

Adam Johnson

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Psychology Department
Bethel University
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Education

PhD –

Advisor: Dr. A.D. Redish
Graduate Program in Neuroscience, June 2008
University of Minnesota, Minneapolis, MN USA
Centre for the Biology of Memory (Fulbright student 2006-2007)
NTNU - Norwegian University of Science and Technology, Trondheim, Norway

BS –

Majors: Physics, Psychology, May 2002
Minor: Mathematics
Minnesota State University - Mankato, Mankato, MN USA

Positions

2010-present Consultant, Neurostimulation/Movement Disorders Group, Medtronic
2008-present Assistant Professor, Psychology Department, Bethel University
2008-present Adjunct Professor, Department of Psychology, University of Minnesota

Awards and Honors

2009 Edgren Scholars Award, Bethel University.
2008 American Legion Brain Sciences Award.
2007-2008 Doctoral Dissertation Fellowship, University of Minnesota.
2007 Beatrice Z. Milne and Theodore Brandenburg Award for Research in the Basic Sciences, Minnesota Medical Foundation, University of Minnesota.
2006 Stark Award, Graduate Program in Neuroscience, University of Minnesota.
2006-2007 Fulbright scholarship (Norway).
2006 Charles and Dorothy Andrew Bird Award, Sigma Xi.
2004-2006 Pre-doctoral fellowship, Center for Cognitive Sciences, University of Minnesota.
2002-2006 3M Graduate fellowship.
2002-2004 Pre-doctoral fellowship, IGERT Computational Neuroscience Training Program, University of Minnesota.
2002-2003 University of Minnesota Graduate Fellowship.
2002 William Rucker Award for Excellence in Psychology, Psychology Department, Minnesota State University – Mankato.
2001-2002 Independent Undergraduate Research Grant, Minnesota State University – Mankato.
2001-2002 College of Science Engineering and Technology General Scholarship, Minnesota State University – Mankato.
2000-2002 Wissink Scholarship, Physics Department, Minnesota State University – Mankato.

Publications

Papers

1. M. van der Meer, **A. Johnson**, N.C. Schmitzer-Torbert, A.D. Redish (in press). "Triple dissociation of information processing in dorsal striatum, ventral striatum, and hippocampus on a learned spatial decision task." *Neuron*.
2. **A. Johnson**, D. Crowe. (2009) "Revisiting Tolman: Theories and cognitive maps." *Cognitive Critique* 1(1), 43-72.
3. **A. Johnson**, C. Kentros, A.A. Fenton, A.D. Redish. (2009) "Looking for cognition in the structure within the noise." *Trends in the cognitive sciences* 13(2), 55-64.
4. A.D. Redish, S. Jensen, **A. Johnson** (2008). "A unified theory of addiction: vulnerabilities in the decision process." *Behavioral and Brain Sciences* 31, 415-487.
5. **A. Johnson**, M. van der Meer, A.D. Redish (2008). "Integrating hippocampus and striatum in decision-making." *Current Opinion in Neurobiology* 17(6):692-7.
6. **A. Johnson**, A.D. Redish (2007). "Neural ensembles in CA3 transiently encode paths forward of the animal at a decision point: a possible mechanism for the consideration of alternatives." *Journal of Neuroscience* 27(45):12176-12189.
-- See related news article by K. Heyman (2007). "Neuroscience: Hippocampal cells help rats think ahead." *Science* 318(5852):900.
<http://www.sciencemag.org/cgi/content/full/318/5852/900>
7. A.D. Redish, S. Jensen, **A. Johnson**, Z. Kurth-Nelson (2007). "Reconciling temporal-difference models with the behavioral extinction and renewal: implications for addiction, relapse, and problem gambling." *Psychological Review* 114(3): 784-805.
8. A.D. Redish, **A. Johnson** (2007). "A computational model of craving and obsession." *Annals of the New York Academy of Sciences* 1104: 324-339.
9. J.C. Jackson, **A. Johnson**, A.D. Redish (2006). "Hippocampal sharp waves and reactivation during awake states depend on repeated sequential experience." *Journal of Neuroscience* 26(48): 12415-12425.
10. **A. Johnson**, A.D. Redish (2005). "Hippocampal replay contributes to within session learning in a temporal difference reinforcement learning model." *Neural Networks* 18(9): 1163-1171.
11. **A. Johnson**, K.D. Seeland, A.D. Redish (2005). "Reconstruction of the postsubiculum head direction signal from neural ensembles." *Hippocampus* 15(1): 86-96.

