Stanford



Jennifer L. Raymond

Berthold and Belle N. Guggenhime Professor

Neurobiology

Bio

ACADEMIC APPOINTMENTS

- Professor, Neurobiology
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Associate Dean, Office of Diversity and Leadership, (2012-2014)

HONORS AND AWARDS

- Ellen and Albert Grass Lecturer, Society for Neuroscience (2019)
- Excellence in Diversity Award, Stanford School of Medicine (2014)
- Graduate Teaching Award, Stanford School of Medicine (2010, 2016)
- EJLB Foundation Scholar, EJLB Foundation (2004)
- Klingenstein Fellow, Klingenstein Foundation (1999)
- McKnight Scholar, McKnight Endowment Fund for Neuroscience (1999)
- Sloan Fellow, Alfred P. Sloan Foundation (1999)
- Terman Fellow, Stanford University (1999)

PROGRAM AFFILIATIONS

- Symbolic Systems Program

PROFESSIONAL EDUCATION

- Ph.D., U Texas, Houston , Neuroscience (1993)
- B.A., Williams College , Mathematics (1987)

LINKS

- Raymond Lab web site: http://raymondlab.stanford.edu/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

My laboratory studies the neural mechanisms of learning. Our research aims to develop an integrated understanding of this fundamental brain function by systematically tracing learning from a sensory experience, through the neural encoding of that experience, to the induction of plasticity at specific loci in the brain, and the ultimate readout of the memory in an altered behavior. Toward this goal, we use a combination of behavioral, neurophysiological and computational approaches.

The model system we study is a form of learning that calibrates the amplitude of eye movements produced by the vestibuloocular reflex (VOR). As an experimental system, learning in the VOR offers many advantages: the neural circuitry mediating the behavior is well understood, putative sites of synaptic plasticity have been identified, and a key neural structure is the cerebellum, which is well suited for both in vivo and in vitro studies of the mechanisms of learning.

One current focus in the lab is to record from the cerebellum in awake behaving animals during the induction of learning in order to identify the neural "error signals" that detect a miscalibration in the VOR and trigger the neural changes underlying learning. Another current project is to study learning in the VOR of transgenic mice, as a tool for linking systems level analysis of learning with cellular and molecular analyses of synaptic plasticity.

Teaching

COURSES

2026-27

- The Neuroscience of Language Learning: OSPFLOR 59F (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

URee Chon, Kenji Marshall

Postdoctoral Faculty Sponsor

Fatemeh Sayehmiri, Balakumar Srinivasan

Postdoctoral Research Mentor

Balakumar Srinivasan

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (PhD Program)

Publications

PUBLICATIONS

- **Synaptic weight dynamics underlying memory consolidation: Implications for learning rules, circuit organization, and circuit function.** *Proceedings of the National Academy of Sciences of the United States of America*
  Bhasin, B. J., Raymond, J. L., Goldman, M. S.
  2024; 121 (41): e2406010121

- **NeuroRoots, a bio-inspired, seamless brain machine interface for long-term recording in delicate brain regions.** *AIP advances*
  Ferro, M. D., Proctor, C. M., Gonzalez, A., Jayabal, S., Zhao, E., Gagnon, M., Slézia, A., Pas, J., Dijk, G., Donahue, M. J., Williamson, A., Raymond, J., Malliaras, et al

