

Brian S. Blais

Bryant University - Science and Technology
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EDUCATION:

- May 1998 **Brown University**, Providence, RI
 PhD. in Physics
 Advisor: Professor Leon N Cooper
- May 1995 **Sc.M.** in Physics
- Spring 1990 **Universität Heidelberg**, Heidelberg, Germany
- May 1992 **Wesleyan University**, Middletown, CT
 B.A. with Honors in Physics
 Advisor: Professor Dale Doering

RESEARCH INTERESTS:

Theoretical Neuroscience:

- learning and memory in neural systems
- vision
- spike-timing dependent plasticity

Bayesian Inference:

- frequentist versus Bayesian statistics
- Bayesian approaches to learning and memory

Digital to Analog Computer Control:

- autonomous thermal cycler for PCR experiments
- neural networks and robotics

Global Resources:

- Dynamics of global resources and economics
- Population growth, Malthusian traps, and energy

TEACHING EXPERIENCE:

August 2006–present **Science and Technology Department**, Bryant University
Associate Professor:

- Taught courses in introductory physics, astronomy, meteorology, machine learning, artificial intelligence and robotics, computational neuroscience

- Created laboratory manuals to highlight the concepts in experimental science, for physics, astronomy, and meteorology
- Designed courses in artificial intelligence and robotics as well as computational neuroscience, supervising undergraduate projects

Fall 2000–August 2006 **Science and Technology Department**, Bryant University

Assistant Professor:

- Taught courses in introductory physics, astronomy, meteorology, machine learning, artificial intelligence and robotics
- Created laboratory manuals to highlight the concepts in experimental science, for both physics and astronomy
- Created an introductory programming manual for Matlab/Octave, for Artificial Intelligence and Machine Learning

Spring 2000 **Science and Technology Department**, Bryant College

Adjunct Professor, Introductory Physics and Laboratory:

- Designed an introductory physics class and laboratory for business students
- Employed lectures and hands-on interaction to teach students
- Created a laboratory manual to highlight the concepts in experimental science

1995 **Physics Department**, Brown University

Teaching Assistant, Advanced Undergraduate Laboratory for Senior Majors:

- Led laboratory sections and help sessions.
- Prepared teaching supplements to enhance student learning.

1994 *Teaching Assistant, Electricity and Magnetism for Sophomore Majors:*

- Employed lectures and hands-on interaction to teach students in a laboratory setting.
- Prepared topical teaching supplements to enrich the learning experience.
- Used the laboratory reports to assess student understanding and promote better learning.

1993–1994 *Teaching Assistant, Introductory Physics for Non-Majors:*

- Prepared lectures to motivate laboratory material.
- Used weekly teaching sessions to augment the in-class learning
- Crafted specific supplements geared toward the non-physics-major students

1997 *Recipient of the Center for the Advancement of College Teaching Certificate:*

- Participated in seminars on pedagogy
- Reviewed a video recording of my own teaching session
- Received feedback on my teaching from observers from the CACT and the physics department

1991 **Physics Department**, Wesleyan University

Undergraduate Teaching Assistant:

- Introductory physics for non-majors.
- Newtonian mechanics and special relativity for advanced majors.

- Led help sessions, made and graded both homework and test questions.

Fall 1990 **Math Department**, Wesleyan University
Undergraduate Teaching Assistant:

- Introduction to computers (Pascal) for non-science majors
- Prepared lectures for and implemented extra class sections
- Used examples, created specifically for non-majors, to highlight possibly difficult ideas
- Made and graded both homework and test questions.

Spring 1991 **Physics Department**, Wesleyan University
Short Course Instructor:

- Designed and taught a course in Pascal programming for physics undergraduates.

