

Louis Kang

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POSITION

Miller Postdoctoral Fellow

2017–2020

University of California, Berkeley, USA

Host departments: Physics and Helen Wills Neuroscience Institute

Host faculty: Mike DeWeese

RESEARCH STATEMENT

Human cognition ultimately emerges from sophisticated computations performed by networks of neurons. I use and develop theoretical tools to investigate how our brains make sense of and respond to our dynamic environments. In particular, I am pursuing a unified understanding for how the hippocampus and entorhinal cortex allow us to form memories and navigate through space.

EDUCATION

MD, Perelman School of Medicine

2017

University of Pennsylvania, Philadelphia, USA

Research elective with Vijay Balasubramanian in theoretical neuroscience

PhD, Department of Physics & Astronomy

2015

University of Pennsylvania, Philadelphia, USA

Thesis advisor: Tom Lubensky

Thesis title: *Chirality and its spontaneous symmetry breaking in two liquid crystal systems*

AB in Chemistry and Physics and Mathematics *summa cum laude*

2009

Harvard University, Cambridge, USA

VISITING POSITION

Visiting Scientist

Summer 2019

RIKEN Center for Brain Science, Wako, Japan

Host faculty: Taro Toyozumi

PUBLICATIONS

*equal contribution †corresponding author

8. **Kang L[†]**, DeWeese MR. Replay as wavefronts and theta sequences as bump oscillations in a grid cell attractor network. *eLife* 8, e46351 (2019). doi:10.7554/eLife.46351.
7. **Kang L[†]**, Balasubramanian V. A geometric attractor mechanism for self-organization of entorhinal grid modules. *eLife* 8, e46687 (2019). doi:10.7554/eLife.46687.

6. **Kang L[†]**, Lubensky TC. Chiral twist drives raft formation and organization in membranes composed of rod-like particles. *Proc Natl Acad Sci USA* 114, E19 (2017). doi:10.1073/pnas.1613732114.
5. **Kang L[†]**, Gibaud T, Dogic Z, Lubensky TC. Entropic forces stabilize diverse emergent structures in colloidal membranes. *Soft Matter* 12, 386 (2016). doi:10.1039/C5SM02038G.
4. Davidson ZS*, **Kang L***, Jeong J*,[†], Still T, Collings PJ, Lubensky TC, Yodh AG. Chiral structures and defects of lyotropic chromonic liquid crystals induced by saddle-splay elasticity. *Phys Rev E* 91, 050501 (2015). doi:10.1103/PhysRevE.91.050501.
3. Jeong J*,[†], **Kang L***, Davidson ZS, Collings PJ, Lubensky TC, Yodh AG. Chiral structures from achiral liquid crystals in cylindrical capillaries. *Proc Natl Acad Sci USA* 112, E1837 (2015). doi:10.1073/pnas.1423220112.
2. Idema T, Dubuis JO, **Kang L**, Manning ML, Nelson PC, Lubensky TC, Liu AJ[†]. The syncytial *Drosophila* embryo as a mechanically excitable medium. *PLOS ONE* 8, e77216 (2013). doi:10.1371/journal.pone.0077216.
1. Heo M, **Kang L**, Shakhnovich EI[†]. Emergence of species in evolutionary “simulated annealing”. *Proc Natl Acad Sci USA* 106, 1869 (2009). doi:10.1073/pnas.0809852106.

GRANTS, AWARDS, AND HONORS

Collaborative Research Travel Grant 2019–2020

Burroughs Wellcome Fund

Project role: PI

Project title: *Complementary input pathways enhance associative memory in a model of CA3*

Travel Award 2018

Computational Neuroscience Meeting (CNS*2018)

Miller Research Fellowship 2017–2020

University of California, Berkeley

Mary Ellis Bell Prize 2016

University of Pennsylvania, Perelman School of Medicine

“This prize is given to a student in the School of Medicine who is engaged in noteworthy research in any field related to medicine.”

Werner Teutsch Memorial Prize 2012

University of Pennsylvania, Department of Physics & Astronomy

“Awarded annually to the graduate student who, by his or her performance in the first year courses, shows the most promise for outstanding achievement in research.”

