

# Curriculum Vitae

**Eric Lynn Hargreaves**

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## Education:

- B.Sc. in Psychology (1986)**      **University of Victoria (Victoria, British Columbia, Canada)**
- M.A. in Psychology (1988)**      **University of Western Ontario (London, Ontario, Canada)**  
Supervisor: Dr. D. Peter Cain, Professor  
Thesis: The effects of controlling for ongoing behavior on behavioral-LTP.
- Ph.D. in Psychology (1993)**      **University of Western Ontario (London, Ontario, Canada)**  
Supervisor: Dr. D. Peter Cain, Professor  
Thesis: Effects of complex environment housing on anatomy  
electrophysiology and behavior.

## Research Experience:

- Jul 2003 – Present**      Position: **Assistant Research Scientist**  
Supervisor: Dr. Wendy Suzuki, Associate Professor  
Center for Neural Science, New York University,  
New York, NY, USA.  
Project: Tetrode recordings in the entorhinal cortex of non-human primates  
during associative learning; analysis of single units and LFPs.  
Project: Generalized Linear Model applications to spike trains; simultaneous  
assessment of intrinsic and extrinsic covariates.
- Oct 2000 – Jun 2003**      Positions: **Research Scientist** (Nov 2001-Jun 2003)  
**Postdoctoral Research Associate** (Oct 2000-Oct 2001)  
Supervisor: Dr. James Knierim, Associate Professor  
Department of Neurobiology and Anatomy,  
University of Texas Medical School,  
Health Science Center @ Houston, Houston, TX, USA.  
Project: Entorhinal Cortex ensemble recording: differences between medial  
and lateral divisions.  
Project: Multi-site ensemble recording: Coherence of CA1 and  
parahippocampal ensemble reactions to cue conflict manipulations.  
Project: Contrasts in sparse encoding: CA1 versus DG.
- Oct 1998-Sept 2000**      Position: **Postdoctoral Research Associate**  
Supervisor: Dr. Robert U. Muller, Professor,  
Department of Physiology, State University of New York,  
Health Science Center @ Brooklyn, Brooklyn, NY, USA.

- Project: Micro-stimulation of place cells, differences in synaptic efficacy and induction of synaptic plasticity.
- Project: Telemetry recording of single units within the hippocampus.
- Project: Expression of dendritic RNAs after synaptic activation.

**Jun 1997-Sept 1998**

- Position: **Postdoctoral Research Associate**
- Supervisor: Dr. Cliff Abraham, Professor,  
Department of Psychology, University of Otago,  
Dunedin, New Zealand.
- Project: Pharmacological extension of LTP2 to LTP3 via Cholinergic and Dopaminergic agonists applied post-tetanus.
- Project: Double dissociations between 400Hz and "thetaburst" protocols, induced in the dentate gyrus and CA1 hippocampal pathways.
- Project: Double dissociation between adrenergic and dopaminergic antagonists on LTP maintenance in the dentate-gyrus versus CA1.

**Oct 1993-May 1997**

- Position: **Postdoctoral Fellowship** (funded by Natural Sciences and Engineering Research Council of Canada).
- Supervisor: Dr. Matthew L. Shapiro, Associate Professor,  
Department of Psychology, McGill University,  
Montreal, Quebec, Canada.
- Project: NMDA antagonism of CA1 primed-burst potentiation; parallel time course to NMDA blockade of CA1 place field stability.
- Project: NMDA basis of CA1 hippocampal place field formation.
- Project: NMDA antagonism of Primed Burst Potentiation in the dentate-gyrus.
- Project: Primed Burst Potentiation across the estrous cycle in the dentate gyrus.
- Project: Systematic variation of Primed burst Potentiation parameters in the dentate gyrus and their impact upon the amplitude and duration of enhancement.