RESEARCH EXPERIENCE:

2006–present **Department of Science and Technology**, Bryant University
Associate Professor:
Institute for Brain and Neural Systems, Brown University
Adjunct Professor:

- Analysis and simulations of neural sensory systems
- Synaptic modification in spiking neurons
- Bayesian data analysis
- Dynamics of global resources and economics

2000–2006 **Department of Science and Technology**, Bryant University
Assistant Professor:
Institute for Brain and Neural Systems, Brown University
Adjunct Professor:

- Analysis and simulations of neural sensory systems
- Spike-timing dependent plasticity
- Dynamics of global resources and economics
- Building hardware computer interfaces for automated data collecting and analysis

1998–2000 **Institute for Brain and Neural Systems**, Brown University
Post-doctoral Research Associate:

- Performed analysis and simulations of neural systems.
- Studied feature extraction in high dimensional data and the statistics of natural images.
- Explored scaling in neural systems, forest fires, and percolation systems

Supervisors: Professor Leon N Cooper and Professor Nathan Intrator

1998–1999 **Institute for Brain and Neural Systems**, Brown University
Research Supervisor:

- Taught and supervised an undergraduate honors thesis.

- Thesis received the 1999 Richard E. Whalen Award for Undergraduate Research Excellence in Neuroscience and Behavioral Biology.

1994–1998 **Physics Department and Institute for Brain and Neural Systems**, Brown University
Research Assistant:

- Carried out analytical and computational work on models of systems of neurons
- Studied the statistics of natural images and its effect on the function of visual neurons
- Examined bias/variance balancing in optimization problems using noise sensitivity

Advisor: Professor Leon N Cooper

1990–1992 **Physics Department**, Wesleyan University
Research Assistant:

- Studied excess electron distributions on insulators in an Ultra-High Vacuum System.
- Implemented computer models of electron emission from insulators
- Honors thesis completed.

Advisor: Professor Dale Doering

Summer 1990 **Chemistry Department**, Brookhaven National Laboratory
Research Assistant:

- Studied two-dimensional phase transitions of noble gases on graphite.

Advisor: Dr. John Larese

COMPUTATIONAL EXPERIENCE:

2002–present **Science and Technology Department**, Bryant University
System Administrator/Programmer:

- Programmed a graphical user interface, in Matlab and C, for complex neural network simulations.
- System administration of a computational neuroscience cluster
- Programmed a multi-platform neural simulator, in Python, for use with rate- and spike-based neurons

1994–2000 **Institute for Brain and Neural Systems**, Brown University
System Administrator/Programmer:

- Programmed a graphical user interface, in Matlab and C, for neural network simulations.
- System administration of a network of Sun workstations, PCs, and Macintosh computers.

1992–1993 **Macro International Inc.**, Burlington, VT.
Computer Programmer:

- Completed an interactive multi-media preschool activities project.

1990–1992 **Physics Department**, Wesleyan University
Research Assistant/Programmer:

- Implemented computer models of electron distributions in Pascal.

Summer 1990 **Chemistry Department**, Brookhaven National Laboratory

Research Assistant/Programmer:

- Interfaced a Macintosh computer with IEEE equipment to remotely run experiments.
- Programmed in Fortran and Basic

Programming languages: Python, C, C++, Matlab (GUI development), Octave, Scilab, Fortran, LISP, Pascal, HTML, S-lang.

Platforms: Linux, OS-X, UNIX on Sun and IBM SP2, MS-DOS, Windows and Macintosh.

Applications: Matlab/Octave, Maple, L^AT_EX, Emacs, Word, Excel, and others.

REFEREED PUBLICATIONS:

