

Curriculum Vitae

Alexander G. Dimitrov

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Business Address:

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Montana State University
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Degrees

- Ph.D., 1998, Applied Mathematics, The University of Chicago
- M.Sc., 1993, Physics, The University of Chicago
- B.Sc., 1991, Physics, Sofia University

Positions

- 2003 – current** Assistant Professor, Department of Cell Biology and Neuroscience, and Center for Computational Biology, Montana State University.
- 2000 – 2003** Assistant Research Professor, Center for Computational Biology, Montana State University.
- 2000 – 2001** Research Scientist (part time), The Spectrum Lab, Montana State University.
- 1998 – 2000** Research Fellow, Center for Computational Biology, Montana State University.

Graduate education

- 1993–1998, Computational and Applied Mathematics Program, Department of Mathematics, The University of Chicago, Chicago, IL, USA.
- 1991–1993, Department of Physics, The University of Chicago, Chicago, IL, USA.

Undergraduate education

- 1988–1991, Department of Physics, Sofia University “St. Kliment Ohridski”, Bulgaria. Concentration: Theoretical Physics.
- 1984–1985, Professional School for Information Service, Sofia Mathematical School, Sofia, Bulgaria.

References

Paul Bressloff	Oxford University	bressloff@maths.ox.ac.uk	+44 1865 615150
Tomáš Gedeon	Montana State University	gedeon@math.montana.edu	(406)994-5359
Don H. Johnson	Rice University	dhj@rice.edu	(713)348-4956
Aurel Lazar	Columbia University	aurel@ee.columbia.edu	(212)854-1747
Len Maler	University of Ottawa	lmaler@uottawa.ca	(613)562-5800 (8189)
John P. Miller	Montana State University	jpm@cns.montana.edu	(406)994-7332

Honors

- 2009 Outstanding Coach Award, 2008-2009 Montana FIRST Lego League Championship Tournament
- 2008 Panelist, NCI think tank *Physical Sciences-Based Frontiers in Oncology The Coding, Decoding, Transfer, and Translation of Information in Cancer*
- 2007 MSU/Bozeman Chamber of Commerce Award for Teaching Excellence
- 1996–1998 GAANN Graduate Scholarship (US Dept. of Education)
- 1993 Graduate Fellowship, The University of Chicago, Department of Mathematics
- 1988–1990 Scholastic Excellence Prize, Sofia University

Grants**pending**

- 2008 – Proposals to NSF **Cyber-Enabled Discovery** (CDI), DARPA BAA (PI and co-PI, Bio-inspired Engineering, under review)

funded

- 2004 – 2008 NSF, HHMI REU (faculty adviser, \approx \$40,000).
- 2005 – 2007 NIH INBRE 5P20RR016455 (faculty adviser, \$52,000)
- 2006 – 2007 NCSI computational grant IBN060005N (PI, \approx \$10,000 in supercomputer time and support)
- 2003 – 2004 EPSCoR NSF EPS-03464585 (PI, \$100,000, startup equipment/personnel).
- 2002 – 2007 NSF CIS *Biological Information Technology Systems* EIA-0129895 (co-PI, \$1,400,347; allocated \$232,000).
- 1998 – 2001 NIMH NRSA 5F32MH012159 postdoctoral research award (\$94,236).

Research Interests

Information-theoretic and probabilistic approaches to neural computing and cognitive processes; mathematical neuroscience; non-linear neuronal models; chaotic dynamical systems; non-linear signal processing and prediction; systems identification; neural-based intelligent agents. Bio-inspired engineering.

Areas of Teaching Competence

All levels in Mathematical Biology, Mathematical and Computational Neuroscience and Neurobiology, college level Animal Physiology. All level of Applied Mathematics (ODE, PDE, Dynamical Systems Theory, Bifurcations and Chaos, Mathematical Methods in Physical and Biological Sciences). College level Mathematics (Calculus, Pre-Calculus, Linear Algebra, Analytic Geometry). College level Probability and Statistics. Information Theory and applications.

Publications**Books**

- Dimitrov.** Aspects of Cortical Information Processing. Ph.D. Thesis, The University of Chicago, 1998

Invited Papers

- Dimitrov.** Pings the body electric (and means it too). *Journal of Neurophysiology* 97:2577-2578, 2007.
- Gedeon, Parker and **Dimitrov.** Information Distortion and Neural Coding. *Canadian Mathematical Quarterly*, 10:33-70, 2003.
- Dimitrov,** Miller, Aldworth, Gedeon, Parker. Analysis of neural coding using quantization with an information-based distortion measure. *Network: Computation in Neural Systems*, 14:151-176, 2003.

