Anne Churchland

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Research goals

My long-term goal is to understand the neural circuits that support decision-making. To achieve this, my lab develops behavioral paradigms to assay decision-making, measures neural responses in cortical structures, and uses computational approaches to connect the two. We study humans, and also rodents so as to take advantage of molecular/genetic tools for dissecting neural circuits and to leverage genetic models of mental illness. My training in cognitive development, systems neuroscience, psychology, mathematics and computational neuroscience together support my goal of understanding normal and disrupted activity in the neural circuits for complex behavior.

Education

Wellesley College: B.A., Mathematics and Psychology 9/1992-6/1996

Oxford University: visiting student, Mathematics and Psychology 9/1994-6/1995

University of California, San Francisco: Ph.D., Neuroscience 9/1998-11/2003

- Advisor: Dr. Stephen Lisberger
- Thesis: Representations of eye and image velocity in exstrastriate cortex of macaque monkeys
- Funding: National Science Foundation predoctoral fellowship

University of Washington: Postdoctoral fellow 7/2004-7/2010

- Advisor: Dr. Michael Shadlen
- Research: An experimental and computational approach to understanding complex decisions
- Funding: K99 Pathways to Independence Award, National Eye Institute

Positions held

Associate Professor 2014-present

Cold Spring Harbor Laboratory

Assistant Professor 2010-2014

Cold Spring Harbor Laboratory

Adjunct Assistant Professor 2012-present

Stony Brook University

Research technician 1996-1998

University of California, San Francisco (laboratory of Dr. S. Lisberger).

Funding from foundation awards

- Simons Collaboration on the Global Brain (2014-2017)
- Klingenstein-Simons Fellowship Award in the Neurosciences (2014-2017)
- Pew Charitable Trust: Scholar Award (2014-2018)
- Chapman Foundation: Research award (2012-2015)

- McKnight Foundation: Scholar award (2012-2015)
- Merck Foundation: Scholar award (2011-2015)

Federal funding

- R01 (2012-2017) National Eye Institute.
  Role: PI
  Title: The role of parietal cortex in multisensory decision-making
- NSF (2011-2014) Research and Evaluation on Education in Science.
  Role: Co-PI
  Title: A Bayesian Approach to Number Reasoning
- R00 Pathways to Independence Award (2010-2013) National Eye Institute
  Role: PI
  Title: Complex decision-making: an experimental and computational approach

Other Funding

- Evelyn Willard Fund (2010)
- Schwartz Foundation (2011)

Other honors and awards

- Society for Neuroscience: Trubatch career development award (2012)
- Pathways to Independence award: NIH National Eye Institute (K99:2008; R00:2010)
- National Science Foundation: Predoctoral fellowship (2000)

Peer reviewed publications

1. Raposo, D., Kaufman, M. T. & Churchland, A. K. (2014) A category-free neural population supports evolving demands during decision-making. Nature Neuroscience.
2. Kiani, R., Churchland, A.K., Shadlen, M.N. (2013). Integration of direction cues is invariant to the temporal gap between them. Journal of Neuroscience 33(42):16483-9.
3. Sheppard, J., Raposo, D., & Churchland, A.K. (2013). Dynamic weighting of multisensory stimuli shapes decision-making in rats and humans. Journal of Vision 13(6):1-19.
4. Raposo, D., Sheppard, J., Schrater, P. & Churchland, A.K. (2012). Multisensory decision-making in rats and humans. Journal of Neuroscience, 32(11):3726-35.
5. Drugowitsch, J., Moreno-Bote, R., Churchland, A.K., Shadlen, M.N. & Pouget, A. (2012). The Cost of accumulating evidence in perceptual decision making. Journal of Neuroscience, 32(11):3612-28.
6. Churchland, A.K., Kiani, R., Chaudhuri, R., Wang, X.J., Pouget, A. & Shadlen, M.N. (2011). Variance as a signature of neural computations during decision-making. Neuron, 69(4):818–83.
7. Beck, J.M., Ma, W.J., Kiani, R., Hanks, T., Churchland, A. K., Roitman, J., Shadlen, M.N., Latham, P. & Pouget, A. (2008). Probabilistic population codes for Bayesian decision-making. Neuron, 60(6):1142-52 (Highlighted in Preview).