- Blais, B.S.** (in press). Automatic Flushing Toilets: An Entertaining Platform for Exploring Scientific Thinking. *Physics Teacher*.
- Blais, B.S.** 2010. Using Python to Program LEGO MINDSTORMS Robots: The PyNXC Project. *Python Papers* 5 (2).
- Blais, B.S**, Cooper, L.N , and Shouval H.Z. 2009. Effect of correlated lateral geniculate nucleus firing rates on predictions for monocular eye closure versus monocular retinal inactivation *Physical Review E* 80 (6): 061915.
- Blais, B.S**, Frenkel M. , Kuindersma S., Muhammad R., Shouval H.Z, Cooper, L.N , and Bear M. F. 2008 Recovery from monocular deprivation using binocular deprivation: Experimental observations and theoretical analysis. *Journal of Neurophysiology*. 100:2217-2224.
- Blais, B.S.** and Cooper, L.N 2008. BCM Theory. *Scholarpedia* 3(3):1570.
- Kuindersma, S.R., **Blais, B.S.** 2007. Teaching Bayesian Model Comparison With the Three-sided Coin. *American Statistician*. **61**(3): 239-244.
- Yeung, L.C., Shouval, H.Z, **Blais, B.S.**, Cooper, L. N. 2004. Synaptic Homeostasis and Input Selectivity Follow From a Calcium-Dependent Plasticity Model. *Proceedings of the National Academy of Science*. **101**(41): 14943-14948.
- Brian S. Blais.** 2003. Teaching Energy Balance using Round Numbers: A Quantitative Approach to the Greenhouse Effect and Global Warming. *Physics Education*. **38**(6): 519-525.
- David F. Betsch and **Brian S. Blais.** 2003. A Programmable \$25 Thermal Cycler for PCR. *Biochemistry and Molecular Biology Education*. **31**(2): 113-114.
- Yeung L. C., **Blais, B.S**, Cooper L. N, Shouval H. Z. 2003. Calcium as the associative signal for a model of Hebbian plasticity: application to multi-input environments. *Neurocomputing* 52-54:437-440.
- Shouval, H. Z., Castellani, G. C., **Blais, B.S.**, Yeung, L. C., and Cooper L. N. 2002. Converging evidence for a simplified biophysical model of synaptic plasticity. *Biological Cybernetics: Special Issue "Hebb in Perspective"*. **87**(5-6) 383-391.
- Lee A. B., **Blais B.S**, Shouval H.Z. , and Cooper L. N, Statistics of lateral geniculate nucleus

(LGN) activity determine the segregation of ON/OFF subfields for simple cells in visual cortex. 2000. *Proceedings of the National Academy of Science*. **97**(23):12875-12879.

Blais B.S., Cooper L. N. and Shouval H. Formation of Direction Selectivity in Natural Scene Environments. 2000. *Neural Computation*. **12**(5): 1057:1066.

Blais B.S., Shouval H., and Cooper L. N. 1999. The Role of Presynaptic Activity in Monocular Deprivation: Comparison of Homosynaptic and Heterosynaptic Mechanisms. *Proceedings of the National Academy of Science*. **96**: 1083-1087.

Blais B.S., Intrator N., Shouval H., and Cooper L. N. 1998. Receptive field formation in natural scene environments: comparison of single cell learning rules. *Neural Computation*. **10** (7):1797–1813.

Carroll, D.L., Doering, D.L., and **Blais, B.S.**. 1992. Thermally- and Optically-Stimulated Exoelectron Emission from an Electron Beam Irradiated Glass-Ceramic Material. *Journal of Vacuum Science Technology*. **10** (7):2863.

CONFERENCE PROCEEDINGS AND ABSTRACTS:

Blais, B. S. Modeling Ecosystems and Climates: A Teaching Simulator for Systems Dynamics. *Rhode Island Space Grant Consortium Annual Symposium*, November 2009.

Blais, B. S., Kuindersma, S. R. A Hierarchical Spatiotemporal Model of Neocortex With Probabilistic Feedback. In *Twelfth International Conference on Cognitive and Neural Systems (ICCNNS)*, May 2008

Shouval, H.Z, Gavornik, J. P., Shuler, M., Bear, M. F., and **Blais, B.S.** 2007. Learning Reward Timing using Reinforced Expression of Synaptic Plasticity In *Collaborative Research in Computational Neuroscience (CRCNS) Conference*.

Yang, H., Blais B.S., Perez, G. F., Colvin, S. , Pagani, M. 2006. Climatic signals registered as C isotopic values in Metasequoia leaf tissues: A statistical analysis. In *Abstracts of 2006 American Geophysical Union (AGU) Fall Meeting*

Shouval, H.Z, Bear, M.F., and **Blais, B.S.**. 2006. The cellular basis of receptive field plasticity in visual cortex, an integrative experimental and theoretical approach In *Collaborative Research in Computational Neuroscience (CRCNS) Conference*.

Blais, B.S. and Kuindersma, S. 2005. Synaptic Modification in Spiking-Rate Models: A Comparison between Learning in Spiking Neurons and Rate-Based Neuron Models In *Society For Neuroscience Conference Abstracts*.

