

Jon C. Horvitz

Education:

BA Haverford College, 1985, Neuropsychology, magna cum laude

PhD University of California, Santa Barbara, 1991, Psychology. Dissertation Title: The role of central dopamine systems in reinforcement and motor processes. Advisor: Dr. Aaron Ettenberg

Post doc, Princeton University Program in Neuroscience, 1992-1995, Single-unit studies of midbrain dopamine neurons in freely-moving animals in the laboratory of Dr. Barry L. Jacobs

Professional Experience:

2003 - present, Associate Professor, Department of Psychology, Boston College

2002 - 2003, Associate Professor, Doctoral Program in Neurobiology and Behavior, Columbia University

2000-2003, Associate Professor, Department of Psychology, Columbia University

1995 - 2000, Assistant Professor, Columbia University Department of Psychology

Grants, Honors and Awards:

NIH, NIDA, R01, 2007-2012 "Accumbens coding of reward expectation: electrophysiology and neuropharmacology", \$1,395,000 direct costs, Horvitz PI.

National Science Foundation, 2005-2008 "Dynamics of Affective Reactivity". \$600,000 total award. Horvitz Co-PI (Feldman-Barrett PI).

NIH, NIDA, R21, 2003-2006, "Timing: Pharmacology and Conditioning", \$300,000 direct costs, Horvitz Co-PI. (Balsam PI).

NIH, NIDA First Award, 1998-2003. "Mechanisms of Drug Abuse: Dopamine and CS-Reward Learning". \$580,000 direct costs, Horvitz PI.

NIH, NIMH, National Research Service Award, 1992-1995. "VTA Dopamine Activity during Feeding and Drinking"

Phi Beta Kappa, Haverford College, 1985

Academic and Professional Service:

Boston College Service:

Director of the Graduate Program in Psychology
(2006-present)
Chair of Graduate Admissions for Psychology (2005-6)
University Committee on Strategic Planning for the
Sciences (2004-5)
University Research Council, charged with
contributing to the conditions for success of
research at Boston College (2003-5)
Psychology Department Committee to Improve the
Quality of Training in Teaching for our graduate
students. (2003-4)

Columbia University Service:

Chair of Colloquium Committee, 1998-2001
Chair of Human Subject Pool Committee, 1996-1998
Columbia College Freshman and Sophomore Advisor,
1996-1997
Member of Institutional Animal Care and Use
Committee, 1997-2000
Neuroscience and Behavior Major Advisor, 1997-2003

Editorial Board for *Developmental Disabilities*

Ad Hoc Editorial Reviewer 1990-present, for the following journals:

Behavioral and Brain Research; Behavioral
Neuroscience; European Journal of Neuroscience;
Journal of Neuroscience; Letters to Neuroscience;
Molecular Psychiatry; NeuroReport; Neuroscience;
Progress in Neuropsychopharmacology and Biological
Psychiatry; Pharmacology Biochemistry and Behavior;
Psychopharmacology; Science

Grant Review, NSF *Integrative Biology & Neurosciences* division, 1999, 2003; NIH *Biobehavioral and Behavioral Processes 1* 2007

Professional Affiliations:

APA
Cognitive Neuroscience
Society for Neuroscience
Behavioral and Brain Sciences Associate

Teaching Experience:

Boston College, Department of Psychology, 2003- present:

Learning and Motivation. An undergraduate lecture course examining the fundamental processes of animal learning, and their neural substrates.

Neurobiological Basis of Learning. Identical to *Neural Basis of Behavior*, below.

Columbia University, Department of Psychology, 1995 - 2003:

Learning and Motivation. An undergraduate lecture and laboratory course examining fundamental processes of animal learning. Students train their rats to acquire stimulus-outcome and response-outcome associations under classical and operant paradigms. Complementary lectures and text explore the principles underlying associative learning.

Behavioral Neuroscience. An undergraduate lecture course examining principles governing neuronal activity, the role of neurotransmitter systems in memory and motivational processes, and the presumed brain dysfunctions that give rise to schizophrenia and depression.

