

BECKET EBITZ, PHD

Assistant Professor
Department of Neuroscience
Université de Montréal, Montréal, QC, Canada

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POSITIONS:

2020- **Professeur Adjoint** (tenure-track Assistant Professor)
Financially supported by Power Corporation of Canada Chair in
Neurosciences of the Université de Montréal
Département de neurosciences, Faculté de Médecine
Université de Montréal, Montréal, QC, Canada

EDUCATION/TRAINING:

2017-2020 **Postdoctoral Researcher**, Mentor: Dr. Ben Hayden
University of Minnesota, Department of Neuroscience, Minneapolis, MN
University of Rochester, Brain and Cognitive Sciences, Rochester, NY

2015-2017 **CV Starr Fellow**, Mentors: Drs. Tim Buschman, Jon Cohen
Princeton University, Princeton Neuroscience Institute, Princeton, NJ

2013-2017 **Postdoctoral Fellow**, Mentor: Dr. Tirin Moore
Stanford University & HHMI, Neurobiology Department, Stanford, CA

2007-2013 **Ph.D. in Neurobiology**, Mentor: Dr. Michael Platt
Duke University, Neurobiology Department, Durham, NC
Certificate in Cognitive Neuroscience, Center for Cognitive Neuroscience
Dissertation: *Determinants of distraction in the rhesus macaque.*

2005-2007 **Research Assistant**, Mentor: Dr. Leslie Ungerleider
National Institutes of Health, Bethesda, MD

2001-2005 **B.A.** (cum laude)
Simon's Rock (Early) College, Great Barrington, MA
Concentrations: Biology, Psychology, Research Methods

ACTIVE RESEARCH SUPPORT:

2021-2026 Project Grant, Canadian Institutes of Health Research, *Role*: PI
“Interactions between cortical stimulation and population dynamics”
\$983,206 direct cost across 5 years

2021-2024 Research Fellowship, Jacobs Foundation, *Role*: Fellow
“Understanding and optimizing learning through stability and plasticity”
\$204,000 direct costs across 3 years, \$20,400 indirect

- 2021-2023 John R. Evans Leaders Fund, Canadian Foundation for Innovation, *Role:* PI
 “An Oculomotor Platform for Examining Neuronal Decision-making Dynamics in Exploration (OPENeye)”
 \$460,868 in equipment, plus a small fund for upkeep and maintenance
- 2020-2025 Discovery Grant, Natural Sciences & Engineering Research Council, *Role:* PI
 “Neurophysiological mechanisms for exploration and mistakes”
 \$203,000 direct costs across 5 years
- 2020-2024 Junior 1 Chercheur-Boursier, Fonds de Recherche du Quebec Santé, *Role:* PI
 “Neurophysiologie cognitive et computationnelle de la prise de décision”
 \$257k in salary support, \$80k direct costs, \$17.5k COVID supplement
- 2020-2023 Chaire Power Corporation du Canada en neurosciences de l’Université de Montréal (Power Corporation Chair of Canada in Neurosciences de UdeM)
 \$450,000 direct costs across 3 years

COMPLETED RESEARCH SUPPORT:

- 2019-2021 Young Investigator Award, Brain & Behavior Research Foundation, *Role:* PI
 “Neuromodulatory interventions to regulate flexibility”
 US\$70,000 direct costs across 2 years (no-cost extension to 2021)
- 2015-2017 CV Starr Foundation Fellowship, Princeton University, *Role:* Fellow
 US\$120k in salary support, US\$40k in research expenses across 2 years
- 2014-2017 Ruth L. Kirschstein National Research Service Award, *Role:* Fellow
 National Institutes of Mental Health, National Institutes of Health, USA
 ~US\$150k in salary support, US\$5k in research expenses across 3 years

AWARDS AND FELLOWSHIPS:

