Curriculum Vitae
Timothy P. Lillicrap

Work Address:
Google Deepmind
6 Pancras Square
London, Kings Cross
United Kingdom, N1C 4AG

Home Address:
Flat 30 York Way Court
265 Copenhagen St.
London, Kings Cross
United Kingdom, N1 0BY

Citezenship: Canadian (also British)
Phone: +44 (0) 7557 926064
E-Mail: timothylillicrap@google.com
Date: September 9, 2017

Direction:

My research focuses on machine learning and statistics for optimal control and decision making, as well as using these mathematical frameworks to understand how the brain learns. In recent work, I've developed new algorithms and approaches for exploiting deep neural networks in the context of reinforcement learning, and new recurrent memory architectures for one-shot learning. Applications of this work include approaches for recognizing images from a single example, visual question answering, deep learning for robotics problems, and playing games such as Go and StarCraft. I'm also fascinated by the development of deep network models that might teach us how robust feedback control laws are learned and employed by the central nervous system.

Professional Experience:

Adjunct Professor at University College London 2016–Present

Staff Research Scientist at Google DeepMind 2016–Present
Senior Research Scientist 2015–2016
Research Scientist 2014–2015

Postdoctoral Research Fellow at the University of Oxford 2012–2014
Department of Pharmacology, Oxford, Oxfordshire, United Kingdom
Supervisor: Dr. Colin J. Akerman

Education:

Ph.D., Systems Neuroscience 2005–2012
Queen's University, Kingston, Ontario, Canada
Supervisor: Dr. Stephen H. Scott

Hon. B.Sc. Cognitive Science & Artificial Intelligence 2000–2005
University of Toronto, Toronto, Ontario, Canada

Manuscript preprints:

6. Vinyals, O., et al., Lillicrap, T. [DeepMind], Calderone, K., et al., Tsing, R. [Blizzard] (2017) *StarCraft II: A New Challenge for Reinforcement Learning*, arXiv:1708.04782.
5. Gemici, M., Hung, C., Santoro, A., Wayne, G., Mohamed, S., Rezende, D., Amos, D., Lillicrap, T.P. (2017) *Generative Temporal Models with Memory*, arXiv:1702.04649.
4. Guergiuev, J., Lillicrap, T.P., Richards, B.A. (2016) *Towards deep learning with segregated dendrites*, arXiv:1610.00161.
3. Heess, N., Wayne, G., Tassa, Y., Lillicrap, T.P., Riedmiller, M., Silver, D. *Learning and transfer of modulated locomotor controllers* (2016) arXiv:1610.05182.
2. Dulac-Arnold, G., Evans, R., Hasselt, H., Sunehag, P., Lillicrap, T.P., Hunt, J., Mann, T., Weber, T., Degris, T., Coppin, B. (2015) *Deep reinforcement learning in large discrete action spaces*, arXiv:1512.07679.
1. Sutskever, I., Jozefowicz, R., Gregor, K., Rezende, D., Lillicrap, T.P., Vinyals, O. (2015) *Towards principled unsupervised learning*, arXiv:1511.06440.

Publications:

29. Santoro, A., Raposo, D., Barrett, D. G., Malinowski, M., Pascanu, R., Battaglia, P., & Lillicrap, T.P. (2017) *A simple neural network module for relational reasoning*, 31st NIPS.
28. Gu, S., Lillicrap, T., Ghahramani, Z., Turner, R. E., Schölkopf, B., & Levine, S. (2017) *Interpolated Policy Gradient: Merging On-Policy and Off-Policy Gradient Estimation for Deep Reinforcement Learning*, 31st NIPS.
27. Chen, Y., Hoffman, M.W., Colmenarejo, S.G., Denil, M., Lillicrap, T.P., de Freitas, N. (2017) *Learning to Learn for Global Optimization of Black Box Functions*, ICML 2017.
26. Gu, S., Holly, E., Lillicrap, T.P., Levine, S., (2016) *Deep reinforcement learning for robotic manipulation with asynchronous off-policy updates*, ICRA 2017.
25. Samadi, A., Lillicrap, T.P., Tweed, D.B. (2017) *Deep learning with dynamic spiking neurons and fixed feedback weights*, Neural Computation, 29(3):578–602.