2024; 14 (8): 085109

- **Systemic pharmacological suppression of neural activity reverses learning impairment in a mouse model of Fragile X syndrome** *ELIFE*
  Shakhawat, A. M. D., Foltz, J. G., Nance, A. B., Bhateja, J., Raymond, J. L.
  2024; 12
- **Synaptic weight dynamics underlying systems consolidation of a memory.** *bioRxiv : the preprint server for biology*
  Bhasin, B. J., Raymond, J. L., Goldman, M. S.
  2024
- **Interactions between circuit architecture and plasticity in a closed-loop cerebellar system.** *eLife*
  Payne, H. L., Raymond, J. L., Goldman, M. S.
  2024; 13
- **Population calcium responses of Purkinje cells in the oculomotor cerebellum driven by non-visual input.** *Journal of neurophysiology*
  Fanning, A., Shakhawat, A., Raymond, J. L.
  2021
- **Publisher Correction: Diversity and dynamism in the cerebellum.** *Nature neuroscience*
  De Zeeuw, C. I., Lisberger, S. G., Raymond, J. L.
  2021
- **Mouse entorhinal cortex encodes a diverse repertoire of self-motion signals.** *Nature communications*
  Mallory, C. S., Hardcastle, K., Campbell, M. G., Attinger, A., Low, I. I., Raymond, J. L., Giocomo, L. M.
  2021; 12 (1): 671
- **Diversity and dynamism in the cerebellum.** *Nature neuroscience*
  De Zeeuw, C. I., Lisberger, S. G., Raymond, J. L.
  2020
- **Research on the cerebellum yields rewards** *NATURE*
  Raymond, J. L.
  2020; 579 (7798): 202–3
- **Increasing gender diversity in the STEM research workforce** *SCIENCE*
  Greider, C. W., Sheltzer, J. M., Cantalupo, N. C., Copeland, W. B., Dasgupta, N., Hopkins, N., Jansen, J. M., Joshua-Tor, L., McDowell, G. S., Metcalf, J. L., McLaughlin, B., Olivarius, A., O'Shea, et al
  2019; 366 (6466): 692-+
- **Cerebellar pukinje cells control eye movements with rapid that is invariant to spike irregularity** *ELIFE*
  Payne, H. L., French, R. L., Guo, C. C., Nguyen-Vu, T., Manninen, T., Raymond, J. L.
  2019; 8
- **Cerebellar Purkinje cells control eye movements with a rapid rate code that is invariant to spike irregularity.** *eLife*
  Payne, H. L., French, R. L., Guo, C. C., Nguyen-Vu, T. B., Manninen, T., Raymond, J. L.
  2019; 8
- **Funders should evaluate projects, not people.** *Lancet (London, England)*
  Raymond, J. L., Goodman, M. B.
  2019; 393 (10171): 494–95
- **Funders should evaluate projects, not people** *LANCET*
  Raymond, J. L., Goodman, M. B.
  2019; 393 (10171): 494–95
- **Single-cell transcriptomes and whole-brain projections of serotonin neurons in the mouse dorsal and median raphe nuclei.** *eLife*
  Ren, J. n., Isakova, A. n., Friedmann, D. n., Zeng, J. n., Grutzner, S. M., Pun, A. n., Zhao, G. Q., Kolluru, S. S., Wang, R. n., Lin, R. n., Li, P. n., Li, A. n., Raymond, et al
  2019; 8
- **Depressed by LearningHeterogeneity of the Plasticity Rules at Parallel Fiber Synapses onto Purkinje Cells** *CEREBELLUM*

Suvrathan, A., Raymond, J. L.
2018; 17 (6): 747–55

- **Computational Principles of Supervised Learning in the Cerebellum.** *Annual review of neuroscience*
  Raymond, J. L., Medina, J. F.
  2018; 41: 233–53

- **An Integrated Career Coaching and Time-Banking System Promoting Flexibility, Wellness, and Success: A Pilot Program at Stanford University School of Medicine.** *Academic medicine : journal of the Association of American Medical Colleges*
  Fassiotto, M., Simard, C., Sandborg, C., Valantine, H., Raymond, J.
  2018; 93 (6): 881-887

- **Yet another reason to walk instead of drive** *NATURE NEUROSCIENCE*
  Raymond, J. L.
  2018; 21 (5): 648–49

- **An Integrated Career Coaching and Time Banking System Promoting Flexibility, Wellness, and Success: A Pilot Program at Stanford University School of Medicine** *Academic Medicine*
  Fassiotto, M., Simard, C., Sandborg, C., Valantine, H., Raymond, J.
  2018