**Awards/Fellowships:**

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|------------------------|--|-------------------------------|
| <b>1986-1992</b>       | Special University Scholarship:  | University of Western Ontario |
| <b>1990 &amp; 1992</b> | Summer Graduate Research Award:  | University of Western Ontario |
| <b>1991</b>            | Omnitech Travel Fellowship:  | Society for Neuroscience      |
| <b>1993-1995</b>       | Natural Sciences and Engineering<br>Research Council of Canada (NSERC) | McGill University             |

**Published Peer Reviewed Papers:**

- 1) **Hargreaves, E.L.**, Yoganarasimha, D., and Knierim J.J. (2007). Cohesiveness of spatial and directional representations recorded from neural ensembles in the anterior thalamus, parasubiculum, medial entorhinal cortex, and hippocampus. Hippocampus, 17, 826-841.
- 2) Knierim J.J., Lee, I., and **Hargreaves, E.L.** (2006). Hippocampal place cells: parallel input streams, subregional processing and implications for episodic memory. Hippocampus, 16, 755-764.
- 3) **Hargreaves, E.L.**, Rao, G., Lee, I., and Knierim J. J. (2005). Major dissociation between medial and lateral entorhinal input to dorsal hippocampus. Science, 308, 1792-1794.

- 4) Nimmrich, V., **Hargreaves, E.L.**, Muslimov, I.A., Bianchi, R., and Tiedge, H. (2005). Dendritic BC1 RNA: modulation by kindling-induced afterdischarges. Molecular Brain Research, 133, 110-118.
- 5) Hawley, E.S., **Hargreaves, E.L.**, Kubie, J.L., Rivard, B., and Muller, R.U. (2002). Telemetry system for reliable recording of action potentials from freely moving rats. Hippocampus, 12, 505-513.
- 6) Swanson-park, J.L., Coussens, C.M., Mason-parker, S.E., Raymond, C.R., **Hargreaves, E.L.**, Dragunow, M., Cohen, A.S., and Abraham, W.C. (1999). A double dissociation within the hippocampus of dopamine D1/D5 receptor and Beta-adrenergic receptor contributions to the persistence of long-term potentiation. Neuroscience, 92, 485-497.
- 7) Kentros, C., **Hargreaves, E.L.**, Hawkins, R.D., Kandel, E.R., Shapiro, M.L., and Muller, R.U. (1998). Abolition of long-term stability of new hippocampal place cell maps by NMDA receptor blockade. Science, 280, 2121-2126.
- 8) **Hargreaves, E.L.**, Côté, D., and Shapiro M.L. (1997). A dose of MK801 previously shown to impair spatial learning in the radial maze attenuates primed burst potentiation in the dentate gyrus of freely moving rats. Behavioral Neuroscience, 111, 35-48.
- 9) Cain, D.P., Saucier, D., Hall, J., **Hargreaves, E.L.**, and Boon, F. (1996). Detailed behavioral analysis of water-maze acquisition under APV or CNQX: Contribution of sensorimotor-disturbances to drug-induced acquisition deficits. Behavioral Neuroscience, 110, 86-102.
- 10) Saucier, D., **Hargreaves, E.L.**, Boon, F. Vanderwolf, C.H., and Cain, D.P. (1996). Detailed behavioral analysis of water maze acquisition under systemic NMDA or muscarinic blockade: pretraining eliminates spatial learning deficits resulting from NPC17742, a novel competitive NMDA receptor antagonist. Behavioral Neuroscience, 110, 103-116.
- 11) Carey, D.P., **Hargreaves, E.L.**, and Goodale, M.A. (1996). Reaching to ipsilateral or contralateral targets: Within-hemisphere visuomotor processing cannot explain hemispacial differences in motor control. Experimental Brain Research, 112, 496-504.
- 12) Cain, D.P., Grant, S.G.N., Saucier, D., **Hargreaves, E.L.**, and Kandel, E.R. (1995). Fyn tyrosine kinase is required for normal amygdala kindling. Epilepsy Research, 22, 107-114.
- 13) Dringenberg, H.C., **Hargreaves, E.L.**, Baker, G.B., Cooley, R.K., and Vanderwolf, C.H. (1995). *p*-Chlorophenylalanine-induced serotonin depletion: reduction in exploratory locomotion but no obvious sensory-motor deficits. Behavioral Brain Research, 68, 229-237.
- 14) **Hargreaves, E.L.**, and Cain, D.P. (1995). MK801 induced hyperactivity; duration of effects in rats. Pharmacology Biochemistry and Behaviour, 51, 13-19.
- 15) Mead, L.A., **Hargreaves, E.L.**, Ossenkopp K.-P., and Kavaliers, M. (1995). Multivariate assessment of spontaneous locomotor activity in the mongolian gerbil (*Meriones Unguiculatus*): the influence of age and sex. Physiology and Behavior, 57, 893-899.