24. Raposo, D.*, Santoro, A.*, Barrett, D., Pascanu, R., Lillicrap, T.P., Battaglia, P. (2017). *Discovering objects and their relations from entangled scene representations*, ICLR Workshops.
23. Rae, J., Hunt, J.J., Danihelka, I., Harley, T., Senior, A., Wayne, G., Graves, A., Lillicrap, T.P. (2016) *Scaling memory-augmented neural networks with sparse reads and writes*, 30th NIPS.
22. Vinyals, O., Blundell, C., Lillicrap, T.P., Kavukcuoglu, K., Wierstra, D. (2016) *Matching networks for one shot learning*, 30th NIPS.
21. Lillicrap, T.P., Cownden, D., Tweed, D.B., Akerman, C.J. (2016) *Random feedback weights support learning in deep neural networks*, Nature Communications, 13276, & arXiv:1411.0247 [q-bio.NC; 2014].
20. Heming, E.A., Lillicrap, T.P., Omrani, M., Pruszynski, J.A., Scott, S.H. (2016) *Primary motor cortex neurons classified in a postural task predict muscle activation patterns in a reaching task*, Journal of Neurophysiology, 115(4):2021-2032.
19. Santoro, A., Bartunov, S., Botvinick, M., Wierstra, D., Lillicrap, T.P. (2016) *Meta-learning with memory-augmented neural networks*, ICML 2016.
18. Gu, S., Lillicrap, T.P., Sutskever, I., Levine, S. (2016) *Continuous deep Q-learning with model-based acceleration*, ICML 2016.
17. Mnih, V., Badia, A.P., Mirza, M., Graves, A., Lillicrap, T.P., Harley, T., Silver, D., Kavukcuoglu, K. (2016) *Asynchronous methods for deep reinforcement learning*, ICML 2016.
16. Lillicrap, T.P.*, Hunt, J.J.*, Pritzel, A., Heess, N., Erez, T., Tassa, Y., Silver, D., Wierstra, D. (2016) *Continuous control with deep reinforcement learning*, ICLR 2016.
15. Silver, D.*, Huang, A.*, Maddison, C.J., Guez, A., Sifre, L., Van Den Driessche, G., Schrittwieser, J., Antonoglou, I., Panneershelvam, V., Lanctot, M., Dieleman, S., Grewe, D., Nham, J., Kalchbrenner, N., Sutskever, I., Lillicrap, T.P., Leach, M., Kavukcuoglu, K., Graepel, T., Hassabis, D. (2016) *Mastering the game of Go with deep neural networks and tree search*, Nature, 529(7587):484–489.
14. Heess, H., Hunt, J.J., Lillicrap, T.P., Silver, D. (2015) *Memory-based control with recurrent neural networks*, Deep Reinforcement Learning Workshop, 29th NIPS.
13. Heess, N., Wayne, G., Silver, D., Lillicrap, T.P., Erez, T., Tassa, Y. (2015) *Learning Continuous Control Policies by Stochastic Value Gradients*, 29th NIPS.
12. Suminski, A.J., Mardoum, P., Lillicrap, T.P., Hatsopoulos, N.G. (2015) *Temporal evolution of both premotor and motor cortical tuning properties reflect changes in limb biomechanics*, Journal of Neurophysiology, 113(7):2812-2823.
11. Muldal, A. Lillicrap, T.P., Richards, B.A., Akerman, C.J. (2014) *Clonal relationships bias stimulus selectivity within a phylogenetically ancient brain structure*, Current Biology, 24(16): 1929-1933.