Neural Basis of Behavior. A seminar for graduate and upper-level undergraduate students examining the role of dopamine in reinforcement processes. All readings are primary journal articles. The goals of this course are to 1) enable students to comprehend

primary journal articles in behavioral neuroscience, 2) familiarize students with terminology and issues related to behavioral pharmacology and electrophysiology, and 3) share with the professor in a search for a conceptual framework within which to view the behavioral functions of mesolimbic and nigrostriatal dopamine activity.

Pathophysiology of Psychiatric Disorders. A seminar for graduate and advanced undergraduate students examining research literature related to neurochemical underpinnings of schizophrenia. Particular emphasis is placed upon core cognitive/attentional disturbances underlying positive schizophrenic symptoms and animal models of schizophrenic attentional dysfunctions.

Advanced Topics in the Neurochemistry of Behavior. A graduate seminar in which students read primary research articles and engage in discussion and debate regarding 1) the role of the basal ganglia in habit learning, and 2) the role of prefrontal mechanisms in working memory.

Invited Addresses and Colloquia:

Symposium on the Neural Bases of Reward and Decision Making, "Dopamine involvement in the sequencing of learned behavioral components decreases following extended training", Instituto Gulbenkian de Ciência, Lisbon, 2007.

UCLA Symposium on Reward and Decision Making in Cortico-basal Ganglia Networks. "Dopamine-independent performance of appetitive habits". Los Angeles, 2006

Boston University School of Medicine, Colloquium, "The role of D1 and D2 dopamine receptor activity in the acquisition and expression of habits", Boston, 2005

Invited Address for Motivational Neuroscience Conference, "The role of D1 and D2 dopamine receptor activity in the acquisition and expression of habits", New York, 2005

University of Santiago de Compostela, Department of Psychology Colloquium, "The role of dopamine in the acquisition and expression of habits", Galicia, Spain 2004

Eastern Psychological Association, Invited Address, "The role of DA in the acquisition and expression of habits" 2004

Tufts University, Behavioral Neuroscience Series, "D1 versus D2 dopamine receptor involvement in the acquisition and performance of simple conditioned responses in the rat", Somerville, MA, 2004

"Frontiers in Addiction Research", Invited address, sponsored by the National Institute on Drug Abuse, New Orleans, 2003

Conference on Dopamine and Memory, Integrating Computational and Empirical Approaches, Invited Address, "Dopamine and habit learning: conditioned responding becomes dopamine-independent after overtraining", New York, 2003

Boston College, Department of Psychology, "How is dopamine like a good parent? Dopamine facilitates learning and performance of goal-directed behaviors, permitting them to become dopamine independent", Boston 2003.

University of Texas, Neuroscience Colloquium Series, "The role of dopamine in internally-generated, stimulus-elicited, and habitual behavior", Austin 2002.

Columbia University, Columbia Presbyterian Medical Center, Neuroscience Scientific Seminar Series, "D1 versus D2 dopamine receptor involvement in the acquisition and performance of a simple conditioned response in the rat", New York 2001

Brooklyn College, CUNY, Department of Psychology, Colloquium, "D1 versus D2 dopamine receptor involvement in the acquisition and performance of simple conditioned responses in the rat", New York 2001

Queens College, CUNY, Department of Psychology, Colloquium, "The role of dopamine receptors in the performance of internally-generated and cue-elicited

behaviors: Relevance to parkinson's disease", New York 2001

American Psychological Association, Invited two-person address with Marcel Kinsbourne, "Dopamine dysregulation and ADHD: Perspectives from human and animal studies", San Francisco 2001

University of Santiago De Compostela, Faculty of Medicine, Neuroscience Colloquium, "The role of D1- and D2-family dopamine receptors in the performance of internally-generated and cue-elicited behaviors: Relevance to parkinson's disease", Galicia, Spain 2001

University of Cantabria, Department of Physiology and Pharmacology Colloquium, "The role of D1- and D2-family dopamine receptors in the performance of internally-generated and cue-elicited behaviors: Relevance to parkinson's disease", Cantabria, Spain 2001