Blais, B.S., Frenkel, M.Y., Kuindersma, S., Bear, M.F. 2005. The Role of Structure and Noise in the Plasticity of the Mouse Visual System. In *Proceedings of the Ninth International Conference on Cognitive and Neural Systems*.

Yeung, L.C., **Blais, B.S.**, Cooper, L. N, and Shouval, H. Z. 2003. Metaplasticity and the Unified Calcium Model Lead to Input Selectivity in Spiking Neurons. *Computational Neuroscience: Trends in Research 2003*. Amsterdam: Elsevier Science.

Yeung, L.C., **Blais, B.S.**, Cooper, L. N, and Shouval, H.Z. 2003. Selectivity and Metaplasticity in a Unified Calcium-Dependent Model. *Advances in Neural Information Processing Systems 15*. Becker, S. Thrun, and K. Obermayer, editors. MIT Press.

- Yeung, L.C., **Blais, B.S.**, and Shouval, H.Z, Cooper, L. N. 2003. Homeostatic Metaplasticity Accounts for Synaptic Scaling. In *Society For Neuroscience Conference Abstracts*.
- Blais, B.S.** 2002. Plasticity: A Synaptic Modification Simulation Environment. Demonstration in *Neural Information Processing Systems: Natural and Synthetic*.
- Yeung, L.C., **Blais, B.S.**, Cooper, L. N, and Shouval, H. Z. 2002. Calcium as the associative biochemical signal for a model of Hebbian plasticity. *Computational Neuroscience: Trends in Research 2002*. Amsterdam: Elsevier Science.
- Blais, B.S.**, Shouval, H. and Cooper, L. N. 2001. The Formation of Orientation and Direction Selectivity Maps: Comparing Rules of Synaptic Modification. In *Proceedings of the Fifth International Conference on Cognitive and Neural Systems*.
- Lee, A. B, **Blais, B.S.**, Shouval, H. and Cooper, L. N. 1999. Statistics of LGN activity determine the segregation of ON/OFF subfields for simple cells in cortex. In *The Neurobiology of Computation: Proceedings of the seventh CNS conference* .
- Blais, B.S.**, Shouval, H. and Cooper, L. N. 1998. Formation of Direction Selectivity in Natural Scene Environments. *Computational Neuroscience Meeting*.
- Blais, B.S.**, Intrator, N., Shouval, H. and Cooper, L. N. 1997. Receptive field formation in natural scene environments: comparison of kurtosis, skewness, and the quadratic form of BCM. In *Proceedings of Neural Information Processing Systems*.
- Blais, B.S.**, Shouval, H. and Cooper, L. N. 1997. Role of Noise in Visual Deprivation: a comparison between models and experimental results in visual cortex. In *Society For Neuroscience Conference Abstracts*.
- Blais, B.S.**, Shouval, H. and Cooper, L. N. 1997. How Sparse is Sparse? What is required in the natural scene environment for orientation selectivity. *Natural Scene Statistics Meeting*.
- Blais, B.S.**, Shouval H., and Cooper L. N. 1997. Dynamics of synaptic plasticity: A comparison between models and experimental results in visual cortex. In *The Neurobiology of Computation: Proceedings of the fifth CNS conference* .
- Perrone, M.P., and **Blais, B.S.**. 1995. Regression NSS: An Alternative to Cross Validation. In *Proceedings of the Eighth Annual Conference on Computational Learning Theory*. 385-391.
- Carroll, D.L., Doering, D.L., and **Blais, B.S.**. 1992. Dynamic Redistribution of Excess Charge During Photoemission in an Electron Bombarded Glass-Ceramic. In *Proceedings of the Materials Research Society*. 235:395.

THESES AND UNREFEREED PUBLICATIONS:

- Cooper, L. N, Intrator, N., **Blais, B.S.**, Shouval, H. Z. 2004. *Theory of Cortical Plasticity*. World Scientific Publishing.
- Blais, B.S.**. 1998. The Role of the Environment in Synaptic Plasticity: Towards an Understanding of Learning and Memory. *PhD Dissertation, Brown University*.
- Blais, B.S.** 1997. The Brain. Pure and Simple. How Physicists Model the Mind. *The Catalyst*.
- Blais, B.S.**. 1992. Electron Trapping Centers In Insulators: Experiment and Model. *Honors Thesis, Wesleyan University*.