Papers

- Basta, Clinton, **Dimitrov,** McClure. Evolution of Teleost Fish Retroviruses: Identification of New Retroviruses With Cellular Genes. *Journal of Virology*, 83(19):2546-2558, 2009.
- Dimitrov,** Sheiko, Baker, Yen. Spatial and temporal jitter distort estimated functional properties of visual receptive neurons. *Journal of Computational Neuroscience*, DOI 10.1007/s10827-009-0144-8, 2008.
- Dimitrov,** Azouz and Israeli. Effects of stimulus transformations on estimated functional properties of mechanosensory neurons in rat. *Neurocomputing* 70:1772-1776, 2007.
- Dimitrov,** Gedeon. Effects of stimulus transformations on characteristics of sensory neuron function. *Journal of Computational Neuroscience*, 20:265-283, 2006
- Aldworth, Miller, Gedeon, Cummins, and **Dimitrov.** Dejittered Spike-Conditioned Stimulus Waveforms Yield Improved Estimates of Neuronal Feature Selectivity and Spike-Timing Precision of Sensory Interneurons. *The Journal of Neuroscience*, 25(22):5323-5332, 2005
- Mumey, Sarkar, Gedeon, **Dimitrov,** Miller. Finding neural codes using random projections. *Neurocomputing*, 58-60: 19-25, 2004
- Dimitrov,** Gedeon, Mumey, Snider, Parker and Miller. Derivation of Natural Stimulus Feature Set Using a Data-Driven Model. In *Lecture Notes in Computer Science: Computational Science – ICCS 2003*, P.M.A. Sloot et al., Eds., pp. 337-345, Springer Verlag, Berlin, 2004.
- Mundel, Milton, **Dimitrov,** Wilson, Pelizzari, Uftring, Torres, Erickson, Spire and Towle. Transient inability to distinguish between faces: electrophysiologic studies. *Journal of Clinical Neurophysiology*, 20:102-10, 2003
- Cummins, Crook, Ganje, **Dimitrov,** Jacobs and Miller. Structural and biophysical mechanisms underlying dynamic sensitivity of primary sensory interneurons in the cricket cercal sensory system. *Neurocomputing*, 52-54:45-52, 2003.
- Dimitrov.** Spike sorting the other way. *Neurocomputing*, 52-54:741-745, 2003.
- Parker, Gedeon, **Dimitrov.** Annealing and the rate distortion problem. In *Advances in Neural Information Processing Systems 15*, Becker, Thurn, Obermayer (eds), 969-976, 2003, The MIT Press
- Dimitrov,** Miller, Aldworth and Parker. Spike pattern-based coding schemes in the cricket cercal sensory system. *Neurocomputing*, 44-46:373-379, 2002.
- Dimitrov,** Miller. Neural coding and decoding: communication channels and quantization. *Network: Computation in Neural Systems*, 12(4): 441-472, 2001.
- Dimitrov,** Miller, Aldworth, Gedeon. Non-uniform quantization of neural spike sequences through an information distortion measure. *Neurocomputing*, 38-40:175-181, 2001
- Penev, **Dimitrov,** Miller. Characterization of and Compensation for the Nonstationarity of Spike Shapes during Physiological Recordings. *Computational Neuroscience: Trends in Research 2001* ed. J. Bower, Elsevier.
- Dimitrov,** Miller. Analyzing sensory systems with the information distortion function. In R. B. Altman, editor, *Pacific Symposium on Biocomputing 2001*. World Scientific Publishing Co., 2000.

- Dimitrov**, Miller. Natural time scales for neural encoding. *Neurocomputing*, 32-33:1027–1034, 2000.
- Dimitrov**, Cowan. Spatial decorrelation in orientation selective cortical cells. *Neural Computation*, 10(7):1779–1795, 1998.
- Dimitrov**, Cowan. Edge detectors and texture detectors differ in their lateral connectivity. *Computational Neuroscience: Trends in Research 1998*, ed. J. Bower, Plenum Press.
- Dimitrov**, Cowan. Spatial decorrelation in orientation tuned cortical cells. *Advances in Neural Information Processing System 9*, Mozer, Jordan and Petsche (eds), 1997, The MIT Press.
- Mundel, **Dimitrov**, Cowan. Visual cortex circuitry, pop-out, and the tilt illusion. *Advances in Neural Information Processing System 9*, Mozer, Jordan and Petsche (eds), 1997, The MIT Press.
- Mundel, **Dimitrov**, Cowan. A simple model for cortical orientation selectivity. *Computational Neuroscience: Trends in Research 1997* ed. J. Bower, Plenum Press.

Pending Papers

- Aldworth, Miller, **Dimitrov**. Temporal coding in a nervous system. *Journal of Neurophysiology*, 2009 (under review).
- Parker, **Dimitrov**, Gedeon. Symmetry breaking in soft clustering decoding of neural codes. *IEEE Transactions on Information Theory (special issue on Molecular Biology and Neuroscience)*, 2009 (under review).