- 2021-2023 Research Fellow, Jacobs Foundation
- 2020-2024 Junior 1 Chercheur-Boursier, Fonds de Recherche du Quebec—Santé
- 2019-2020 Young Investigator Award, Brain and Behavior Research Foundation
- 2019 Momental Foundation Unfettered Research Grant (\$10k direct costs)
- 2019 Promising Investigator Award, Ripple Neuro (\$85k in equipment)
- 2019 Presenters Travel Grant, Cosyne meeting
- 2018 Finalist, Ripple Innovation in Research and Technology Competition
- 2018 Poster Spotlight and Travel Awards, Cognitive Science Society Workshops
 Understanding Exploration-Exploitation Trade-offs
- 2015-17 Postdoctoral Fellow, CV Starr Foundation
- 2014, 2016 Travel awards, Gordon Conference, Neurobiology of Cognition
- 2014-17 NIMH National Research Service Award (F32)
- 2013-14 Stanford Vision Training Program Fellowship (T32)
- 2009-10 Ruth K. Broad Foundation Fellowship, Duke University

2007-11 James B. Duke Fellowship, Duke University
2005-07 Intramural Research Training Award, NIMH
2003-05 Robert M. Hutchins Scholarship, Simon's Rock College
2001-03 Acceleration to Excellence Scholarship, Simon's Rock College
1999 8th Place in the USA, Discovery Young Scientists Challenge

PUBLICATIONS: (* CONTRIBUTED EQUALLY)

Ebitz, R. B. & Hayden, B. Y. (2021). "The population doctrine revolution in cognitive neuroscience." *Neuron*, in press.

Chen, C. S., Knep, E., Han, A., **Ebitz, R. B.**, & Grissom, N. M. (2021). "Sex differences in learning from exploration." *Elife*, in press.

Wilson, R. C., Bonawitz, L., Costa, V. D., & **Ebitz, R. B.** (2021). "Balancing exploration and exploitation with information and randomization." *Current Opinion in Behavioral Sciences* 38.

Ebitz, R. B., Tu, J. C. & Hayden, B. Y. (2020). "Rule adherence warps feature encoding in decision circuits." *PLoS Biology* 18(11).

Chen, C. S.*, **Ebitz, R. B.***, Bindas, S. R., Redish, A. D., Hayden, B. Y., & Grissom, N. M. (2020). "Divergent strategies for learning in males and females." *Current Biology* 31(1).

Ebitz, R. B., Sleezer, B.J., Jedema, H.P., Bradberry, C.W., Hayden, B. Y. (2019). "Tonic exploration governs both flexibility and lapses." *PLoS Comp. Bio* 15(11).

Ebitz, R. B. & Moore, T. (2019). "Both a gauge and a filter: Cognitive modulations of pupil size." *Frontiers in Neurology* 9, 1190.

Ebitz, R. B., Albarran, E., & Moore, T. (2018). "Exploration disrupts choice predictive signals and alters population dynamics in prefrontal cortex." *Neuron* 97 (2), 450-61. (**Cover**)

Ebitz, R. B., Moore, T. (2017). "Selective modulation of the pupil light reflex by microstimulation of prefrontal cortex." *Journal of Neuroscience* 37 (19), 5008-18.

Ebitz, R. B. & Hayden, B. (2016). "Dorsal anterior cingulate: A Rorschach test for cognitive neuroscience." *Nature Neuroscience*, 19, 1278-79.

Ebitz, R. B., Platt, M. L. (2015). "Neuronal activity in primate dorsal anterior cingulate cortex signals task conflict and predicts adjustments in pupil-linked arousal." *Neuron* 85(3), 628-40.

Ebitz, R. B., Pearson, J., Platt, M. L. (2014). "Pupil size and social vigilance in rhesus macaques." *Frontiers in Neuroscience* 8(100).

Pearson, J., Watson, K. K., Klein, J., **Ebitz, R. B.**, & Platt, M. L. (2013). Individual differences in social information gathering revealed through Bayesian hierarchical models. *Frontiers in Neuroscience* 7(165).

Ebitz, R. B., Watson, K. K., & Platt, M. L. (2013). “Oxytocin reduces social vigilance in rhesus macaques.” *Proceedings of the National Academy of Sciences*, 110(28), 11630-5.

