

Alan D. Dorval II

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Academic History

- Jan. 2009 – **University of Utah, College of Engineering**, Salt Lake City, UT
present Assistant Professor of Biomedical Engineering in the Department of Bioengineering with appointments in the Neuroscience Program and the Brain Institute
Research focused on using engineering approaches to understand the nervous system and utilizing that knowledge to improve neural function and quality of life for individuals with neurological diseases and disorders.
Methods include: computational modeling; multi-electrode recording in awake and behaving rodent models; in vitro recording of neurons and small neuronal networks; information-theoretic signal analysis; and clinical experiments with human participants.
- Sept. 2004 – **Duke University, Pratt College of Engineering**, Durham, NC
Dec. 2008 Research Associate in Biomedical Engineering with Dr. Warren M. Grill.
Research focused on Deep Brain Stimulation, a treatment for movement disorders.
Methods include: computational modeling of affected brain regions; multi-electrode recording in a rodent model of movement disorder; information-theoretic signal analysis of data from rodent and primate models of movement disorders; and intra- and post-operative experiments in human subjects.
- Sept. 1997 – **Boston University, College of Engineering**, Boston, MA
May 2004 Earned Ph.D. in Biomedical Engineering. Adviser: Dr. John A. White.
Dissertation included design and implementation of hard real-time system capable of producing neuronal conductance changes in vitro, examination of differential effects of current and conductance inputs on nerve cells, and exploration of the role of intrinsic noise sources on qualitative behaviors of stellate cells in superficial medial entorhinal cortex.
Passed qualifying exams in physiology, cell biology, engineering math, signals & systems, circuit theory, electromagnetic fields, instrumentation and excitable membranes.
- Aug. 2001 **Marine Biological Laboratories**, Woods Hole, MA
Completed Methods in Computational Neuroscience course. Co-directors: Dr. William Bialek and Dr. Robert de Ruyter van Stevenick.
Explored the application of information theory approaches to experimental and computational neuroscience at all levels, from ion channel fluctuations to organism behavior.
- Jan. 1995 – **Rensselaer Polytechnic Institute, College of Engineering**, Troy, NY
May 1997 Received B.S. in Biomedical Engineering with a concentration in Electrical Engineering.
Focused on cellular biology, organic chemistry, physiology, analog & digital circuits, dynamical systems, embedded control and image processing.
Completed senior project: software program to identify and localize brain activity in fMRI data.
- July 1992 – **United States Naval Academy**, Annapolis, MD
Aug. 1994 Pursued studies in Electrical Engineering and Computer Science.
Primary classes included calculus, physics, electronics, computer programming, leadership, naval & American history, and naval navigation, tactics & strategies

Teaching Experience

- Aug. 2004 **Marine Biological Laboratories**, Woods Hole, MA
Teaching Assistant: Neural Systems and Behavior, post-graduate course.
Lectured about dynamic clamp techniques and difficulties. Guided students in their own dynamic clamp experiments in rat neural tissue.
- Aug. 2003 **Marine Biological Laboratories**, Woods Hole, MA
Teaching Assistant: Methods in Computational Neuroscience, post-graduate course.
Created problem sets, assisted students in material comprehension and problem sets.
- Aug. – Dec., 2002, 2000 & 1998 **Boston University, College of Engineering**, Boston, MA
Teaching Fellow or Assistant: Quantitative Studies of Excitable Membranes, graduate course.
Instructed laboratory periods, conducted office hours, prepared solutions to projects & homework assignments, and graded exams, projects & homework.
- Jan. 2000 – May 2000 **Boston University, College of Engineering**, Boston, MA
Teaching Assistant: Advanced Signals and Systems, graduate course.
Conducted office hours and graded homework assignments & projects.
- Jan. 1999 – May 1999 **Boston University, College of Engineering**, Boston, MA
Teaching Fellow: Biomedical Instrumentation, graduate course.
Assisted in curriculum development, presented lectures, led laboratory periods, held office hours, graded homework & projects, and helped determine final grades.
- Aug. 1998 – Dec. 1998 **Boston University, College of Engineering**, Boston, MA
Teaching Fellow: Quantitative Studies of Cardiovascular & Respiratory Systems, grad. course.
Conducted office hours and graded projects.
- Jan. 1997 – May 1997 **Rensselaer Polytechnic Institute, College of Engineering**, Troy, NY
Teaching Assistant: Physics I, undergraduate course.
Assisted laboratory period instruction, graded projects and homework.

Related Experience

- Sept. 1996 – Aug. 1997 **AutoQuant Imaging, Inc.**, Troy, NY
Software Engineer and Researcher.
Lead creation team of fMRI activation analysis suite AutoDetect and analyzed fMRI data.
Implemented various novel visualization and reconstruction algorithms for three-dimensional medical visualization software, AutoVisualize.
Assisted in programming of a blind deconvolution software package, used for microscope data reconstruction, AutoDeblur.