10. Lillicrap, T.P., Scott, S.H. (2013) *Preference distributions of primary motor cortex neurons reflect control solutions optimized for limb biomechanics*, Neuron, 77(1):168-179.
9. Lillicrap, T.P.*, Moreno-Briseño, P.*, Diaz, R., Tweed, D.B., Troje, N.F., Fernández-Ruiz, J. (2013) *Adaptation to inversion of the visual field: a new twist on an old problem*, Experimental Brain Research, 228(3):327-339.
8. Vervaeke, J., Lillicrap, T.P., Richards, B.A. (2012) *Relevance realization and the emerging framework in cognitive science*, Journal of Logic and Computation, 22(1):79-99.
7. Taylor, P., Lillicrap, T.P.*, Cownden, D.* (2011) *Inclusive fitness analysis on mathematical groups*, Evolution, 65:849-859.
6. Rendell, L., Boyd, R., Cownden, D., Enquist, M., Eriksson, K., Feldman, M.W., Fogarty, L., Ghirlanda, S., Lillicrap, T.P., Laland, K.N. (2010) *Why copy others? Insights from the social learning strategies tournament*, Science, 328:208-213.
5. Lillicrap, T.L.*, Pruszynski, J.A.*, Scott, S.H. (2010) *Complex spatio-temporal tuning in human upper-limb muscles*, Journal of Neurophysiology, 103:564-572.
4. Pruszynski, J.A., Kurtzer, I., Lillicrap, T.P., Scott, S.H. (2009) *Temporal evolution of 'automatic gain scaling'*, Journal of Neurophysiology, 102:992-1003.
3. Abdelghani, M.N., Lillicrap, T.P., Tweed, D.B. (2008) *Sensitivity derivatives for flexible sensorimotor learning*, Neural Computation, 20:2085-2111.
2. Pruszynski, J.A., Coderre, A.M., Lillicrap, T.P., Kurtzer, I. (2007) *Temporal encoding of movement in motor cortical neurons*, Journal of Neuroscience, 27(38):10076-10077.
1. Cristillo, A.D., Mortimer J.R., Barrette I.H., Lillicrap T.P., Forsdyke D.R. (2001) *Double-stranded RNA as a not-self alarm signal: to evade, most viruses purine-load their RNAs, but some (HTLV-1, Epstein-Barr) pyrimidine-load*, Journal of Theoretical Biology, 208:475-491.

* indicates equal contributions.

Other Refereed Contributions:

6. Richards, B., Lillicrap, T.P, Grewe, B.F., Kell, A., Christensen, A., Yamins, D. (2017) *Deep learning and the brain*, Workshop at Computational and Systems Neuroscience (COSYNE), Salt Lake City, UT, USA.
5. Guervuiev, J., Lillicrap, T.P., Richards, B.A. (2016) *Biologically realistic deep supervised learning*, Computational and Systems Neuroscience (COSYNE), Salt Lake City, UT, USA.
4. Lillicrap, T.P., Cownden, D., Akerman, C.J., Tweed, D.B. (2013) *Multilayer controllers can learn from random feedback weights*, Selected to speak at Translational and Computational Motor Control (TCMC), Society for Neuroscience Annual Meeting, San Diego, CA, USA.
3. Suminski, A., Mardoum, P., Lillicrap, T.P., Hatsopoulos, N. (2013) *Population dynamics in both premotor and motor cortical ensembles reflect changes in limb biomechanics*, Selected

for a poster presentation at Translational and Computational Motor Control (TCMC), Society for Neuroscience Annual Meeting, San Diego, CA, USA.

2. Lillicrap, T.P., Scott, S.H., (2008) *The activity of primary motor cortex is shaped by the properties of the musculoskeletal system*, Selected to speak at Advances in Computational Motor Control (ACMC), Symposium at the Society for Neuroscience Meeting, Washington, DC, USA.
1. Lillicrap, T.P., Trottier, L., (2008) *Learning coupled dynamics is an important and unsolved problem*, Selected to speak at University of Toronto Interdisciplinary Symposium on the Mind (UTISM), University of Toronto, Canada.