University of Massachusetts, Neuroscience Colloquium, "Midbrain dopamine activity: Environmental elicitors and behavioral consequences", Amherst, 2001
Columbia University Seminar on Appetitive Behavior, "Dopamine and Appetitive Learning", New York 2001

Scripps Research Institute Colloquium, "Midbrain dopamine activity: Stimulus elicitors and behavioral consequences", San Diego, 2001

Rockefeller/Cornell, Colloquium, "Midbrain dopamine activity: Stimulus elicitors and behavioral consequences", New York, 2001

National Institute on Drug Abuse, Colloquium, "Midbrain dopamine activity: Stimulus elicitors and behavioral consequences", Baltimore, 2001.

New York State Psychiatric Institute, College of Physicians and Surgeons, Department of Developmental Psychobiology, "Midbrain dopamine activity: Stimulus elicitors and behavioral consequences", New York 2000.

International Society for Developmental Psychobiology, Invited Address, "Dopamine, Arousal and Conditioning", Hawaii 1999.

Rockefeller University, Neurobiology and Behavior,
"Dopamine and Arousal", New York 1999.

International Society for Developmental Psychobiology,
Invited Address, "What Do I Need Brain Dopamine for?
Dopamine and CS-reward Learning", Miami 1999.

Yale University, Department of Psychology, Behavioral
Neuroscience Faculty, "Dopamine and Reward: Is the
Anhedonia Hypothesis undergoing Extinction?" New Haven,
Connecticut 1999.

Albert Einstein College of Medicine, Department of
Neuroscience, "Search for the Reward Substrate", New York
1998.

University of Illinois at Chicago, Department of
Psychology, "The Role of Dopamine in Reward and
Reinforcement Processes", Chicago, Illinois 1995.

Johns Hopkins University School of Medicine, Behavioral
Biology Research Center, "Dopamine and Reinforced
Behavior", Baltimore, Maryland 1995.

Publications:

Choi, W., Morvan, C., Balsam, P.D., Horvitz, J.C.
Respective roles for Dopamine D1 and D2 receptors in the
initiation and duration of movements. Submitted to
Journal of Neuroscience.

Wickens, J., Horvitz, J.C., Costa, R., Killcross, S.
Dopaminergic Mechanisms in Actions and Habits, Journal of
Neuroscience, 27, 8181-3, 2007.

Horvitz, J.C., Choi, W., Morvan, C., Eyny, Y. Balsam,
P.D. A "Good Parent" function of dopamine: transient
modulation of learning and performance during early
stages of training. New York Academy of Sciences, 1104,
270-288, 2007.

Taylor, K.M., Horvitz, J.C., Balsam, P.D. Amphetamine
affects the start of responding in the peak interval
timing task, Behav Processes, 74, 168-75, 2007

Rick, J.H., Horvitz, J.C., Balsam, P.D. The Effect of
Dopamine Receptor Blockade on Behavioral Variability and

Comparisons to Extinction, Behavioral Neuroscience, 120, 488-92, 2006.

Horowitz, T.S., Choi, W., Horvitz, J.C., Cote, L.J., Mangels, J.A. Visual search deficits in Parkinson's disease are attenuated by bottom-up target salience and top-down information, Neuropsychologia, 44, 1962-77, 2006.

Choi, W., Balsam, P.D., Horvitz, J.C. "Extended Habit Training Reduces Dopamine Mediation of Appetitive Response Expression", Journal of Neuroscience, 25, 6729-33, 2005.

Stern, E.R., Horvitz, J.C., Cote, L.J., Mangels, J.A. Maintenance of Response Readiness in Patients with Parkinson's Disease: Evidence from a Simple Reaction Time Task, Neuropsychology, 19, 54-65, 2005.

Davidson, M.C., Horvitz, J.C., Tottenham, N., Fossella, J.A., Watts, R., Ulug, A.M., Casey, B.J. Differential Cingulate and Caudate Activation Following Unexpected Non-Rewarding Stimuli, NeuroImage, 23, 1039-1045, 2004.