Book chapters

1. **A. Johnson**, J.C. Jackson, A.D. Redish (2009). "Measuring distributed properties of neural representation beyond the decoding of local variables – implications for cognition." chapter in C. Holscher and Munk, eds. *Mechanisms of information processing in the Brain: Encoding of information in neural populations and networks*. Cambridge University Press, Cambridge UK.

PhD Dissertation

A. Johnson (2008). On the use of cognitive maps. Graduate Program in Neuroscience, University of Minnesota.

Submitted papers and papers in preparation

1. M.A.A van der Meer, **A. Johnson**, N.C. Schmitzer-Torbert, A.D. Redish. "Decoding the roles of rat dorsolateral striatum, ventral striatum, and hippocampus on a spatial decision task." Submitted.
2. **A. Johnson**, Z. Varberg, P. Schrater. "A theory of hippocampal function: hierarchical latent variable models for memory consolidation and episodic memory." In preparation.

Abstracts

1. Z. Varberg, P. Schrater, **A. Johnson** (2010). "Hippocampal learning and cognitive maps as products of hierarchical latent variable models." *Midbrains Annual Meeting*.
2. **A. Johnson**, Z. Varberg, P. Schrater (2010). "Hippocampal learning and cognitive maps as products of hierarchical latent variable models." *Cosyne Annual Meeting*.
3. M.A.A. van der Meer, **A. Johnson**, N.C. Schmitzer-Torbert, A.D. Redish (2009). "Multiple dissociations in neural ensemble dynamics between rat dorsal striatum, ventral striatum, and hippocampus." *Cosyne Annual Meeting*.
4. **A. Johnson**, A.A. Fenton, C. Kentros, A.D. Redish (2008). "Identifying structure in the noise - covert variables and cognition." *Society for Neuroscience Annual Meeting*.
5. A.D. Redish, N.C. Schmitzer-Torbert, **A. Johnson**, M.A.A. van der Meer (2008). "Lost in thought? Pausing behavior at the high-cost choice point on the multiple-T task." *Society for Neuroscience Annual Meeting*.
6. **A. Johnson**, A.D. Redish (2008). "Decoding multiple information processing modes: implications for decision-making." *Neural Circuits and Decision Making in Rodents: Invited special meeting at Janelia Farm HHMI*.
7. **A. Johnson**, P. Schrater A.D. Redish (2007). "Application of multiple generative models for identification and decoding of spatial memory in the hippocampus." *Cosyne Annual Meeting*.
8. **A. Johnson**, N.C. Schmitzer-Torbert, P. Schrater A.D. Redish (2006). "Neural ensembles in CA3 transiently encode paths forward of the animal at a decision point: a possible mechanism for the consideration of alternatives." *Society for Neuroscience Annual Meeting*.
9. **A. Johnson**, N.C. Schmitzer-Torbert, P. Schrater A.D. Redish (2006). "Neural representations underlying learning and memory: critical analyses and theoretical considerations for experimental data." *Computational Neuroscience Annual Meeting*.
10. **A. Johnson**, N.C. Schmitzer-Torbert, J.C. Jackson, and A.D. Redish (2005). "Differential changes in neural activity in the dorsal hippocampus and dorsal striatum during performance of a multipleT task." *Society for Neuroscience Annual Meeting*.
11. A.D. Redish S. Jensen, **A. Johnson**, Z. Kurth-Nelson (2005). "Reward loss does not produce unlearning: Implications for TDRL." *Society for Neuroscience Annual Meeting*.
12. J.C. Jackson, **A. Johnson**, A.D. Redish (2005). "Sharp-wave events and correlated neuronal activity increase during behavior." *Society for Neuroscience Annual Meeting*.
13. G.P. Cortese, M. Little, **A. Johnson**, A.D. Redish (2005). "Opposite effects of inactivations of dorsal hippocampus or dorsal striatum on maze learning." *Society for Neuroscience Annual Meeting*.
14. **A. Johnson**, A.D. Redish (2005). "Observation of transient neural dynamics in the rodent hippocampus during behavior of a sequential decision task using predictive filter methods." *European Brain and Behavior Society Annual Meeting*.
15. J. Jackson, **A. Johnson**, A.D. Redish (2005). "Hippocampal sharp wave events increase during behavior with experience within session." *Computational Neuroscience Annual Meeting*.
16. A.D. Redish, **A. Johnson**, S. Jensen, J. Jackson (2005). "Latent learning requires multiple value functions with temporal difference reinforcement learning." *Computational Neuroscience Annual Meeting*.
17. **A. Johnson**, A.D. Redish (2005). "Hippocampal replay contributes to within session learning in a temporal difference reinforcement learning model." *Computational Neuroscience Annual Meeting*.
18. **A. Johnson**, K.D. Seeland, A.D. Redish (2003). "Head-direction ensembles recorded from awake, behaving rats in an open field environment under cue-conflict situations." *Society for Neuroscience Annual Meeting*.
19. **A. Johnson**, A. Mohanty, R. Flint (1999). "Effects of glucose on spatial memory." *Psi Chi Poster – Midwest Psychological Association Annual Meeting*.