Research Support

“Career Development in the Mechanisms of Deep Brain Stimulation.” *PI:* Alan D. Dorval II
Award: NIH/NINDS, K25-NS0535444 *Direct Support:* \$510,000
Period: 1/1/06 - 12/31/10

The project objective is to determine the mechanisms by which deep brain stimulation alleviates symptoms of neurological movement disorders and to improve treatment. Methods include: computational modeling of affected brain regions; multi-electrode recording in a rodent model of movement disorder; information-theoretic analysis of data from rodent and primate models; and intra- and post-operative measurements in human patients.

Professional Activities

National Postdoctoral Association, Advocacy Committee & Meetings Committee, 2008 – 2009.

Duke University Postdoctoral Association, Executive Board 2006-2007, President 2008.

Boston University Student Association of Graduate Engineers, Officers' Committee, 1998 – 2003.

BioMedical Engineering Society (BMES), Member, 2003 – *present*.

Society for Neuroscience (SfN), Member, 2000 – *present*.

Reviewed manuscripts for following journals:

Annals of Biomedical Engineering

Journal of Neurophysiology

Journal of Neuroscience Methods

Neural Computation

Publications

Dorval AD, Kuncel AM, Birdno MJ, Turner D, Grill WM. “Stimulation of the subthalamic nucleus that regularizes thalamic throughput alleviates bradykinesia in human participants with Parkinson's disease.” (*in preparation, January 2009*).

Dorval AD, Russo GS, Hashimoto T, Xu W, Grill WM, Vitek JL. “Deep brain stimulation reduces neuronal entropy in the MPTP-primate model of Parkinson's disease.” *J Neurophysiol*, 100(5): 2807-2818, 2008.

Dorval AD. “Probability distributions of the logarithm of inter-spike intervals yield accurate entropy estimates from small datasets.” *J Neurosci Meth*, 173(1):129-139, 2008.

Birdno MJ, Kuncel AM, **Dorval AD**, Turner DA, Grill WM. “Tremor varies as a function of the temporal regularity of deep brain stimulation.” *NeuroReport*, 19(5):599-602, 2008.

Haas JS, **Dorval AD**, White JA. “Contributions of I_h to feature selectivity in layer II stellate cells of the entorhinal cortex.” *J Comput Neurosci*, 22(2):161-171, 2007.

Dorval AD. “The rhythmic consequences of ion channel stochasticity.” *The Neuroscientist* 12(5):442-448, 2006.

Dorval AD, White JA. “Synaptic input statistics tune the variability and reproducibility of neuronal responses.” *Chaos*, 16(2):26105, 2006. **selected as highlight publication 7/1/2006: *Virtual Journal of Biological Physics Research*.

Dorval AD, White JA. “Channel noise is essential for perithreshold oscillations in entorhinal stellate neurons.” *J Neurosci*, 25(43):10025-10028, 2005.

Netoff TI, Banks MI, **Dorval AD**, Acker CD, Haas JS, Kopell N, White JA. “Synchronization in hybrid neuronal networks of the hippocampal formation.” *J Neurophysiol*, 93(3):1197-1208, 2005.

Dorval AD, Christini DJ, White JA. “Real-time linux dynamic clamp: a fast and flexible way to construct virtual ion channels in living cells.” *Ann Biomed Eng*, 29: 897-907, 2001.

Book Chapters and Peer Reviewed Conference Manuscripts

Dorval AD, Bettencourt JB, Netoff TI, White JA. “Hybrid Neuronal Network Studies Under Dynamic Clamp.” *Methods in Molecular Biology: Applied Patch Clamp*, Humana Press, Totowa, NJ, 2007.

White JA, **Dorval AD**. “Neuro-electric principles.” *The Electrical Engineering Handbook*, 3rd edition. Dorf RC (Ed.), CRC Press, Boca Raton, 2005.

Dorval AD, Netoff TI, White JA. “Real-time experimental control in cellular neurophysiology.” *Proceedings of the 1st International IEEE EMBS Conference on Neural Engineering*, 71-74, 2003.

White JA, Netoff TI, **Dorval AD**, Banks MI. “Assessing neuronal synchronization properties using spike time response methods.” *Proceedings of the 25th Annual International Conference of the IEEE EMBS*, 3:2235-2238, 2003.

White JA, Netoff TI, Acker CD, **Dorval AD**, Haas JS. “The biophysical bases of synchronous activity in the hippocampal formation.” *Proceedings of the Second Joint EMBS/BMES Conference*, 3:1958-1959, 2002.

White JA, Haas JS, **Dorval AD**. “Stochastic dynamic clamping as a method for studying the effects of biological noise sources.” *Proceedings of the First Joint EMBS/BMES Conference*, 2:880, 1999.