8. Churchland, A.K., Kiani, R. & Shadlen, M.N. (2008). Decision-making with multiple alternatives. Nature Neuroscience, 11(6):693-702 (Highlighted in News & Views).
9. Churchland, A.K., Huang, X. & Lisberger, S.G. (2007). Responses of neurons in the medial superior temporal visual area to apparent motion stimuli in macaque monkeys. Journal of Neurophysiology, 97(1):272-82.
10. Churchland, A.K. & Lisberger, S.G. (2005). Relationship between extraretinal component of firing rate and eye speed in area MST of macaque monkeys. Journal of Neurophysiology, 94(4):2416-26.
11. Churchland, A.K. & Lisberger, S.G. (2005). Discharge properties of MST neurons that project to the frontal pursuit area in macaque monkeys. Journal of Neurophysiology 94(2):1084-90.
12. Churchland, A.K., Gardner, J.L., Chou, I.H., Priebe, N. & Lisberger, S.G. (2003). Directional anisotropies reveal a functional segregation of visual motion processing for perception & action. Neuron, 37(6):1001-11.
13. Blake, D.T., Strata, F., Churchland, A.K. & Merzenich, M.M. (2002). Neural correlates of instrumental learning in primary auditory cortex. Proceedings of the National Academy of Sciences, 99(15):10114-9.
14. Churchland, A. K. and S. G. Lisberger (2002). Gain control in human smooth-pursuit eye movements. Journal of Neurophysiology 87(6): 2936-2945.
15. Diamond, A., Churchland, A.K., Cruess, L. & Kirkham, N.Z. (1999). Early developments in the ability to understand the relation between stimulus and reward. Developmental Psychology 35(6):1507-17.

Reviews/ Other publications

1. Odoemene, O., & Churchland, A. K. (2014). Listening for the right sounds. Neuron (Preview), 82(5):944-945.
2. Carandini, M. & Churchland, A.K. (2013). Probing perceptual decisions in rodents. Nat. Neuroscience (Review)16(7):824-31.
3. Kaufman, M. & Churchland, A.K. (2013). Sensory noise drives bad decisions. Nature (News & Views) 496:172-3
4. Churchland, A. K. & Ditterich, J. (2012) New advances in understanding decisions among multiple alternatives. Current opinion in neurobiology (Review).
5. Churchland, A.K. (2011). Normalizing relations between the senses. Nature Neuroscience (News & Views) 14:672-3
6. Churchland, A.K. & Shadlen, M.N. (2007). Decision and Vision. In "The New Encyclopedia of Neuroscience," Editor: Larry Squire.
7. Shadlen, M.N., Hanks, T.D., Churchland, A.K., Kiani, R., & Yang, T. (2007). The Speed and Accuracy of a Simple Perceptual Decision: A Mathematical Primer. In "Bayesian Brain: Probabilistic Approaches to Neural Coding," Editors: Kenji Doya, Shin Ishii, Alexandre Pouget, and Rajesh P.N. Rao.

Invited seminars

- Cortex Club, Oxford University (2014)
- Humboldt University, Berlin (2014)
- University of Geneva Neurobiology Department (2014)
- UCSD Cognitive Science Department (2014)
- University of Pennsylvania Neuroscience Department (2013)
- University College London Neuroscience Department (2013)
- Stanford University Neuroscience Retreat (2013)
- Riken Institute for Brain Science, Japan (2013)

- Duke University Center for Cognitive Neuroscience (2013)
- Baylor College of Medicine Neurobiology Department (2012)
- Columbia University Center for Theoretical Neuroscience (2012)
- Stony Brook Neurobiology Department (2011)
- Princeton University Neurobiology Department (2010)
- NYU Center for Neural Science (2010)

Invited conference presentations

- Brain, Language and Philosophy: Decision-making across the disciplines, Princeton Univ. (2014)
- Optical Society for America, Philadelphia, PA (2014)
- CSHL Symposium on Quantitative Biology (2014)
- Computational and Systems Neuroscience meeting, Salt Lake City, UT (2014)
- Reinforcement learning & decision-making meeting, Princeton University (2013)
- Quantifying structure in large datasets conference; Columbia University (2013)
- Noise in Decision-Making conference; Sant Fruitos de Bages, Spain (2013)
- Brain and cognitive sciences symposium, University of Rochester (2012)
- Mathematical Brain Institute, Cognitive Neuroscience Workshop (2012)
- Areadne conference on neural coding, Santorini, Greece (2012)