- **Pulled in Too Many Directions: The Causes and Consequences of Work-Work Conflict** *Sociological Perspectives*
  Wynn, A. T., Fassiotto, M., Simard, C., Raymond, J. L., Valantine, H.
  2018

- **Magnetic eye tracking in mice** *ELIFE*
  Payne, H. L., Raymond, J. L.
  2017; 6

- **A saturation hypothesis to explain both enhanced and impaired learning with enhanced plasticity.** *eLife*
  Nguyen-Vu, T. B., Zhao, G. Q., Lahiri, S., Kimpo, R. R., Lee, H., Ganguli, S., Shatz, C. J., Raymond, J. L.
  2017; 6

- **Timing Rules for Synaptic Plasticity Matched to Behavioral Function** *NEURON*
  Suvrathan, A., Payne, H. L., Raymond, J. L.
  2016; 92 (5): 959-967

- **Purkinje cell responses during visually and vestibularly driven smooth eye movements in mice** *BRAIN AND BEHAVIOR*
  Katoh, A., Shin, S., Kimpo, R. R., Rinaldi, J. M., Raymond, J. L.
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- **Signals and learning rules guiding oculomotor plasticity.** *journal of neuroscience*
  Shin, S., Zhao, G. Q., Raymond, J. L.
  2014; 34 (32): 10635-10644

- **Cerebellar encoding of multiple candidate error cues in the service of motor learning.** *journal of neuroscience*
  Guo, C. C., Ke, M. C., Raymond, J. L.
  2014; 34 (30): 9880-9890

- **Gating of neural error signals during motor learning** *ELIFE*
  Kimpo, R. R., Rinaldi, J. M., Kim, C. K., Payne, H. L., Raymond, J. L.
  2014; 3

- **Obscuring Gender Bias with "Choice"** *SCIENCE*
  Conner, A. L., Cook, K. S., Correll, S. J., Markus, H. R., Moss-Racusin, C. A., Muller, C. B., Raymond, J. L., Simard, C.
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- **Cerebellar Purkinje cell activity drives motor learning.** *Nature neuroscience*
  Nguyen-Vu, T. D., Kimpo, R. R., Rinaldi, J. M., Kohli, A., Zeng, H., Deisseroth, K., Raymond, J. L.
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- **Elimination of climbing fiber instructive signals during motor learning** *NATURE NEUROSCIENCE*
  Ke, M. C., Guo, C. C., Raymond, J. L.
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  Katoh, A., Chapman, P. J., Raymond, J. L.
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- **Impaired motor learning in the vestibulo-ocular reflex in mice with multiple climbing fiber input to cerebellar Purkinje cells** *JOURNAL OF NEUROSCIENCE*
  Kimpo, R. R., Raymond, J. L.
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- **Motor deficits in homozygous and heterozygous P/Q-type calcium channel mutants** *JOURNAL OF NEUROPHYSIOLOGY*
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- **Active reversal of motor memories reveals rules governing memory encoding** *NEURON*
  Boyden, E. S., Raymond, J. L.
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- **Contribution of background and target motion to the induction of motor learning in the interneurons VOR** *Conference on Recent Developments in Cerebellar Research*
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  NEW YORK ACAD SCIENCES.2002: 525–525
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- **Learning in the oculomotor system: from molecules to behavior** *CURRENT OPINION IN NEUROBIOLOGY*
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- **Multiple subclasses of Purkinje cells in the primate floccular complex provide similar signals to guide learning in the vestibulo-ocular reflex** *LEARNING & MEMORY*
  Raymond, J. L., Lisberger, S. G.
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- **Behavioral analysis of signals that guide learned changes in the amplitude and dynamics of the vestibulo-ocular reflex** *JOURNAL OF NEUROSCIENCE*
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- **The cerebellum: A neuronal learning machine?** *SCIENCE*
  Raymond, J. L., Lisberger, S. G., Mauk, M. D.
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  Raymond, J. L., Lisberger, S. G.
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  Lisberger, S. G., Raymond, J. L.
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