- 16) Cain, D.P., **Hargreaves, E.L.**, and Boon, F. (1994). Brain temperature-and behavior-related changes in the dentate gyrus field potential during sleep, cold water immersion, radiant heating, and urethane anesthesia. Brain Research, 658, 135-144.
- 17) Galea, L.A.M., Kavaliers, M., Ossenkopp, K.-P., Innes, D.L., and **Hargreaves, E.L.** (1994). Sexually-dimorphic spatial learning varies seasonally in deer mice. Brain Research, 635, 18-26.
- 18) Ossenkopp, K.-P., Rabi, J., Eckel, L., and **Hargreaves, E.L.** (1994). Reduction in body temperature and spontaneous activity in rats exposed to horizontal rotation: abolition following chemical labyrinthectomy. Physiology and Behavior, 56, 319-324.
- 19) Cain, D.P., **Hargreaves, E.L.**, Boon, F., and Dennison, Z. (1993). An examination of the relations between hippocampal long-term potentiation kindling afterdischarge and place learning in the water maze. Hippocampus, 5, 153-163.
- 20) Cain, D.P., Saucier, D., **Hargreaves, E.L.**, Wilson, E., and Desouza, J. (1993). Polypropylene pellets as an inexpensive reusable substitute for milk powder in the Morris water maze. Journal of Neuroscience Methods, 49, 193-197.
- 21) Ossenkopp, K.-P., and **Hargreaves, E.L.** (1993). Spatial learning in an enclosed eight-arm radial maze in rats with sodium arsenite-induced labyrinthectomies. Behavioral and Neural Biology, 59, 253-257.
- 22) Cain, D.P., Boon, F., and **Hargreaves, E.L.** (1992). Evidence for different pharmacological contributions to long term potentiation and to kindling-induced potentiation: role of NMDA and urethane-sensitive mechanisms. Experimental Neurology, 116, 330-338.
- 23) **Hargreaves, E.L.**, and Cain, D.P. (1992). Hyperactivity, hyper-reactivity, and sensorimotor deficits induced by low doses of the N-methyl-D-aspartate non-competitive channel blocker MK801. Behavioral Brain Research, 47, 23-33.
- 24) Ossenkopp, K.-P., Eckel, L.A., **Hargreaves, E.L.**, and Kavaliers, M. (1992). Sodium arsenite - induced vestibular dysfunction in meadow voles (*Microtus pennsylvanicus*): effects on posture, spontaneous locomotor activity, and swimming behavior. Behavioral Brain Research, 47, 13-22.
- 25) Watson, N.V., **Hargreaves, E.L.**, Penava, D., Eckel, L.A., and Vanderwolf, C.H. (1992). Serotonin-dependent cerebral activation: effects of methiothepin and other 5HT antagonists. Brain Research, 597, 16-23.
- 26) **Hargreaves, E.L.**, Cain, D.P., and Vanderwolf, C.H. (1990). Learning and behavioral-long-term potentiation: importance of controlling for motor activity. Journal of Neuroscience, 10, 1472-1478.
- 27) Ossenkopp, K.-P., Prkacin, A., and **Hargreaves, E.L.** (1990). Sodium arsenite-induced vestibular dysfunction in rats: effects on open-field behavior and spontaneous activity in the automated digiscan monitoring system. Pharmacology Biochemistry and Behavior, 36, 875-881.