Conference Abstracts

- Qi RY, **Dorval AD**, Grill WM. "Computational modeling of the effects of rate and regularity of deep brain stimulation." *BioMedical Engineering Society, annual meeting*, Oct. 2008.
- Birdno MJ, Kuncel AM, **Dorval AD**, Turner D, Grill WM. "Correlation of human tremor responses with model neuron spike patterns during deep brain stimulation." *BioMedical Engineering Society, annual meeting*, Oct. 2008.
- Dorval AD**, Kuncel AM, Birdno MJ, Turner D, Grill WM. "Deep brain stimulation that regularizes neural activity alleviates parkinsonian motor symptoms." *Neural Interfaces Conf., biannual meeting*, Jun. 2008.
- Dorval AD**, Kuncel AM, Birdno MJ, Turner D, Grill WM. "Deep brain stimulation that regularizes thalamic throughput alleviates parkinsonian bradykinesia." *Society for Neuroscience, annual meeting*, Nov. 2007.
- Birdno MJ, Kuncel AM, **Dorval AD**, Turner D, Grill WM. "Tremor reduction by deep brain stimulation (DBS) is dependent on stimulation rate and regularity." *Society for Neuroscience, annual meeting*, Nov. 2007.
- Dorval AD**, Kuncel AM, Birdno MJ, Turner D, Grill WM. "High frequency stimulation that regularizes thalamic activity treats parkinsonian bradykinesia." *BioMedical Engineering Society, annual meeting*, Sept. 2007.
- Dorval AD**, Russo GS, Hashimoto T, Xu W, Vitek JL, Grill WM. "Pallidal neurons phase lock to high frequency stimulation of the subthalamic nucleus." *Society for Neuroscience, conference*, Oct. 2006.
- Dorval AD**, Russo GS, Hashimoto T, Xu W, Vitek JL, Grill WM. "Pallidal neurons phase lock to deep brain stimulation in the subthalamic nucleus." *BioMedical Engineering Society, annual meeting*, Oct. 2006.
- Dorval AD**, Russo GS, Hashimoto T, Xu W, Vitek JL, Grill WM. "Effective deep brain stimulation eliminates disordered neural activity." *NIH & NINDS Neural Interfaces Workshop*, Aug. 2006.
- Dorval AD**, Russo GS, Hashimoto T, Xu W, Vitek JL, Grill WM. "Subthalamic high frequency stimulation regularizes pallidal and thalamic neural activity." *Society for Neuroscience, annual meeting*, Oct. 2005.
- Dorval AD**, Russo GS, Hashimoto T, Xu W, Vitek JL, Grill WM. "Deep brain stimulation puts neural activity back in order." *BioMedical Engineering Society, annual meeting*, Sept. 2005.
- White JA, Bettencourt J, **Dorval AD**, Netoff T. "Real-time virtual realities for living neurons." *BioMedical Engineering Society, annual meeting*, Sept. 2005.
- Dorval AD**, Russo GS, Hashimoto T, Xu W, Vitek JL, Grill WM. "High frequency subthalamic stimulation restores order to pallidal firing patterns." *NIH & NINDS Neural Interfaces Workshop*, Sept. 2005.
- Dorval AD**, White JA. "Persistent sodium channel flicker enables normal theta-rhythmic activity in stellate cells of the medial entorhinal cortex." *Society for Neuroscience, annual meeting*, Nov. 2004.
- Dorval AD**, White JA. "Intrinsic noise broadens the spectrum of expressible neuronal behaviors." *BioMedical Engineering Society, annual meeting*, Oct. 2004.
- Dorval AD**, White JA. "Stellate cell responses to conductance input: reliability resonance in the theta frequency band." *Society for Neuroscience, annual meeting*, Nov. 2003.
- Dorval AD**, White JA. "Neurons respond differently to applied current and applied conductance." *BioMedical Engineering Society, annual meeting*, Oct. 2003.
- Netoff TI, **Dorval AD**, White JA. "Hybrid neuronal networks of biological cells interacting with virtual counterparts." *BioMedical Engineering Society, annual meeting*, Oct. 2003.
- Haas JS, **Dorval AD**, White JA. "Resonance and feature selectivity in stellate cells of the entorhinal cortex." *Society for Neuroscience, annual meeting*, Nov. 2002.
- Netoff TI, **Dorval AD**, Acker CD, Kopell N, White JA. "Testing predictions of spike time response curve models on neuronal dynamics in medial entorhinal cortex." *Society for Neurosci., annual meeting*, Nov. 2002.
- Dorval AD**, White JA. "General purpose dynamic clamp for constructing virtual ion channel conductances in living neurons." *Society for Neuroscience, annual meeting*, Nov. 2001.
- Dorval AD**, White JA. "A quick and inexpensive method to achieve real-time control in biomedical experiments." *BioMedical Engineering Society, annual meeting*, Oct. 2001.
- White JA, **Dorval AD**. "Effects of channel noise in the hippocampal formation." *BioMedical Engineering Society, annual meeting*, Oct. 2000.