Drew, M., Malpani, C., Horvitz, J.C., Balsam, P.D. Dopamine antagonist effects on the timing of two intervals, Pharmacology, Biochemistry and Behavior, 75, 9-15, 2003.

Eyny, Y.S. and Horvitz, J.C. Opposing roles of D1 and D2 receptors in appetitive conditioning. Journal of Neuroscience, 23, 1584-87, 2003.

Horvitz, J.C. Dopamine, Parkinson's disease, and volition. Behavioral and Brain Sciences, 25(5), 586, 2002.

Horvitz, J.C. Dopamine gating of glutamatergic sensorimotor and incentive motivational inputs to the striatum. Behavioral Brain Research, 137, 65-74, 2002.

Horvitz, J.C. The effects of D1 and D2 receptor blockade on the acquisition and expression of a conditioned appetitive response. Appetite, 37, 119-120, 2001.

Ohyama, T., Horvitz, J.C., Kitsos, E., and Balsam, P.D. The role of dopamine in the timing of pavlovian

conditioned keypecking in ring doves. Pharmacology Biochemistry and Behavior, 69, 617-627, 2001.

Horvitz, J.C., Williams, G, Joy, R. Time-dependant actions of D2 family agonist quinpirole on components of spontaneous behavior: dissociation between sniffing and locomotion. Psychopharmacology, 154, 350-355, 2001.

Ohyama, T., Horvitz, J.C., Drew, M., Gibbon. J. and Balsam, P.D. Conditioned and unconditioned behavioral/cognitive effects of a dopamine antagonist. Behavioral Neuroscience, 114,1251-1255, 2000.

Horvitz, J.C., and Eyny, Y. Dopamine D2 receptor blockade reduces response likelihood but does not affect latency to emit a learned sensory-motor response: Implications for Parkinson's disease. Behavioral Neuroscience, 114, 934-939, 2000.

Horvitz, J.C. Mesolimbic and nigrostriatal dopamine responses to salient non-reward events. Neuroscience, 96, 651-656, 2000.

Pitts, S.M. & Horvitz, J.C. Similar effects of D1/D2 receptor blockade on feeding and locomotor behavior. Pharmacology, Biochemistry, and Behavior, 65, 433-438, 2000.

Horvitz, J.C., Stewart, T., & Jacobs, B.L. Burst activity of ventral tegmental dopamine neurons is elicited by sensory stimuli in the awake cat. Brain Research, 759, 251-258, 1997.

Horvitz, J.C., Richardson, W.B., & Ettenberg, A. Dopamine receptor blockade and reductions in thirst produce differential effects on drinking behavior. Pharmacology, Biochemistry, and Behavior, 45, 725-728, 1993.

Horvitz, J.C. & Ettenberg, A. Conditioned incentive properties of a food-paired CS remain intact during dopamine receptor blockade. Behavioral Neuroscience, 105, 536-541, 1991.

Ettenberg, A. & Horvitz, J.C. Pimozide prevents the response-reinstating effects of water reinforcement in rats. Pharmacology, Biochemistry, and Behavior, 37, 465-469, 1990.

Horvitz, J.C. & Ettenberg, A. Haloperidol blocks the response-reinstating effects of food reward: A methodology for separating neuroleptic effects on reinforcement and motor processes. Pharmacology, Biochemistry, and Behavior, 31, 861-865, 1989.

Schull, J., McEachron, D.L., Adler, N.J., Fiedler, L., Horvitz, J.C., Noyes, A., Olson, M., & Shack, J. Effects of thyroidectomy, parathyroidectomy and lithium on circadian wheelrunning in rats. Physiology and Behavior, 42, 33-39, 1988.

Conference Presentations:

Morvan, C.I., Choi, W.Y., and Horvitz, J.C (2007) Dissociable roles of dopamine D1 and D2 receptors in the initiation and duration of motor acts. Presented at the Annual Meeting for the Society of Neuroscience.

