

## Andrew Alexander

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🐦 @\_AndyAlexander

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### Education

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- 2011-2016     **Doctor of Philosophy in Cognitive Science**  
University of California, San Diego  
La Jolla, CA
- 2004-2009     **Bachelor of Science with Honors in Cognitive Science**  
University of California, San Diego  
La Jolla, CA

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### Research Experience

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#### Postdoctoral Research

- 2017-present     **Dr. Michael Hasselmo Laboratory**  
Boston University, Center for Systems Neuroscience  
Department of Psychological and Brain Sciences  
*Egocentric vector representations of retrosplenial cortex*

#### Graduate Research

- 2009 – 2016     **Dr. Douglas Nitz Laboratory**  
University of California, San Diego  
*Spatial representations of the retrosplenial cortex*  
*Physiological dynamics of basal forebrain neurons in complex behavior*
- 2008 – 2011     **Dr. Andrea Chiba Laboratory**  
University of California, San Diego  
*Encoding of temporal context in the dentate gyrus of the hippocampus*

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### Major Research Awards and Fellowships

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- 2017 – 2020     NIH Postdoctoral Ruth L. Kirschstein National Research Service Award
- 2011 – 2016     NSF Graduate Research Fellow
- 2014             Kavli Institute for Brain and Mind Innovative Research Grant PI
- 2011 – 2016     Robert J. Glushko and Pamela Samuelson Graduate Fellowship

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### Publications

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#### Experimental Articles

**Alexander, A. S.**, Carstensen, L. C., Hinman, J. R., Raudies, F, Chapman G W., Hasselmo, M. E. (2020). Egocentric boundary vector tuning of the retrosplenial cortex., *Science Advances (In press)*

**Alexander, A. S.**, Rangel, L. M., Tingley, D., & Nitz, D. A. (2018). Neurophysiological signatures of temporal coordination between retrosplenial cortex and the hippocampal formation. *Behavioral neuroscience*, 132(5), 453-468.

Tingley, D., **Alexander, A. S.**, Quinn, L. K., Chiba, A. A., & Nitz, D. (2018). Multiplexed oscillations and phase rate coding in the basal forebrain. *Science advances*, 4(8)

Rounds E.L., **Alexander, A.S.**, Nitz, D.A., Krichmar, J.L. (2018) Conjunctive Coding in an Evolved Spiking Model of Retrosplenial Cortex. *Behavioral Neuroscience*. In press.

**Alexander, A. S.**, & Nitz, D. A. (2017). Spatially periodic activation patterns of retrosplenial cortex encode route sub-spaces and distance traveled. *Current Biology*, 27(11), 1551-1560.

Rounds, E.L., Scott, E.O., **Alexander, A.S.**, De Jong, K.A., Nitz, D.A., Krichmar, J.L. (2016). An evolutionary framework for replicating neurophysiological data and spiking neural networks. *International Conference on Parallel Problem Solving from Nature*, 537-547. Springer International Publishing.

**Alexander, A. S.**, & Nitz, D. A. (2015). Retrosplenial cortex maps the conjunction of internal and external spaces. *Nat. Neuro.*, 18(8), 1143-1151.

Tingley, D., **Alexander, A. S.**, Quinn, L. K., Chiba, A. A., & Nitz, D. A. (2015). Cell Assemblies of the Basal Forebrain. *J. Neurosci.*, 35(7), 2992-3000.

Tingley, D., **Alexander, A. S.**, Kolbu, S., de Sa, V. R., Chiba, A. A., & Nitz, D. A. (2014). Task-phase-specific dynamics of basal forebrain neuronal ensembles. *Front. Sys. Neuro.*, 8.

Rangel, L. M., **Alexander, A. S.**, Aimone, J. B., Wiles, J., Gage, F. H., Chiba, A. A., & Quinn, L. K. (2014). Temporally selective contextual encoding in the dentate gyrus of the hippocampus. *Nat. Comm.*, 5.

