engineering, Johns Hopkins University, 5/97.
- “Mathematical model of axon guidance by diffusible factors”, Cold Spring Harbor, 1/98.
- “Neural Development”, Tutorial (3 hours) given at the International Conference on Artificial Neural Networks in Edinburgh, 9/99.
- “Computational Models of Neural Development”, Anatomy & Neurobiology, University of Maryland, 9/99.
- “Computational Models of Neural Development”, Neurobiology, Mount Sinai School of Medicine, 12/99.
- “Computational Models of Neural Development”, Neuroscience, UC Davis, 4/00.
- “Computational models of axon guidance and visual map development”, Center for Molecular and Behavioral Neuroscience, Rutgers University, 11/00.
- “Computational models of column development in visual cortex”, Department of Biology, George Mason University, 1/01.
- “Computational Models of Neural Development”, Maryland Biotechnology Center, University of Maryland Center, 6/01.
- “The effect of variable elastic topologies on the structure of ocular dominance and orientation maps”, Cold Spring Harbor, 10/01.
- “Interconnects in biological systems”, Defense Sciences Research Council workshop on interconnects in nano-, micro-, and macrosystems, Arlington, 12/01.
- “Computational models of neural development”, Neuroscience Department, Baylor College of Medicine, 1/02.
- “How do axons detect gradients?”, Neural and Cognitive Sciences, University of Maryland, 2/02.
- “ Visual cortical maps and computational models of their development”, Neural and Cognitive Sciences, University of Maryland, 3/02.
- “Wiring up the brain: how axons detect gradients”, Systems Neuroscience Spring School, Nara, Japan, 3/03.
- “Wiring up the brain: how axons detect gradients”, MRC Centre for Developmental Neurobiology, London, 3/03.
- “Wiring up the brain: how axons detect gradients”, Institute for Adaptive and Neural Computation, Edinburgh University, 3/03.
- “Axon guidance and visual cortical maps: experiments and computational models”, University of New South Wales, Australia, 6/03.

- “Axon guidance and visual cortical maps: experiments and computational models”, Australian National University, 6/03.
- “Axon guidance and visual cortical maps: experiments and computational models”, University of Queensland, Australia, 6/03.
- “Axon guidance: models and experiments”, Gatsby Computational Neuroscience Unit, University College London, 1/04.
- “Modeling cortical maps with the elastic net algorithm”. Workshop on Mathematical Neuroscience, Berkeley, 3/04.
- “Computational models of neural development”, Department of Informatics, Edinburgh University, 4/04.
- “How do axons detect molecular gradients?”, Queensland Brain Instiutute, University of Queensland, 7/04.
- “Computational models of visual cortical map formation”, Department of Mathematics, University of Queensland, 7/04.
- “Axonal chemotaxis: theories and experiments”, Center for Neurobiology and Behavior, Columbia University, 4/05.
- “Axonal chemotaxis: theories and experiments”, Salk Institute, 4/05.
- “Axonal chemotaxis: theories and experiments”, Cold Spring Harbor Laboratories, 4/05.
- “Axonal chemotaxis: theories and experiments”, Salk Institute, 4/05.
- “Understanding the brain as a computational device”, Winter School in Computational Biology, University of Queensland, 7/05.
- “Gradient detection by growth cones is limited by stochastic fluctuations in receptor binding”, Institute of Neuroscience, Shanghai, China, 10/05.
- “Computational modelling of connectivity development in visual cortex”, Connectivity Symposium - Neuroimaging and Systems Neuroscience Approaches, Australian Neuroscience Society Annual Meeting, Sydney, 2/06.
- “How do axons detect molecular gradients?” Axon Guidance Symposium, Australian Neuroscience Society Annual Meeting, Sydney, 2/06.
- “Axon guidance: theories and experiments”, Workshop on Mathematical Models of Development and Learning in the Nervous System, Edinburgh University, 7/06
- “Axon guidance and map formation”, Okinawa Computational Neuroscience Course, Japan, 6/06.
- “Noise constraints on axonal chemotaxis”, Workshop on Mathematical and Computational Neuroscience, University of Queensland, 8/06.
- “The effect of neural activity on visual cortical map development”, Second Pacific Rim Brain Conference, Queensland, 8/06.
- “Measuring and modelling axonal chemotaxis”, Institute of Neuroscience, Shanghai, China, 10/06.
- “Normative models of chemotaxis in shallow gradients”, Gordon Research Conference on Gradient Sensing & Directed Cell Migration, Ventura, USA, 1/07.
- “Mathematical models of visual map development in the brain”, University of Sydney, 8/07.
- “Computational models for the development of neuronal wiring”, Riken Brain Sciences Institute, Tokyo, 9/07.
- “Optimal signal processing for axonal chemotaxis”, joint Wellcome Trust / Cold Spring Harbor meeting on Integrative Approaches to Brain Complexity, Hinxton, UK, 10/07.
- “Formation and structure of visual maps”, educational session at the Human Brain Mapping conference, Melbourne, 6/08.
- “Measuring and modeling the limits of axon guidance by molecular gradients”, University of Tasmania, 10/08.

- “Wiring the brain: modelling axon guidance & visual map development” Informatics, University of Edinburgh, 3/09.
- “Wiring the brain: modelling axon guidance & visual map development” Stirling University, 3/09.
- “The response of axons to molecular gradients is predicted by a Bayesian model”, Mathematical Neuroscience Workshop, Royal Society of Edinburgh, 03/09.