Talks:

33. Lillicrap, T.P.† (2017) *Deep reinforcement learning*, CogSci2017, Workshop on Deep Learning Invited Talk, London, UK.
32. Lillicrap, T.P.† (2017) *Memory and unsupervised learning in artificial and biological networks*, CIFAR LMB Workshop on Deep Learning & Neuroscience Invited Talk, Paris, France.
31. Lillicrap, T.P.† (2017) *Deep learning methods and architectures*, Ibro-Simons Computation Neuroscience Imbizo Summer School (isiCNI2017), Capetown, South Africa.
30. Lillicrap, T.P.† (2016) *Data-efficient deep reinforcement learning for continuous control*, Deep Learning for Action and Interaction, NIPS Workshop Invited Talk, Barcelona, Spain.
29. Lillicrap, T.P.† (2016) *New memory architectures: one-shot learning and scaling up with sparse access*, Berkeley Artificial Intelligence Research Laboratory Invited Talk.
28. Lillicrap, T.P.† (2016) *Recent advances in deep reinforcement learning*, Guest Lecture CS294-131: Special Topics in Deep Learning, Berkeley, California.
27. Lillicrap, T.P.† (2016) *Continuous control with deep reinforcement learning*, Research@Google, Mountain View, California.
26. Lillicrap, T.P.† (2016) *Trends in deep reinforcement learning*, Research@Google, Mountain View, California.
25. Lillicrap, T.P.† (2016) *Deep reinforcement learning: algorithms and applications from reaching and grasping to winning at Go*, 15th Neural Computation and Psychology Workshop, Drexel University, Pennsylvania.
24. Lillicrap, T.P.† (2016) *Augmenting deep networks with reinforcement learning and memory*, Neurotheory Seminar Series, Columbia University, New York.
23. Lillicrap, T.P.† (2016) *Synthesizing sophisticated behaviours by pairing deep networks with reinforcement learning*, Workshop on Biological Implementation of Deep Learning, Universität Bern, Switzerland.

22. Lillicrap, T.P.† (2016) *Feedback alignment and the (un)importance of weight symmetry for deep learning*, Workshop on Biological Implementation of Deep Learning, Universität Bern, Switzerland.
21. Lillicrap, T.P.† (2016) *Building complex behaviour by combining deep networks with reinforcement learning*, Computational Brain Sciences Talks, Western University, Canada.
20. Hinton, G.†, Lillicrap, T.P. (2016) *Can the brain do back-propagation?*, Stanford EE Computer Systems Colloquium, Stanford University.
19. Lillicrap, T.P.*, Cownden, D., Tweed, D.B., Akerman, C.J. (2014) *Random feedback weights support learning in deep neural networks*, Neuro-theory Forum, University of Oxford.
18. Lillicrap, T.P.*, Sutskever, I.*†, Martens, J. (2013) *Learning control laws with recurrent neural networks*, Internation Conference on Machine Learning (ICML), Challenges in Representation Learning, Invited talk, Atlanta, GA, USA.
17. Muldal, A.M.†, Lillicrap, T.P., Richards, B.A., Akerman, C.J. (2013) *Keeping it in the family: functional clustering of sister neurons within the Xenopus optic tectum*, Paton Prize Talks, Winner of the Paton Prize for best talk. Oxford, UK.
16. Lillicrap, T.P.†, Scott, S.H. (2009) *Preferences of motor cortex neurons reflect control solutions optimized for biomechanics*, Annual meeting of the Canadian Action and Perception Network, Ingersoll, ON, Canada.
15. Scott, S.H.†, Lillicrap, T.P. (2009) *Statistical models of the limb in primary motor cortex*, The Fifth Computational Motor Control Workshop at Ben-Gurion University in Negev, Israel.
14. Lillicrap, T.P.†, Scott, S.H. (2009) *Computing network based control solutions to understand movement preference in primary motor cortex neurons*, High Performance Computing Symposium, Kingston, ON, Canada.
13. Lillicrap, T.P.†, Scott, S.H. (2009) *Why do neurons in motor cortex prefer certain movements and loads?*, Sensorimotor Learning Group, University of Cambridge, Cambridge, United Kingdom.
12. Lillicrap, T.P.*†, Daniel, C.*† (2009) *When is innovation worthwhile? Insights from a social learning strategies tournament*, Ecology, Evolution, and Behaviour Seminar Series, Queen's University, Kingston, ON, Canada.
11. Lillicrap, T.P.†, Scott, S.H. (2009) *How do the properties of the musculoskeletal system shape the activity of primary motor cortex?*, Machine Learning Group Seminar, University of Toronto, Toronto, ON, Canada.
10. Lillicrap, T.P.†, Scott, S.H. (2009) *How do the properties of the musculoskeletal system shape the activity of primary motor cortex?*, Math-Neuro Group Seminar, Université de Montréal, Montreal, QC, Canada.
9. Lillicrap, T.P.†, Richards, B.A., Scott, S.H., (2008) *Unsupervised learning on sensory data compensates for the scarcity of labelled data*, Annual meeting of the Group for Action and

Perception, Ingersoll, ON, Canada.