MANUSCRIPTS IN PROGRESS:

NON-CONFERENCE PRESENTATIONS:

- “A Nobel Night with Bryant Science Technology Professors”, October 2010.
- “Cython: Optimization in Python.”, Bryant Finance and Science Joint Research Meeting, April 2008.
- “Inhibition and BCM.” IBNS Research Meeting, April 2008.
- “Statistics and Environmental Resources: Projects for Collaboration.” Bryant-China University of Geosciences (CUG) Joint Research Event, December 2007
- “TTX and BCM” , MIT Lab Presentation, August 2007.
- “Numerical Computing in Python: A Guide for Matlab Users.”, Bryant University, Faculty Development Seminar, May 2007.
- “Teaching Bayesian Model Comparison with the Three-sided Coin”. with Scott Kuindersma (UMass Amherst). Bryant University Faculty Research Day, January 2007.
- “ Plasticity in the Brain: A Physicist’s Perspective on Learning and Memory”, Brown University, Frontiers in the Interaction Between Physics and Biology, November 2005.
- “Learning and Teaching Statistical Inference: An Open Discussion”, Bryant University, Faculty Development Seminar, November 2005.
- “BCM and Deprivation: How does it work?”, MIT Lab Presentation, July 2005.
- “The Challenges of Robotics”, at the follow-up ‘Meet the Professionals’ day for the Math Accelerating Professionals (MAP) Program, February 2005.
- “Simulations of Visual Deprivation in Mice”, invited MIT research seminar. August, 2004.
- “Space Exploration”, F.A.S.T. (Faculty and Students Together) seminar, April, 2004.
- “Hot Topics in Global Warming: The Science of Global Warming”, at International Week Bryant College, November 2002.
- “Robot War Demonstration”, at the ‘Meet the Professionals’ day for the Math Accelerating Professionals (MAP) Program, June 2002.
- “The Physics of the Brain: Towards an Understanding of Learning and Memory”, Bryant College Science Seminar, February 2002.
- “Teaching a Spherical Chicken to Read: Feature Extraction in Neural Networks”, Bryant College Interdisciplinary Research Seminar, October 2001.
- “An exploration of models of learning using a graphical interface for single cell and network simulations”, Institute for Brain and Neural Systems Seminar, September 1999.
- “Strobe Rearing Prevents the Convergence of Inputs With Different Response Timings Onto Simple Cells: Exploring a Model of Direction Selectivity” Institute for Brain and Neural Systems Seminar, May 1999.
- “Physicists Studying the Brain”, Providence Rotary Club, March 1998.
- “Physicists Studying the Brain”, East Providence High School, May 1997.
- “How to Read the Mind of a Spherical Chicken”, Department Undergraduate Group meeting, Brown University Physics Department, April 1996.

“PVM and Parallel Programming”, Institute for Brain and Neural Systems Journal Club, March 1996.

AWARDS AND SOCIETIES:

- 2006 Received a 3-year NSF Collaborative Research in Computational Neuroscience (CRCNS) grant: “The synaptic and cellular basis of receptive field plasticity in visual cortex, an integrative experimental and theoretical approach”
- 2005 Received a Service Award for exemplary service as a faculty member at Bryant College.
- 2002 Received a Merit Award for exemplary performance as a faculty member at Bryant College.
- 2001 Received Biomedical Research Infrastructure Network (BRIN) grant, as part of a cooperative effort with URI and other Rhode Island Universities.
- 1998–1999 Postdoctoral Associate, Institute for Brain and Neural Systems, Brown University
- 1997 Center for the Advancement of College Teaching (CACT) Teaching Certificate
- 1997–present American Association of Physics Teachers (AAPT)
- 1994–1998 Research Assistantship, Brown University.

LANGUAGES:

Reading and basic speaking competence in German

PROFESSIONAL REFERENCES:

Available upon request.