Work in Progress

- Ganje, Miller, **Dimitrov**. Temporal coding in sensory afferents of the cricket cercal sensory system. 2009 (in preparation)
- Dimitrov**. What you show is what you get: sampling biases distort biological sensory function. 2009 (in preparation)

Invited Talks

- Querying for Relevant Stimuli. *Methods of Information Theory in Computational Neuroscience CNS*07 Workshop*. Toronto, Canada, July 2007.
- Lossy Compression in Neural Sensory Systems: At what Cost (Function)? *Methods of Information Theory in Computational Neuroscience CNS*06 Workshop*. Edinburgh, UK, July 2006.
- Effects of stimulus transformations on the perceived function of sensory neurons. *New Approaches to Characterizing Neural Responses, CoSyNe 2005 Workshop*. Snowbird, UT, March 2005.
- Analysis and modeling of sensory systems through quantization. *Understanding the Brain Program*. Kavli Institute for Theoretical Physics, UC Santa Barbara, July - October 2004.
- Information Distortion as a model of sensory processing. *Workshop on Information Theory and Learning, Neural Information Processing Systems*. Whistler, BC, December 2003
- Unit failure and neural circuit complexity *Workshop on Optimization and constraints in the evolution of brain design*. Cold Spring Harbor Laboratory, July 2003
- Analysis and modeling of sensory systems through quantization. *Workshop on neural coding and functionality*. Mathematical Biosciences Institute, Ohio State University, Columbus, Ohio. February, 2003
- Information distortion and neural coding. *Workshop: Information and Statistical Structure in Spike Trains. Neural Information Processing System*. Whistler, BC, December, 2001
- Coding schemes based on activity classes in the cricket cercal sensory system. *Neural Information and Coding Workshop IV*. Big Sky, Montana. March, 2001

Conference Presentations

1996 – Over 25. 1-2 yearly at each of the Organization for Computational Neuroscience and Society for Neuroscience annual meetings. Occasional presentations at NIPS, CoSyne, SAND, Gordon Conferences and specialized colloquia.

Research Experience

2003 – **Assistant Professor**, Cell Biology and Neuroscience and Center for Computational Biology, Montana State University.

2000 – 2003 **Assistant Research Professor**, Center for Computational Biology, Montana State University.

1998 – 2000 **Research Fellow**, Center for Computational Biology, Montana State University.

Research Topics

Invariances and Functional Properties of Sensory Systems.

Information Processing in Biological Sensory Systems.

Structure/Function Relations in Biological Sensory Systems.

Neural Coding.

2000 – 2001 **Research Scientist**, The Spectrum Lab, Montana State University.

Research Topics

Signal Processing with High Bandwidth Holographic Devices.

Professional activities**Membership in Professional Organizations**

Society for Industrial and Applied Mathematics

Society for Neuroscience

Conference Organizer

2009–now Board Member, Organization for Computational Neuroscience

2006–2009 Program Committee Member, Organization for Computational Neuroscience

Workshop Organizer

"Methods of Information Theory in Computational Neuroscience" CNS, July 2009, Berlin, Germany.

"Methods of Information Theory in Computational Neuroscience" CNS, July 2008, Portland, OR.

"Methods of Information Theory in Computational Neuroscience" CNS, July 2007, Toronto, Canada.

"Methods of Information Theory in Computational Neuroscience" CNS, July 2006, Edinburgh, UK.

"Constraints on neural systems design", CNS, July 2003, Alicante, Spain.

Peer Review

Editor Review editor, *Frontiers in Computational Neuroscience*

Reviewer *Network: Computation in Neural Systems*; *Journal of Computational Neuroscience*; *Biological Cybernetics*; *Neuron*; *Journal of Neuroscience*; *Journal of Neurophysiology*; *Computational Neuroscience Conference*; *Journal of Physics A: Mathematical and General*; *Journal of the Optical Society of America*

Panel Review NSF CRCNS Panelist, 2009

Participant in International Conferences

annually Society for Industrial and Applied Mathematics Meeting

annually Society for Neuroscience Meeting

annually Computational Neuroscience Meeting

2005,2009 Computational and Systems Neuroscience (CoSyNe)

1997,2003 Neural Information Processing Systems

Other Professional Experience

Parallel Computing Environments: ccNUMA (SGI Origin 2000, Altix 350, Altix 3600), Beowulf class (MPI, openMP), starP (Matlab parallel backend), Matlab Distributed Computation Engine, Jacket (Matlab GPU computing platform).

Numeric and Symbolic Computer packages: Matlab, R (gnu S-Plus), Maple, Mathematica, XPP-AUTH, StarLOGO, LabView, RoboLab.

Computer Programming languages: C, C++, Forth, FORTRAN, Pascal, Python.

Operating Systems: Unix (Linux, SGI), Windows.