8. Lillicrap, T.P.†, (2007) *Is the cortex doing back propagation of error?*, Centre for Neuroscience Studies, Friday Fights, Queen's University, Kingston, ON, Canada.
7. Lillicrap, T.P.†, (2007) *A brief introduction to the theory behind support vector machines*, Guest lecture for CISC452: Neural Networks, Queen's University, Kingston, ON, Canada.
6. Lillicrap, T.P.†, (2007) *What algorithm is the cortex running?*, Biomath Group, Queen's University, Kingston, ON, Canada.
5. Lillicrap, T.P.*†, Moreno-Briseño*, P., Fernández-Ruiz, J., (2007) *A simple task which reverses error-action mappings*, CIFAR NCAP Summer School, University of Toronto, Toronto, ON, Canada.
4. Lillicrap, T.P.†, Richards, B.A., (2006) *Unsupervised learning can be used to tighten distribution dependent bounds*, CIAR NCAP Summer School, University of Toronto, Canada.
3. Lillicrap, T.P.†, Pruszynski, J.A., Scott, S.H., (2006) *Selecting models for single cell spike train data*, 9th Annual Scientific Meeting for Health Sciences Research Trainees, Faculty of Health Sciences, Queen's University, Canada.
2. Lillicrap, T.P.†, Abdelghani, M.N., Tweed, D.B., (2005) *Adaptive control in sensorimotor systems*, The University of Toronto Machine Learning Group, Canada.
1. Lillicrap, T.P.†, Tweed, D.B., (2004) *Using structured error signals to learn temporally complex motor commands*, The CIHR Group for Action and Perception, Canada.

† indicates presenting author(s). * indicates equal contributions.

Conference Abstracts:

25. Muldal, A.M., Lillicrap, T.P., Richards, B.A., Akerman, C.J. (2013) *Multiphoton functional imaging of clonally-related neurons in the Xenoopus optic tectum*, Oxford Neuroscience Symposium, Winner of the Sherrington Prize for second best poster, Oxford, UK.
24. Blohm, G., Lillicrap, T.P., Standage, D. (2012) *An alternative to explicit divisive normalization models*, Vision Sciences Society Annual Meeting (VSS), Naples, FL, USA.
23. Heming, E.A., Herter, T.M., Pruszynski, J.A., Omrani, M., Lillicrap, T.P., Scott, S.H. (2012) *Load-classified motor cortical neurons predict muscle activation patterns in a reaching task*, 42nd Annual Meeting of the Society for Neuroscience, New Orleans, LA.
22. Heming, E.A., Herter, T.M., Pruszynski, J.A., Omrani, M., Lillicrap, T.P., Scott, S.H. (2011) *Activity of motor cortical neurons in posture task predicts patterns of EMG during reaching*, 41st Annual Meeting of the Society for Neuroscience, Washington, DC.
21. Cownden, D., Lillicrap, T.P. (2009) *When is innovation worth while?: Insights from a social learning strategies tournament*, European Human Behaviour and Evolution Association, University of St. Andrews, St. Andrews, UK.