Minces, V. H., **Alexander, A. S.**, Datlow, M., Alfonso, S. I., & Chiba, A. A. (2013). The role of visual cortex acetylcholine in learning to discriminate temporally modulated visual stimuli. *Front. Behav. Neuro.*, 7.

#### Review & Commentary Articles

Dannenberg, H, **Alexander, A. S.**, Robinson, J. C., Hasselmo, M. E. (2019). The Role of Hierarchical Dynamical Functions in Coding for Episodic Memory and Cognition. *Journal of cognitive neuroscience* 31 (9), 1271-1289

**Alexander, A. S.**, & Hasselmo, M. E. (2018). Navigation: Shedding light on stellate cells. *eLife*, 7, e41041.

Hinman, J. R., Dannenberg, H., **Alexander, A. S.**, & Hasselmo, M. E. (2018). Neural mechanisms of navigation involving interactions of cortical and subcortical structures. *Journal of neurophysiology*, 119(6), 2007-2029.

**Alexander, A.S.**, & Shelley, L.E. (2018). Sleep-Stage-Dependent Hippocampal Coordination with Cingulate and Retrosplenial Association Cortices. *Journal of Neuroscience.*, 38(3), 512-514; DOI: 10.1523/JNEUROSCI.2781-17.2017

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#### Invited Presentations & Conference Posters

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##### Talks

- 2019 Speaker, Spring Hippocampal Research Conference, Taormina, Italy
- 2018 Speaker, Brain Behavior and Cognition Seminar Series, BU, Boston, MA
- 2017 Speaker, Boston University, Boston, MA
- 2015 Speaker, Kavli Institute for Brain and Mind Innovative Research, San Diego, CA
- 2014 Speaker, Neurobiology of Learning and Memory, Park City, UT
- 2012 Speaker, Society for Neuroscience, New Orleans, LA
- 2009 Speaker, UCSD Undergraduate Research Conference, San Diego, CA

##### Selected conference abstracts (first author only)

- 2019 Egocentric boundary vector tuning of the retrosplenial cortex. Soc. Neuro. Abs., Chicago, IL
- 2018 Retrosplenial and entorhinal cortical representation during visually-based triangulation. Soc. Neuro. Abs., San Diego, CA

- 2018 Spatial correlates of the retrosplenial cortex during free exploration. iNAV, Mont Tremblant, CAN
- 2017 Representation of navigational distance in the Retrosplenial cortex.
- 2016 Representation of self-motion, target position, and place in hippocampus and posterior parietal and retrosplenial cortices during pursuit behavior. Soc. Neuro. Abs., San Diego, CA
- 2016 Hippocampal and posterior parietal cortex spatial encoding during pursuit. FENS Forum, Copenhagen, Denmark
- 2016 Retrosplenial cortex spatial firing patterns represent sub-spaces within broader routes. iNAV, Bad Gastein, Austria
- 2015 Route versus environment-centered properties in the spatial firing patterns of retrosplenial cortex neurons. Soc. Neuro. Abs., Chicago, IL
- 2014 Retrosplenial cortex and Hippocampus share modulation of firing activity by allocentric space and the Hippocampal theta rhythm. Soc. Neuro. Abs., Washington D.C.
- 2014 Cell Assemblies of the Basal Forebrain. Joint Symposium on Neural Computation, UC Irvine
- 2013 Retrosplenial cortex activity integrates allocentric, route-centric, and egocentric spatial frames of reference. Soc. Neuro. Abs., San Diego, CA
- 2013 Cell Assemblies of the Basal Forebrain. Soc. Neuro. Abs., San Diego, CA
- 2012 Firing of basal forebrain and posterior parietal cortex neurons maps multiple distinct task phases in a selective attention task. Soc. Neuro. Abs., New Orleans, LA
- 2011 Basal forebrain neuronal activity predicts trial outcome subsequent to cue detection in a selective attention task. Soc. Neuro. Abs., Washington D.C.