**Invited Book Chapters and Commentaries:**

- 28) Shapiro, M.L., and **Hargreaves, E.L.** (1997). Long term potentiation: attending to levels of organization of learning and memory mechanisms. Invited Commentary on BBS target article Shors & Matzel LTP: what's learning got to do with it? Behavioral Brain Sciences, 20, 631-632.
- 29) Mead, L.A., **Hargreaves, E.L.**, and Galea, L.A.M. (1996). Sex differences in rodent spontaneous activity levels. In: Sanberg, P.R., Ossenkopp, K.-P., and Kavaliers, M. (Eds) Motor Activity and Movement Disorders: Research Issues and Applications. (pp. 111-135) Totowa NJ: Humana Press.
- 30) Cain, D.P., Boon, F. and **Hargreaves, E.L.** (1990). Pharmacological dissociation between the mechanisms of kindling and long-term potentiation by APV and urethane anesthesia. In: Wada, J.A. (Ed.), Kindling 4, (pp.343-350) New York; Plenum Press.

**Manuscripts in Preparation:**

**Hargreaves, E.L.**, G. Czanner, Eden, U., Wirth, S., Yanike, M.A., Brown, E.N., and Suzuki, W.A. (in prep.). Neural responses in the primate hippocampus: simultaneous assessment of spike history and experimental covariates by generalized linear model point processes. Targeted for: Journal of Neurophysiology.

**Recent Abstracts and Presentations (Last 5 years):**

- Hargreaves, E.L.** and Suzuki, W. (2008). Further characterization of trial outcome cells in the primate MTL cortex during a location-scene association task. Neuroscience Abstracts, 34, (in press).
- Tambini, A., **Hargreaves, E.L.** and Suzuki, W. (2008). Modulation of correlated activity in primate entorhinal cortex cell pairs for well-learned associations compared to new associations. Neuroscience Abstracts, 34, (in press).
- Hargreaves, E.L.**, Naya, Y., and Suzuki, W. (2007). Unit and local field potential (LFP) analysis of trial outcome in primate entorhinal cortex during location-scene associative learning. Neuroscience Abstracts, 33, Program No. 427.12. 2007 Abstract Viewer/Itinerary Planner, (Presented Oct., San Diego ELH & YN).
- Hargreaves, E.L.**, Smith, A.C., Brown, E.N. and Suzuki, W. (2006). Tetrode recordings of learning related neural activity in the primate entorhinal cortex during a location-scene task. Neuroscience Abstracts, 32, Program No. 574.23. 2006 Abstract Viewer/Itinerary Planner, (Presented Oct., Atlanta ELH).
- Hargreaves, E.L.**, Czanner, G., Eden, U., Wirth, S., Yanike, M.A., Chiu, C. and Suzuki, W. (2005). Using General linear models (GLMs) to identify significant evoked neural responses in the primate hippocampus. Neuroscience Abstracts, 31, Program No. 776.2. 2005 Abstract Viewer/Itinerary Planner, (Presented Nov., Washington ELH).

Knierim J.J, Yoganarasimha D., **Hargreaves E.L.**, Rao G, and Lee I. (2005). Functional interactions between hippocampal/cortical place cells and thalamic head direction cells. Cold Spring Harbor Laboratory Learning and Memory, (Presented Apr., CSHL JJK).

**Hargreaves, E.L.**, Wirth, S., Yanike, M.A., and Suzuki, W. (2004). Inverse relationship between direction of visual and delay activity with shifts in inter-spike-interval variance recorded from primate hippocampus. Neuroscience Abstracts, 30, Program No. 324.18. 2004 Abstract Viewer/Itinerary Planner, (Presented Nov., San Diego ELH).

Yoganarasimha, D., **Hargreaves, E.L.** and Knierim, J.J. (2003). Rotational coherence of head direction, medial entorhinal and CA1 Place cell ensembles. Neuroscience Abstracts, 29, Program No. 91.12. 2003 Abstract Viewer/Itinerary Planner, (Presented Nov., New Orleans YD).

**Hargreaves, E.L.**, D. Yoganarasimha, D., and Knierim, J.J. (2003). Coherence of spatial representations encoded by entorhinal cortex, CA1, and head direction cells. Cold Spring Harbor Laboratory Learning and Memory, 34, (Presented Apr., CSHL ELH).