Ebitz, R. B. & Platt, M. L. (2013). “An evolutionary perspective on the behavioral consequences of exogenous oxytocin delivery.” *Frontiers in Behavioral Neuroscience* 2, 225.

Chang, S. W., Barter, J. W., **Ebitz, R. B.**, Watson, K. K., & Platt, M.L. (2012). “Inhaled oxytocin amplifies both vicarious reinforcement and self reinforcement in rhesus macaques (*Macaca mulatta*).” *Proceedings of the National Academy of Sciences*, 109(3), 959-964.

PREPRINTS:

Ebitz, R.B., Smith, E. H., Horga, G., Schevon, C. A., Yates, M. J., McKhann, G. M., Botvinick, M. M., Sheth, S. A.*, & Hayden, B. Y.* (on bioRxiv/under review). “Human dorsal anterior cingulate neurons signal conflict by amplifying task-relevant information.”

Fine, J. M., Yoo, S. B. M., **Ebitz, R. B.**, & Hayden, B. Y. (on bioRxiv/under review). “Subspace alignment as a mechanism for binding.”

Sleezer, B. J., Post, R. J., Bulkin, D. A., **Ebitz, R. B.**, Lee, V., Han, K., Warden, M. R. (on bioRxiv/under review). “Tonic activity in lateral habenula neurons promotes disengagement from reward-seeking behavior.”

Voloh, B., Eisenreich, B., Maisson, D. J. N., **Ebitz, R. B.**, Park, H. S., Hayden, B. Y., Zimmermann, J. (on bioRxiv/under review). “Hierarchical organization of rhesus macaque behavior.”

TALKS:

- 2021 Society for Neuroeconomics Annual Meeting (virtual meeting)
Cognitive Science Colloquium, University of Arizona, Tucson, AZ USA
Neuropsychiatry Journal Club, bi-weekly virtual meeting across Brown, Stanford, Baylor Universities, and the U. Minnesota
- 2020 Montréal Artificial Intelligence and Neuroscience (MAIN), Montréal, QC Canada
Local AI/neuroscience meeting, U. Montréal, Montréal, QC
Journée Scientifique, Department of Neuroscience, U. Montréal, Montréal, QC
Cosyne meeting, workshop: “Structure learning: Graphs, manifolds, and geometries,”
Breckenridge, CO, USA
- 2019 David LaBerge Seminar Series, Simon’s Rock College, Great Barrington, MA, USA
Society for Neuroscience Meeting, Nanosymposium, Chicago, IL, USA
Jacobs Foundation Marbach Workshop, Öhningen, Germany

- Rising Star Speaker Series, Google DeepMind, London, UK
 International Behavioral Neuroscience Society, Cairns, Australia
 Cosyne main meeting (selected talk), Lisbon, Portugal
- 2018 Department of Neurosciences, Université de Montréal, Montréal, QC, Canada
 Society for Neuroscience Meeting, Nanosymposium, San Diego, CA, USA
 Ecology, Evolution and Behavior Dept., U of Minnesota, St Paul, MN, USA
 Biomedical Engineering Dept., U of Minnesota, Minneapolis, MN, USA
 Cognitive Science Society, workshop: “Exploration-Exploitation Trade-offs,”
 Madison, WI, USA
 Montreal Neurological Institute, McGill University, Montréal, QC, Canada
- 2017 Neuroscience and Social Decision Making, Princeton University, Princeton, NJ, USA
 Charles River Analytics, Cambridge, MA, USA
- 2016 Computational Neuroscience Initiative, U of Pennsylvania, Philadelphia, PA USA
 Gordon Seminar on the Neurobiology of Cognition, Newry, ME, USA
 Cosyne meeting, workshop: “Executive Flexibility”, Snowbird, UT, USA
 Cosyne main meeting (selected talk), Salt Lake City, UT, USA
- 2015 Maths, Monkeys, & Machines, Stanford University, Stanford, CA, USA
- 2014 Memory, Attention, and Decision-Making, Stanford University, Stanford, CA, USA
 Department of Neuroscience, Columbia University, New York, NY, USA
 Translational Oxytocin Research Group, Stanford University Medical School,
 Stanford, CA, USA
 Department of Brain and Cognitive Sciences, U of Rochester, Rochester, NY, USA
- 2012 Society for Neuroscience, Nanosymposium talk, New Orleans, LA, USA
 Neurobiology Department, Northwestern University, Chicago, IL, USA
 Decision Making Across the Disciplines Conference, Duke Center for
 Interdisciplinary Decision Sciences, Durham, NC, USA