Invited Lectures

1. "A theory of hippocampal function: memory consolidation and episodic memory." Center for Cognitive Science, University of Minnesota, April, 2010.
2. "Hippocampal function: theory and experiment." Harvard University, March 2010.
3. "On the use of cognitive maps." Neuroscience seminar, St. Olaf College, October 2008.
4. "Spatial representations, memory and imagination in the rat hippocampus." Cognitive Neuroscience Seminar, Macalester College, February 2008.
5. "Learning and memory in the rodent hippocampus." Guest lecture, Bethel University, February 2008.
6. "The physics and biology of memory." Graduate Physics Seminar, Minnesota State University – Mankato, February 2008.
7. "Neural signals and neural representations." Neural Engineering, Biomedical Engineering, University of Minnesota, November 2007.
8. "Spatial representations and imagination." Brain Machine Interfaces Seminar, St. Thomas University, St. Paul, MN, October 2007.
9. "Dynamic representations in the hippocampus: thinking from here to there." Graduate Biology Seminar, Minnesota State University – Mankato, September 2007.
10. "Dynamic representations in the hippocampus: implications for navigation and memory." Cosyne workshop on Hippocampus and Entorhinal Cortex, February 2007.
11. "Developing representations in the hippocampus." Special seminar at the Centre for the Biology of Memory, September 2006.
12. "What's that rat thinking? Information processing in the brain." 3M TechForum Special Lecture – Life Sciences, Statistics and Modeling chapters, October 2005.

Teaching

Teaching experience

- 2008-present Assistant professor of Psychology, Bethel University
- 2008 Co-teaching with Paul Schrater for *Machine learning methods in modeling human learning*, Psychology Department, University of Minnesota.
- 2008 Co-teaching with A. David Redish for *Theoretical Neuroscience*, Neuroscience Department, University of Minnesota.
- 2007-2008 *Preparing Future Faculty* Course, University of Minnesota.

Courses taught

Introduction to psychology (guest lecturer) – An introductory course on psychology. Lectures on sensation and perception; neuroscience.

History of psychology (guest lecturer) – An introductory course on the history of psychology for psychology majors. Lectures on decision-making, free will and the brain; early behaviorism.

Animal behavior (guest lecturer) – An introductory course on ethology and animal behavior. Lectures on navigation and migration; learning and memory.

Sensation and perception – An introductory course on sensation and perception for juniors and seniors.

Physiological psychology – An introductory course on the physiological basis of cognition and behavior for sophomores, juniors and seniors.

Introductory statistics for psychology and experimental design – An introductory course for sophomores and juniors in psychology and biology.

Behavioral robotics – An introductory, interdisciplinary course on robotics and computational neuroscience.

Theoretical neuroscience – an introduction to theoretical approaches to neural coding, learning, memory and decision making for upper level undergraduates and graduate students.

Machine learning methods in modeling human learning – a graduate seminar examining the potential contribution of recent advances in machine learning for understanding and modeling human and animal learning.

Service

Professional society memberships

Society for Neuroscience
American Psychological Society
Sigma Xi (International science honor society – associate member – Minnesota chapter)
Faculty for Undergraduate Neuroscience

Ad-hoc reviewer

Journal of Neuroscience Methods
MIT Press

Miscellaneous service

Institutional review board (2008-2009), Psychology Department, Bethel University
“Bring a brain to school” initiative (2008), Bethel University
Doctoral dissertation fellowship application and writing workshop (2007), Graduate School, University of Minnesota.
Brain awareness week (2005-2008), University of Minnesota and surrounding communities.
Student representative (2005-2006) Center for Cognitive Sciences, University of Minnesota.
Provided an interface between students, faculty and administration; led Center trainee program and developed a short grant writing curriculum.
Carnegie Initiative on the Doctorate (2004), Neuroscience, University of Minnesota.
Student Allocations Committee member (2001-2002) Minnesota State University, Mankato.
Developed budget recommendations for university administration on programs supported by student activity fees including university technology, athletics, student health facilities, intramural student organizations. Budget: approximately \$2.3million.