Knierim, J.J., **Eric L. Hargreaves**, and Yoganarasimha, D. (2003). Properties of Cortical inputs to the hippocampus: simultaneous recordings from entorhinal cortex, CA1 place cells, and head direction cells. Cold Spring Harbor Laboratory Learning and Memory, 107, (Presented Apr., CSHL JJK).

### **Presentations and Colloquiums:**

Presented to the Centre for Studies in Behavioural Neurobiology (CSBN), Concordia University, Montreal, Quebec, Canada. (2008, May.)

**Title:** The hippocampal system: *Is a rat is a pig is a dog is a monkey is a boy?"*

Presented to the Center for Neural Science, NYU, New York, NY, USA. (2004, Mar.)

**Title:** Place cells: there and back again... ..a postdoc's tale.

Presented to the Center for Neural Science, NYU, New York, NY, USA. (2002, Jul.)

**Title:** Ensemble activity of CA1 place fields and spatial tuning in the rat ventroposterior cortices.

Presented to the Gyorgy Buzsaki & Farzan Nadim labs, Rutgers University, Newark, NJ, USA. (2002, Jul.)

**Title:** Ensemble activity of CA1 place fields and spatial tuning in the rat ventroposterior cortices.

Presented to the Montreal Neurological Institute, Quebec, Canada. (2002, May.)

**Title:** Ensemble activity of CA1 place fields and spatial tuning in the rat ventroposterior cortices.

Presented to the Centre for Studies in Behavioural Neurobiology (CSBN), Concordia University, Montreal, Quebec, Canada. (2000, Aug.)

**Title:** A tapestry of hippocampal place cells and LTP... ..a picture of learning?

Presented to Neurobiology and Anatomy, U. of Texas Medical School @ Houston, USA. (2000, Feb.)

**Title:** A tapestry of hippocampal place cells and LTP... ..a picture of learning?

Presented at the U. of Otago Memory Theme Retreat, Dansey's Pass, Otago, New Zealand. (1997, Oct.)  
**Title:** Plasticity differences within the trisynaptic circuit: seizing the moment.

Presented to the Neuroscience Programme, U. of Otago, Dunedin, New Zealand. (1997, Sept.)  
**Title:** What Hippocampus "Place Cells" can tell us about the NMDA/LTP/Learning story.

Presented to the Psychology Department, U. of Memphis, Tennessee, USA. (1997, Feb.)  
**Title:** The NMDA/learning story; converging lines of evidence from behavior, plasticity, and neural representations.

Presented to the Psychology Department, SUNY Stony Brook, NY, USA. (1996, May)  
**Title:** The rise, fall, and resurrection of: the LTP-NMDA-Learning hypothesis.

Presented to the Psychobiology Department, U. of California at Irvine, California, USA. (1996, Feb.)  
**Title:** LTP and learning: the relationship between a fish and its bicycle.

Presented to the Centre for Studies in Behavioural Neurobiology (CSBN), Concordia University, Montreal, Quebec, Canada. (1995, Aug.)  
**Title:** Towards an understanding of the influence of gonadal hormones on learning and memory: normal electrophysiology and NMDA-dependent plasticity of the female rat dentate-gyrus across estrous.

Presented to the Beckman Institute, CSHL, Cold Spring Harbor, Long Island, NY, USA. (1995, Jan.)  
**Title:** LTP: What's learning got to do with it?

Presented to the Centre for Behavioral Neuroscience, SUNY Stony Brook, NY, USA. (1995, Jan.)  
**Title:** LTP: What's learning got to do with it?

Presented to Laboratory of Neuroendocrinology, Rockefeller University, New York, NY, USA. (1995, Jan.)  
**Title:** LTP: What's learning got to do with it?

Presented to the Physiological Psychology Seminar, McGill, Montreal, Quebec, Canada. (1994, Feb.)  
**Title:** Some like it hot: the relationship between brain temperature and hippocampal evoked potentials.

Presented to the Montreal Neurological Institute, Neuropsychology Seminar, Quebec, Canada. (1993, Feb.)  
**Title:** The consequences of complex environment housing upon the rat; behavior, anatomy, and electrophysiology.