SELECTED MEETING ABSTRACTS (†STUDENTS UNDER MY SUPERVISION):

Shourkeshti, A.[†], Morocco, G.[†], Jurewicz, K.[†], Moore, T., **Ebitz, R. B.** “Pupil size anticipates exploration and predicts disorganization in prefrontal neuronal populations.” (December 2021). American College of Neuropsychopharmacology, San Juan, Puerto Rico.

Jurewicz, K.[†], Sleezer, B. J.[†], Mehta, P., Hayden, B. Y., **Ebitz, R. B.** “Irrational decision-making via a curvilinear value manifold in prefrontal neuronal populations.” (November 2021). Society for Neuroscience, virtual conference.

Chen, C. S.[†], Knep, E., Han, A., **Ebitz, R. B.**, & Grissom, N. M. (2021). “Sex differences in learning from exploration.” (November 2021). Society for Neuroscience, virtual conference.

Harrell, D., Chen, C.[†], Grissom, N., **Ebitz, R. B.**, Meyer, C.[†], Darrow, D., Herman, A. “Foraging vs value-comparison reinforcement learning models of sequential decision-making.” (September 2021), Society for Neuroeconomics, virtual conference. (**Selected for a talk.**)

Jurewicz, K.[†], Sleezer, B. J.[†], Mehta, P., Hayden, B. Y., **Ebitz, R. B.** “Irrational decision-making via a curvilinear value manifold in prefrontal neuronal populations.” (September 2021). Society for Neuroeconomics, virtual conference. (**Selected for a talk.**)

Sleezer, B. J.[†], Mehta, P., Hayden, B. Y., **Ebitz, R. B.** “Irrational decision-making via a curvilinear value manifold in prefrontal neuronal populations.” (August 2021). Canadian Association for Neuroscience, virtual conference.

Morocco, G.[†], Jurewicz, K.[†], Moore, T., **Ebitz, R. B.** “Pupil size anticipates exploration and predicts disorganization in prefrontal neuronal populations.” (August 2021). Canadian Association for Neuroscience, virtual conference.

Chen, C.[†], **Ebitz, R. B.**, Knep, E., Meyer, C. S.[†], Herman, A. B., Grissom, N. M. “Volatility influences exploration in reward-guided decision-making.” (February 2021). Cosyne, virtual.

Ebitz, R.B., Tu, J.C. [†], Hayden, B.Y. “Rule adherence warps decision-making.” (December 2020). NeurIPS Workshop on Biological and Artificial Reinforcement Learning.

Ebitz, R.B., Tu, J.C. [†], Hayden, B.Y. “Rule adherence warps decision-making.” (February 2020). Cosyne, Denver, CO.

Chen, C. S.[†], **Ebitz, R. B.**, Bindas, S., Hayden, B., Grissom, N. “Divergent strategies for learning in males and females.” (July 2019). Reinforcement Learning and Decision Making (RLDM), Montreal, Canada.

Chen, C. S. [†], **Ebitz, R. B.**, Bindas, S., Hayden, B., Grissom, N. “Divergent strategies for learning in males and females.” (February 2019). Cosyne, Lisbon, Portugal.

Ebitz, R.B., Hayden, B.Y., Moore, T. “Exploration via disrupted sensorimotor control dynamics.” (July 2018). Cognitive Science Society 2018 Workshop: Understanding Exploration-Exploitation Trade-offs. (**Spotlight Award Poster**)

Ebitz, R.B., Cohen, J.D., & Buschman, T. (November 2017). “Control mechanisms for flexibility in a changing world.” Society for Neuroscience, Washington, DC.