Taylor, K.M., Horvitz, J.C., and Balsam, P.D. (2006) Amphetamine alters timed behavior but not time perception. Society for Neuroscience Abstracts. 572.15

Morvan, C. I., Kalich, C.L., Baranello, J.V., Gostine, A.L., Frame, A., and Horvitz, J. C. Horvitz (2006). The shift to dopamine-independent expression of an overtrained pavlovian approach response coincides with the shift to S-R performance. Society for Neuroscience Abstracts 463.10.

Kang, H, Taylor, K.M, Horvitz, J.C., Balsam, P.D. (2005) Amphetamine-paired conditioned stimuli produce hyperactivity but do not alter time perception. Society for Neuroscience Abstracts, 413.8

Horvitz, J.C., Choi, W. (2004) The Expression of a Simple Appetitive Response Becomes Dopamine-independent with Overlearning. Annual meeting of the American College of Neuropsychopharmacology.

Hale, A. E., Horvitz, J.C. (2004) Effects of excitotoxic lesions within prefrontal cortical regions on working memory function and vulnerability to proactive interference in the rat. Society for Neuroscience Abstracts, 771.13

Rick, J.H., Horvitz, J.C., Balsam, P.D. (2004) The effect of dopamine receptor blockade on behavioral variability and comparisons to extinction. Society for Neuroscience Abstracts, 439.13

Taylor, K.M., Drew, M.R., Fortinsky, P., Rick, J.H., Horvitz, J.C., Balsam, P.D. (2004) 6-OHDA lesions of the striatum do not disrupt interval timing in the rat. Society for Neuroscience Abstracts, 550.21

Horvitz, J.C., Choi, W. (2003) A Pavlovian Approach Response Become D1 Receptor-Independent After Overtraining: Contribution Of Both Time-Dependent Consolidation And Training Trials. Society for Neuroscience Abstracts, 29, 716.2

Choi, W., Horvitz, J.C. (2003) D1 but not D2 Receptor Mediation of the Expression of a Pavlovian Approach Response. Society for Neuroscience Abstracts, 29, 716.1

Schwaninger, J., Beattie, J.A., Biewald, M.A., Persaud, C.L., White, J.M., Fienberg, A.A., Allen, P.B., Greengard, P., Horvitz, J.C. (2003) DARPP-32/I-1 knockout mice show learning and performance deficits in a discrimination and inhibition task. Society for Neuroscience Abstracts, 29, 936.15

Davidson, M.C., Horvitz, J.C., Totenham, N., Fossella, J.A., Casey, B.J. (2002) fMRI investigation of saliency, expectation, and reward circuitry. Society for Neuroscience Abstracts, 28, 725.28

Choi, W., Horvitz, J.C. (2002) Functional Dissociations Produced by D1 Antagonist SCH 23390 Infusion to the Nucleus Accumbens Core versus Dorsal Striatum under an Appetitive Approach Paradigm. Society for Neuroscience Abstracts, 28

Stern, E., Horvitz, J.C., Cote, L., Mangels, J. (2002) Motor readiness and working memory performance in Parkinson's Disease patients on a simple reaction time task. Society for Neuroscience Abstracts, 28

Zupan, B., Drew, M.R., Currie, P.J., Horvitz, J.C., & Balsam, P.D. (2001) Lesions to the caudate-putamen and nucleus accumbens differentially affect timing and response rate in a peak interval timing task. Society for Neuroscience Abstracts, 27, 850.9

Horvitz, J.C., Choi, W., Hale, A.E., & Eyny, Y.S. (2001) The effects of D1 versus D2 dopamine receptor blockade on the expression of internally- and externally-generated responses in the rat. Society for Neuroscience Abstracts, 27, 827.1

Choi, W. & Horvitz, J.C. (2001) Effects of D1 antagonist SCH-23390 on spontaneous versus stimulus-elicited behavioral responses during early and later stages of learning. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 27, 422.6

Connelly, S.T., Eyny, Y.S., Lira, A., Drew, M. & Horvitz, J.C. (2000) Modulation of single-unit activity of prefrontal cortical neurons by D2 antagonist raclopride in the behaving rat. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 26, 2252.