Oral conference presentations selected from contributed abstracts

- FENS Neural Circuits conference, Copenhagen, Denmark (2014)
- Vision Sciences Symposium, Florida (2011)

Educational activities

Undergraduate teaching

- Co-director of CSHL Undergraduate Research Program 2012-present
    i. I have supported the continuation of this historic summer research program at all levels: admissions, faculty-student pairing, overseeing the program and evaluating its success]
    ii. I am co-PI on the NSF grant that funds the program (CSHL NSF-REU Bioinformatics and Computational Biology Summer Undergraduate Program)
    iii. I am currently extending the NSF-funded portion of the program to include Computational Neuroscience alongside bioinformatics, a new direction for the program.
    iv. I have added career development content to the program including leading an annual seminar on work/family balance
- Undergraduate mentor (Batty, Bryan, Cannon)

Invited lecturer at courses

- Dynamic Brain Workshop, Allen Institute for Brain Sciences (2014)

- Computational Vision summer course, Cold Spring Harbor (2014)
- Neural circuits for Vision summer course, Cold Spring Harbor (2013)
- Computational and Cognitive Neurobiology summer school, Suzhou, China (2011)
- Emerging Techniques in Neuroscience short course, Kavli Institute for Theoretical Physics (2010)

Graduate mentoring

- Research mentor for Watson School students Lital Chartarifsky and Onyekachi Odeomene
- Research mentor for visiting Ph.D. student David Raposo (Champalimaud
- Thesis committee chair for Watson School students (Kazakoff, Bandyopadhyay)
- Thesis committee member for Watson School students (Znamenskiy)
- Qualifying committee member for Watson school students (Ghosh, Bandyopadhyay, Marbach, Garvin)

Graduate school teaching/activities

- Member, admissions committee (2012-2014)
- Lecturer in Neuroscience (2010-present)

Professional activities

Conference organization

- Computational and systems neuroscience conference (cosyne)
  Member, executive committee (2012-present)
  Member, advisory board (2011)
  General co-chair (2010)
  Program co-chair (2009)
  Workshop co-organizer (2008)
- Society for Neuroscience Annual Meeting
  2013: Selected as official blogger (churchlandlab.org)
  2012: Session chair
  2011: Nanosymposium organizer: Experimental and theoretical approaches to decision-making

Website creation/management

- anneslist.net 2012-present

  I created and maintain this database of female computational/systems neuroscientists. Conference organizers, editors, and other groups seeking to achieve gender balance in selecting scientists for professional activities use the database. It has been highlighted by SFN President Carol Mason in her letter to the society and in New Scientist magazine as an example of how to promote women in science.
- churchlandlab.org 2010-present

  I created and maintain this blog that highlights the science in my laboratory and the larger neuroscience community. It was selected by the Society for Neuroscience to be an official blog for the 2013 SFN conference.
- cosyne.org 2009-2012

I maintained and improved the website for the Computational and Systems Neuroscience meeting. It provides information about the meeting for attendees and advice and resources for presenters.

Community outreach

- K-12 Education
    i. Organized faculty "team-of-experts" to assist local elementary school teachers (2013)
    ii. Led brain awareness week activities coordinated with existing school curriculum (2010-present)
    iii. Mentored a high school student (Iscowitz) who was an Intel Semifinalist (2012)
- Lectures for invited CSHL Community Members
    i. President's Council Reception (2011)
    ii. Corporate Advisory Board (2011)
- Public lectures
    i. Secret Science Club, Brooklyn NY; 400 attendees (2013)
    ii. Music and the Brain, Cold Spring Harbor Laboratory; 250 attendees (2011)

Editing

- Assistant editor for special issue of "Neuroscience" highlighting different model organisms and their importance for research.

Reviewing

- Nature
- Science
- Nature Neuroscience
- Neuron
- Journal of Neuroscience
- Attention, Perception and Psychophysics
- Public Library of Science
- Journal of Neurophysiology