Ebitz, R.B., Buschman, T., & Moore, T. (June 2017). “Exploration via transient disruptions in prefrontal control.” Reinforcement Learning and Decision-Making, Ann Arbor, MI.

Ebitz, R.B., Moore, T., & Buschman, T. (February 2017). “Bottom-up salience drives choice during exploration.” Cosyne, Salt Lake City, UT.

Ebitz, R.B., Moore, T., & Buschman, T. (November 2016). “Altered balance between top-down and bottom-up control across exploration and exploitation.” Society for Neuroscience, San Diego, CA.

Ebitz, R.B., & Moore, T. (July 2016). “Altered balance between top-down and bottom-up saccade control across exploration and exploitation.” Gordon Research Conference on the Neurobiology of Cognition, Newry, ME.

SELECTED PROFESSIONAL ACTIVITIES:

Invited Reviewer: *Journal of Neuroscience*; *Nature Neuroscience*; *eLife*; *Scientific Reports*; *Hormones and Behavior*; *PLoS One*; *PLoS Computational Biology*; *Frontiers in Neuroscience*; *Frontiers in Neurology*; *Frontiers in Computational Neuroscience*; *Nature Human Behavior*; *Nature Communications*; *Trends in Cognitive Sciences*; *Science Advances*; *Cognitive, Affective and Behavioral Neuroscience*; *Journal of Cognitive Neuroscience*; *eNeuro*; Cosyne meeting; Fonds de Recherche du Québec–Santé

Professional Membership, *Society for Neuroscience*, 2005-present

Professional Membership, *Canadian Association for Neuroscience*, 2018-present

Professional Membership, *Sigma Xi*, 2021-present

- 2021 Session Chair, Montréal AI-Neuroscience (MAIN), Montréal, QC Canada

- 2021- Organizer/Moderator, “UdeM Science PIs”, a social networking group and email list for pre-tenure professors working in the sciences at UdeM

- 2021- Organizing Committee/Host, “L’heure scientifique/Science Hour” Interdisciplinary student seminar series, Faculty of Medicine, UdeM

- 2021- Member, Centre interdisciplinaire de recherche sur le cerveau et l'apprentissage (CIRCA; Interdisciplinary center for brain and learning research)

- 2020- Member, Unifying Neuroscience and Artificial Intelligence—Québec (UNIQUE)

- 2020- Co-organizer, MountAIN Seminar (with Pouya Bashivan and Suresh Krishna) A seminar series/journal club spanning artificial intelligence and neuroscience

- 2020- Consultant, “NeuroPlasticity Research in Support of Mental Health” “NeuroPRSMH” NIMH P50 Grant/Conte Center

- 2020- Consultant, “Sex-biased impacts of 16p11.2 variants on reward-guided choice” NIMH R01; PI: Nicola Grissom

- 2020-21 Co-Organizer, 4th annual Journée scientifique du Département de neurosciences, Université de Montréal

- 2020-21 Co-Organizer, DeToks (with Michael Seng Bum Yoo, MIT) A virtual social gathering and discussion group for neuroscience, psychology, and AI researchers, held during Covid-19 pandemic lockdowns

- 2020 Consultant, “Defining and Evidencing Student Curiosity and Creativity”

A working group hosted by International Baccalaureate (Switzerland), Oxford University Centre for Education Assessment (UK), Jacobs Foundation (Germany), and Australian Council for Educational Research (Australia).