20. Lillicrap, T.P., Scott, S.H. (2008) *Primary motor cortex reflects a statistical model of limb mechanics*, 38th Annual Meeting of the Society for Neuroscience, Washington, DC.
19. Duncan, J.R., Pruszynski, J.A., Lillicrap, T.P., Scott, S.H., Flanagan, J.R., (2008) *Time course of feedback control of hand movements during visually guided reaching*, 38th Annual Meeting of the Society for Neuroscience, Washington, DC.
18. Lillicrap, T.P., Scott, S.H., (2008) *How do the properties of the musculoskeletal system shape motor cortex activity?*, Centre for Neuroscience Studies 4th Annual Research Day, Queen's University, Kingston, ON.
17. Lillicrap, T.P., Richards, B.A., Scott, S.H., (2008) *Unsupervised learning compensates for the scarcity of labelled data*, Meeting for Health Sciences Research Trainees, Queen's University, Kingston, ON.
16. Lillicrap, T.P., Pruszynski, J.A., Scott, S.H., (2008) *Pathlets in upper limb muscles?*, 2nd Annual Canadian Neuroscience Meeting, Montreal, QU.
15. Moreno-Briseño, P., Lillicrap, T.P., Fernández-Ruiz, J., (2007) *Visuomotor learning under incongruent error feedback*, 37th Annual Meeting of the Society for Neuroscience, San Diego, CA.
14. Lillicrap, T.P., Richards, B.A., Scott, S.H., (2007) *Unsupervised learning on sensory input compensates for the scarcity of labelled data*, 37th Annual Meeting of the Society for Neuroscience, San Diego, CA.
13. Herter, T. M., Lillicrap, T.P., Coderre, A. M., Scott, S. H., (2007) *The responses of M1 neurons to limb motion can be altered from passive to active conditions to reflect their contribution to ongoing motor action*, 37th Annual Meeting of the Society for Neuroscience, San Diego, CA.
12. Abdelghani, M. N., Lillicrap, T.P., Tweed, D. B., (2007) *Sensitivity derivatives for flexible sensorimotor learning*, 37th Annual Meeting of the Society for Neuroscience, San Diego, CA.
11. Lillicrap, T.P., Richards, B.A., Scott, S.H., (2007) *To learn the names of objects, the brain first learns a statistical model of images*, Centre for Neuroscience Studies 3rd Annual Research Day, Queen's University, Kingston, ON.
10. Lillicrap, T.P., Scott, S.H., (2006) *Predicting sensory-motor mappings of neurons in motor cortex*, 36th Annual Meeting of the Society for Neuroscience, Atlanta, GA.
9. Richards, B.A., Lillicrap T.P., (2006) *Fast word learning via world models*, Oxford Autumn School in Cognitive Neuroscience, University of Oxford.
8. Lillicrap, T.P., Richards, B.A., Scott, S.H., (2006) *How do children learn the names of objects so quickly? Insight from neural network models*, Centre for Neuroscience Studies 2^{nd} Annual Research Day, Queen's University, Kingston, ON.
7. Lillicrap, T.P., Pruszynski, J.A., Scott, S.H., (2006) *Information theoretic techniques for model*

selection applied to simulated cell data, XXVII International Symposium on Computational Neuroscience, Montreal, QU.

6. Abdelghani, M.N., Lillicrap, T.P., Tweed, D.B., (2006) *Flexible sensorimotor learning with realistic information transport*, XXVII International Symposium on Computational Neuroscience, Montreal, QU.
5. Abdelghani, M.N., Lillicrap, T.P., Tweed, D.B., (2006) *Adaptive control and the flow of information in the brain*, COSYNE Computational and Systems Neuroscience, Salt Lake City, UT.
4. Lillicrap, T.P., Abdelghani, M.N., Scott, S.H., Tweed, D.B., (2005) *A Mechanism for learning temporally complex motor commands*, 35th Annual Meeting of the Society for Neuroscience, Washington, DC.
3. Abdelghani, M.N., Lillicrap, T.P., Tweed, D.B., (2005) *Versatile adaptive control without weight transport*, 35th Annual Meeting of the Society for Neuroscience, Washington, DC.
2. Lillicrap, T.P., Tweed, D.B., Scott, S.H., (2004) *The origin of default learning strategies for limb control*, 34th Annual Meeting of the Society for Neuroscience, San Diego, CA.
1. Cristillo, A.D., Lillicrap, T.P., Forsdyke, D.R., (1998) *Purine loading of EBNA-1 mRNA avoids sense-antisense "collisions"*, Meeting of the American Society for Biochemistry and Molecular Biology, Washington, DC.