Choi, W., Eyny, Y.S., Matin, L. & Horvitz, J.C. (2000). Effects of D1 antagonist SCH 23390 on spontaneous versus stimulus-elicited behavioral responses in the rat. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 26, 2252.

Eyny, Y.S. & Horvitz, J.C.(2000). Dopamine D1 versus D2 receptor involvement in the acquisition of a CS-reward association. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 26, 2252.

Eyny, Y.S., Chen, J. & Horvitz, J.C. (1999). The effect of D2 dopamine antagonist raclopride on goal-tracking behavior of rats. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 25, 1123.

Gallegos, R.A., Criado, J.R., Henriksen, S.J. & Horvitz, J.C. (1999). Single-unit neuronal responses in the VTA during consummatory behavior and during presentation of an auditory distractor. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 25, 875.

Hale, A.E., Milgrom, M., Devidoss, K, Mangels, J. & Horvitz, J.C. (1999). Effects of D1 dopamine antagonist SCH23390 on working memory under the t-maze alternation task. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 25, 610.

Horvitz, J.C. & Jacobs, B.L. (1998). VTA DA neuronal activity: Responses to appetitive and salient nonappetitive stimuli. Invited Symposium presented at 5th Internet World Congress on Biomedical Sciences.

Pitts, S.M., & Horvitz, J.C. (1998). Effects of D2 receptor antagonist vs DA agonist on sensory responsiveness to auditory stimuli. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 24, 1437.

Hale, A.E., & Horvitz, J.C. (1998). D1 involvement under a visual working memory paradigm. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 24, 711.

Pitts, S.M., & Horvitz, J.C. (1997). Effects of nucleus accumbens dopamine receptor blockade on consumption of a palatable food. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 23, 1359.

Horvitz, J.C., Stewart, T., & Jacobs, B.L. (1996). VTA dopamine burst activity in relation to sensory events. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 22, 157.

Horvitz, J.C., Colon, L.R., & Jacobs, B.L. (1994). Single-unit activity of ventral tegmental dopamine neurons: Changes in the neuronal response to a CS+ during conditioning and extinction. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 20, 823.

Gallegos, R.A., Fornal, C.A., Metzler, C.W., Horvitz, J.C., & Jacobs, B.L. (1994). Effects of 5-HT1A autoreceptor blockade with WAY-100635 on sensory-evoked activity of serotonergic neurons in behaving cats. Presented at the annual meeting of the Society for

Neuroscience. Society for Neuroscience Abstracts, 20, 1544.

Horvitz, J.C., Fornal, C., & Jacobs, B.L. (1993). Single-unit activity of ventral tegmental dopamine neurons in response to sensory stimuli. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 19, 1832.

Horvitz, J.C. & Ettenberg, A. (1991). Water-deprived rats remain thirsty during dopamine receptor blockade. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 17, 1049.

Horvitz, J.C. & Ettenberg, A. (1990). Pimozide does not block the conditioned incentive motivational effects of food-related stimuli. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 16, 600.

Horvitz, J.C. & Ettenberg, A. (1989). The effects of pimozide on water-reinforced running and unconditioned drinking. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 15, 56.

Horvitz, J.C. & Ettenberg, A. (1988). Paradoxical effects of haloperidol administered during the extinction phase of an operant runway task. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 14, 369.

Ettenberg, A. & Horvitz, J.C. (1987). Haloperidol blocks the incentive motivational properties of food reinforcement in rats. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 13, 219.

Weiss, F., Horvitz, J.C., Mann, J.G., & Ettenberg, A. (1986). Intra-accumbens injections of CCK block the hyperlocomotion and potentiate the stereotypy produced by d-amphetamine. Presented at the annual meeting of the Society for Neuroscience. Society for Neuroscience Abstracts, 12, 1491.