- 2019-20 Consultant, SaniNudge (Copenhagen, Denmark)
Developed approaches to systematize hand hygiene compliance in hospitals
- 2019 Mentor, Cosyne Undergraduate Travel Grant (Lisbon, Portugal)
- 2018 Organizer and co-chair, “Flexible Decision Making: Circuits and Computations”
Society for Neuroscience Nanosymposium, San Diego, CA, USA
- 2016 Organizer and co-chair, “Executive Flexibility”
Cosyne workshop, Snowbird, UT, USA
- 2014-15 Co-organizer, *Maths, Monkeys & Machines* interdisciplinary seminar series
Stanford University, Stanford, CA, USA
- 2014 Discussant, Gordon Research Seminar on Neurobiology of Cognition
Gordon Research Conferences, Newry, ME, USA
- 2013 Attendee, Bay Area Ophthalmology Course
Bay Area Ophthalmology Consortium, Stanford Medicine, Stanford, CA, USA
- 2010-13 Workshop leader and volunteer, Brain Awareness Week
Durham, NC & Raleigh, NC, USA

OUTREACH & PRESS COVERAGE:

Guest, “Craniotomy” podcast. (November 2021). Hosts: Dr. David Darrow and Dr. Alexander Herman.

Binda, P. & Gamlin, P. D. (2017). “Renewed attention on the Pupil Light Reflex.”
Commentary on “FEF microstimulation modulates the pupil light reflex.” *Trends in Neuroscience* Spotlight article.

Shenhav, A. & Botvinick, M. (2015). “Uncovering a Missing Link in Anterior Cingulate Research.” Commentary on “Neuronal activity in primate dorsal anterior cingulate cortex signals task conflict and predicts adjustments in pupil-linked arousal.” *Neuron* 85(3), 455-7.

“The Science of Love: What Are You Looking At?” Write-up of “Oxytocin reduces social vigilance in rhesus macaques.” in October 10, 2013 *Cell: Select* column. *Cell*, 155, 263.

MENTORING:

Postdoctoral: Katarzyna Jurewicz, PhD (2021-present)
(IVADO Postdoctoral Fellow, 2021-2023)

Brie Sleezer, PhD (co-advised with Dr. B. Hayden, 2020-present)

Graduate (PhD): Akram Shoureshti (2021-present; Cosyne travel grant awardee)
Cathy Chen (co-advised with Dr. N. Grissom, 2017-present)
(MNDrive Graduate Fellow, 2020; Doctoral Dissertation Fellow,
2021; first-author papers in *Current Biology* and *Elife*)

Undergraduates: Gabriel Morocco (summer 2021; presented at the 2021 Canadian
Association for Neuroscience Meeting; manuscript in preparation)
Alix Lavigne-Champagne (2022-present)
Collin Meyer (co-advised with Dr. A. Herman), 2019-present

Laboratory Staff: Alex Hay, MSc (research associate, 2021-present)
Natacha DeSylva (animal technician, 2020-2021)

Thesis/Dissertation Committees:

Cathy Chen (2020-present, PhD student, University of Minnesota, PI: Grissom)
Ian Moreau-Debord (2020-present, PhD student, Université de Montréal, PI: Dancause)
Poune Mirzazadeh (2021-present, PhD student, Université de Montréal, PI: Cisek)

Co-supervision (as a Postdoctoral Fellow):

Cindy Tu (2017-2019, now a PhD student at Washington University in St. Louis)
Eddy Albarran (2013-2014, now a PhD student at Stanford University)

TEACHING:

Co-Director:

Winter 2021 Neurosciences : travaux pratiques (NSC-2004), Université de Montréal
Spring 2022 Colloque en neurosciences (NSC-6045), Université de Montréal

Instructor:

Fall 2021 Colloque en neurosciences (NSC-6044), Université de Montréal
Winter 2021 Neurosciences : travaux pratiques (NSC-2004), Université de Montréal
Spring 2022 Colloque en neurosciences (NSC-6045), Université de Montréal

Postdoctoral or Graduate Student Instructor:

2016 Neuroscience Junior Tutorial (2 sessions), Princeton University
2011 Launch into Pharmacology (2 sessions, summer intensive), Duke University
2010 Biological Bases of Behavior (2 sections), Duke University

Guest Instructor:

2012 Principles of Cognitive Neuroscience (graduate course), Duke University
2010 Introduction to Biology, Guilford College, Greensboro, NC
2010 Sensory Systems, Guilford College, Greensboro, NC

Teaching Assistant/Course Organizer:

2009 Brain and Behavior, Duke University Medical School