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## Teaching

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### Instructor

- 2015 Systems Neuroscience, UCSD, Winter
- 2015 Systems Neuroscience, UCSD, Summer

### Teaching Assistant

- 2015 Hands-On Computing, UCSD
- 2014 Cognitive Neuroscience, UCSD
- 2014 From Sleep to Attention, UCSD
- 2013 Systems Neuroscience, UCSD
- 2012 Systems Neuroscience, UCSD
- 2011 Systems Neuroscience, UCSD
- 2008 Neuroanatomy, UCSD

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## Mentorship

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\*[Research awards]    \*\*\*(Current location)

### Graduate students (BU)

- 2018-current Lucas Carstensen (Graduate Program in Neuroscience)\*\*
- 2017 Lauren Nelson

### Undergraduate students (BU)

- 2018-present Jongyoul Lee [UROP Fellow]\*
- 2018-2019 Elin Johansson [UROP Fellow] (Karolinska Institute, Biomedicine)
- 2018 Jordan Dreher [NSF REU NRTP] (US Army Research Lab)
- 2018 Paola Castro-Mendoza (MGH, Clinical Research Coordinator)
- 2017-2018 Pedro Rodriguez-Echemendia (BU Research Associate, Kantak Lab)
- 2017-2018 Madelynne Campbell (UT Austin Research Technician, Brumback/Howard Lab)

### Undergraduate students (UCSD)

- 2015-2017 Janet Tung (UCSD Cognitive Science PhD program)
- 2016-2017 James Mata [Frontiers of Innovation Scholarship, UCSD] (UCSD School of Medicine)
- 2015-2016 Allison Conner (TEFL, Japan)
- 2014-2015 Chase Cummins (Program Manager, Club Xcite)
- 2014-2015 Avital Birger (National Psychiatric Care and Rehabilitation Programs)
- 2014-2015 Shelby Cohantz [UCSD Cognitive Science Honors Program]
- 2013-2014 Matthew Nguyen

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### Travel Awards and Other Honors

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2018 Society for Neuroscience Trainee and Professional Development Award  
2016 UCSD Dean of Social Sciences Travel Award  
2016 UCSD GSA Travel Award  
2014 Departmental Nominee for ORAU Nobel Laureate Meeting  
2009 UCSD Outstanding Undergraduate Researcher  
2008 UCSD Outstanding Undergraduate Researcher

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### Volunteer/Outreach

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San Diego Brain Bee Judge  
Preuss School Student Mentor  
UCSD Neuroscience Outreach Program

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### Professional Society Memberships and Service

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2017 Boston University Brain Behavior and Cognition Seminar Co-organizer  
2013 UCSD Wa Talk Coordinator  
2011-present Society for Neuroscience

Ad hoc reviewer:

Cerebral Cortex, Journal of Neurophysiology, Behavioral Neuroscience, Frontiers in Psychology, European Journal of Neuroscience, Journal of Neuroscience, Neuron, Current Biology

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### Technical Skills

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- Animal Behavior: rat handling and training on track running, visuospatial attention tasks, and psychophysical paradigms, behavioral scoring, design of novel behavioral tasks to investigate the function of the basal forebrain, spatial systems, and association cortices.
- In vivo Electrophysiology: Microdrive/ hyperdrive construction and design for targeting of multiple brain regions simultaneously, surgical microdrive implantation, single unit recordings in awake-behaving rats (Plexon SortClient, Neuralynx, Open Ephys), spike sorting (Plexon Offline Sorter).
- In vivo optogenetics
- In vivo calcium imaging (w/ one photon microendoscopes)
- MATLAB for analysis of electrophysiological data
- Tissue preparation, staining, and immunohistochemistry.
- Viral methods
- Arduino and methods for behavioral paradigm automation
- 3D design for fabrication of recording devices

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### Research Interests

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Mechanisms of interrelating and anchoring spatial representations generated in distinct brain regions and coordinate systems.

The function of oscillatory dynamics in the coordination of information processing between cortical and subcortical structures.

Learning and memory and interactions between the basal forebrain projection system and the amygdala, hippocampus, and prefrontal cortex.