Invited Journal and Conference Reviews:

- *Proceedings of the National Academy of Sciences* (http://www.pnas.org/)
- *Nature Communications* (http://www.nature.com/ncomms/)
- *Neuron* (http://www.cell.com/neuron/)
- *Journal of Neuroscience* (http://www.jneurosci.org/)
- *Neural Information Processing Systems* (NIPS; https://nips.cc/)
- *International Conference on Machine Learning* (ICML; http://www.icml.cc)
- *International Conference on Learning Representations* (ICLR; http://www.iclr.cc)
- *SIGGRAPH* (http://www.siggraph.org/)
- *Association for the Advancement of Artificial Intelligence* (AAAI; http://www.aaai.org/)
- *IEEE International Conference on Robotics and Automation* (ICRA)
- *International Conference on Intelligent Robots and Systems* (IROS; http://www.iros.org/)
- *PLoS Computational Biology* (http://journals.plos.org/ploscompbiol/)
- *Neural Computation* (http://www.mitpressjournals.org/loi/neco)
- *Journal of Neurophysiology* (http://jn.physiology.org/)
- *PLoS ONE* (http://www.plosone.org)

- *Journal of Motor Behavior* (http://www.tandfonline.com/toc/vjmb20/current)
- *Journal of Computational Neuroscience* (https://www.editorialmanager.com/jcns/)
- *IEEE Robotics and Automation Letters* (http://www.ieee-ras.org/publications/ra-l)
- *IEEE Transactions on Neural Networks and Learning Systems* (TNNLS)
- *Conference on Robot Learning* (CoRL; http://www.robot-learning.org/)

Other Professional Activities:

- Reviewing for the Google Faculty Research Awards in Computational Neuroscience (2016).
- Reviewing for the Google Faculty Research Awards in Computational Neuroscience (2015).

Funding & Awards:

2014–2015

- NSERC Postdoctoral Research Fellowship (PDF); $90,000
- Placed 1st in the 2nd Social Learning Strategies Tournament; €15,000
  A game theoretic competition in which contestants entered computer coded strategies.
  For details visit: http://lalandlab.st-andrews.ac.uk/tournaments/tournament2/

2013–2014

- European Research Council Proof of Concept Grant (ERC-2013-PoC-2); €146,000
  "A biologically inspired algorithm for training deep neural networks", with Colin Akerman.

2010–2011

- Ontario Graduate Scholarship (OGS); $15,000

2009–2010

- Centre for Neuroscience Studies Award for Excellence; $3,000
- Ontario Graduate Scholarship (OGS); $15,000
- Dean's Award, Queen's University; $500
- Placed 1st in the Social Learning Strategies Tournament; €10,000
  A game theoretic competition in which contestants entered computer coded strategies.
  Paid trip to Scotland to attend and present at the EHBEA Conference, April 2009.
  For details visit: http://www.intercult.su.se/cultaptation/tournament.php
- Renewed HPCVL / Sun Microsystems of Canada, Inc. Scholarship in Computational Sciences and Engineering; $5,000

2008–2009

- Conference Travel Award, Queen's University; $300
- Centre for Neuroscience Conference Travel Award, Queen's University; $300
- Selected for Oral Presentation, Advances in Computational Motor Control, Symposium at the Society for Neuroscience Meeting; $300
- Centre for Neuroscience Studies Award for Excellence; $3,000
- Ontario Graduate Scholarship (OGS); $15,000
- Selected for oral presentation, University of Toronto International Symposium on the Mind (UTISM); $500

2007–2008

- Conference Travel Award, Queen's University; $300
- Centre for Neuroscience Conference Travel Award, Queen's University; $300
- HPCVL / Sun Microsystems of Canada, Inc. Scholarship in Computational Sciences and Engineering; $5,000
- Queen's University Graduate Award; $7,000

2006–2007

- Conference Travel Award, Queen's University; $300
- Centre for Neuroscience Conference Travel Award, Queen's University; $300
- Queen's University Graduate Award; $6,000

2005–2006

- Conference Travel Award, Queen's University; $300
- Queen's University Graduate Award; $8,000

2001–2002

- University College Howard Ferguson Entrance Scholarship, University of Toronto; $3,000

2000–2001

- Governor General's Academic Medal — awarded to the graduating student who achieves the highest academic standing in that academic year.

Popular Press:

Copying for success, Interview with Bob Macdonald, *Quirks and Quarks*, May 8, 2010.

To be the best, learn from the rest, Mairi Macleod, *New Scientist*, May 3, 2010.

Imitators dominate innovators in a virtual world, Kate Shaw, *Ars technica*, April 18, 2010.

Post-grad copycats prove that innovation is highly overrated, Sarah Boesveld, *The Globe and Mail*, April 16, 2010.

Conquering by copying, Elizabeth Pennisi, *Science*, April 9, 2010.

A winning combination, Elizabeth Pennisi, *Science*, April 9, 2010.

The art of copying: Scientists tell us that even copying mistakes can be good, *physorg.com*, April 9, 2010.

Copycats prevail in computer survial game, Laura Sanders, *Wired*, April 8, 2010.

Graduate Courses:

- Neuroscience Current Concepts (NSCI 800) | 91% | Top mark
- Foundations Of Neural Networks (CISC 874) | 96% | Top mark
- Sensorimotor Integration (PHGY 826) | 94%
- Memory Decision And Choice (PSYC 965) | 98% | Top mark

Theses:

Lillicrap, T.P., (2014) *Modelling motor cortex using neural network controls laws*, Ph.D. Systems Neuroscience Thesis, Centre for Neuroscience Studies, Queen's University, Kingston, ON.

Lillicrap, T.P., (2007) *Making optimal feedback control principles useful for predicting the activity of neurons*, Mini-Master's Thesis, Centre for Neuroscience Studies, Queen's University, Kingston, ON.

Other Academic Experience:

Level 2 High Performance Computing Certificate, High Performance Computing Virtual Laboratory, Queen's University, February 2008.

Workshop on using the NAG (Numerical Algorithms Group) Numerical Library, High Performance Computing Virtual Laboratory, Queen's University, February 2008.

Organized the Centre for Neuroscience Computational Workshops, Queen's University, September / October 2007.

- Lillicrap, T.P., *An introduction to neural networks and their relationship to linear regression*, November, 2007.

- Lillicrap, T.P., Pruszynski, J.A., *Fitting spatio-temporal models to single cell neuron data*, October, 2007.

Level 1 High Performance Computing Certificate, High Performance Computing Virtual Laboratory, Queen's University, 2007.

Neural Computation and Adaptive Perception, Summer School, Canadian Institute for Advanced Research, 2007.

Judge at the Frontenac-Lennox-Addington regional science fair, Kingston, Ontario, 2007.

Introduction to OpenMP Workshop, at the High Performance Computing Virtaul Laboratory, Queen's University, 2007.

Introduction to MPI Workshop, at the High Performance Computing Virtaul Laboratory, Queen's University, 2007.

Neural Computation and Adaptive Perception, Workshop on time series analysis, Canadian Institute for Advanced Research, 2007.

Sun Application Tuning Seminar, at the High Performance Computing Virtual Laboratory, Queen's University, 2007.

Neural Computation and Adaptive Perception, Summer School, Canadian Institute for Advanced Research, 2006.

Employment:

C-Motion, Inc. - Scott Selbie
Algorithm Design February 2010–May 2010

Designed and implemented bayesian optimal estimation algorithms for 3D motion capture software. Contributed to grant writing related to algorithm implementation.

Queen's University - Patrick Stroman
Research Assistant May 2008–August 2009

Developed computational tools to perform automatic segmentation of fMRI images of the spinal cord.

University of Toronto - Douglas B. Tweed
Research Assistant September 2004–January 2005

Developed novel models of sensorimotor control and learning. Programmed neural network models to investigate versatile adaptive control without weight transport. Attended and led lab discussions on a variety of theoretical and mathematical principles in motor control.

Queen's University - Stephen H. Scott
Research Assistant Summers 2003 & 2004

Developed artificial neural network models of motor adaptation and generalization to account for

limb control behaviour in human subjects. Made frequent contributions to the laboratory computing and database setup.

Real Programming 4 Kids
Programming Instructor September 2001–August 2002

Taught children (in both elementary and highschool) game oriented programming in a variety of languages. Depending on the age group instructed, Visual Basic, Java, or C++ was used, and projects ranged in difficulty from constructing 2D side-scrolling games up to developing modules for 3D engines.