Medical Scientist Training Program 2009–2017

National Institutes of Health (USA), awarded through the University of Pennsylvania

Phi Beta Kappa 2009

Harvard University

CONFERENCE PRESENTATIONS [†]talk

Society for Neuroscience Meeting, Chicago, USA 2019

Replay as wavefronts and theta sequences as bump oscillations in a grid cell attractor network

Bernstein Conference , Berlin, Germany <i>Replay arises naturally as a traveling wavefront in an entorhinal attractor network[‡]</i>	2018
Computational Neuroscience Meeting (CNS*2018) , Seattle, USA <i>A geometric attractor mechanism for the self-organization of entorhinal grid modules[‡]</i>	2018
Interdisciplinary Navigation Symposium (iNAV) , Mont-Tremblant, Canada <i>A geometric attractor mechanism for the self-organization of entorhinal grid modules[‡]</i>	2018
American Physical Society March Meeting , Los Angeles, USA <i>Self-organization of entorhinal grid modules through commensurate lattice relationships[‡]</i>	2018
Computational and Systems Neuroscience (Cosyne) , Denver, USA <i>Self-organization of entorhinal grid modules through commensurate lattices</i>	2018
American Physical Society March Meeting , New Orleans, USA <i>Membrane rafts stabilized by chiral liquid crystal correction to bare interfacial tension[‡]</i>	2017
Computational and Systems Neuroscience (Cosyne) , Salt Lake City, USA <i>Coupling between attractor networks naturally generates a discrete grid cell hierarchy</i>	2017
Gordon Research Conference & Seminar on Liquid Crystals , Biddeford, USA <i>Roles of entropy and chirality in depletion-induced colloidal membranes[‡]</i>	2015
American Chemical Society Colloid & Surface Science Symposium , Philadelphia, USA <i>A theory for depletion-induced colloidal membranes[‡]</i>	2014
American Physical Society March Meeting , Denver, USA <i>A theory for depletion-induced colloidal membranes[‡]</i>	2014
IAS Program on Frontiers of Soft Matter Physics , Hong Kong <i>A theory for depletion-induced colloidal membranes</i>	2014
American Physical Society March Meeting , Baltimore, USA <i>Mitotic wavefronts mediated by mechanical signaling in early Drosophila embryos[‡]</i>	2013
EXTERNAL SEMINARS <hr/>	
Ludwig-Maximilians-Universität München , Germany Bernstein Center for Computational Neuroscience Munich <i>Modules (and phase precession and replay) in continuous attractor models of grid cells</i>	2018
University College London , UK Institute for Behavioural Neuroscience <i>Replay arises naturally as a traveling wavefront in an entorhinal attractor network</i>	2018
École Normale Supérieure , Paris, France Group for Neural Theory <i>Self-organization of entorhinal grid modules through commensurate lattice relationships</i>	2017
Institut Curie , Paris, France Pierre Sens Group <i>Chiral twist drives raft formation and organization in membranes composed of rod-like particles</i>	2017
University College London , UK	2016

Gatsby Computational Neuroscience Unit

Coupling between attractor networks naturally generates a discrete grid cell hierarchy

University of California, Los Angeles, USA

2016

Center for Biological Physics

Chiral twist drives raft formation and organization in membranes composed of rod-like particles

TEACHING

Teaching Assistant

2011–2015

University of Pennsylvania

Modern physics, wave phenomena, electromagnetism, physics laboratory

Teaching Fellow

2006–2007

Harvard University

Organic chemistry, linear algebra

CLINICAL SERVICE

Medical Volunteer

2018–present

Project Homeless Connect

Providing medical care at homeless services events in San Francisco

Medical Student Volunteer

2010–2013

United Community Clinics

Provided medical care at a free health clinic in Philadelphia

REFERENCES

Mike DeWeese

Postdoctoral advisor

University of California, Berkeley

Redwood Center for Theoretical Neuroscience

deweese@berkeley.edu

Vijay Balasubramanian

Research mentor

University of Pennsylvania

Department of Physics & Astronomy

vijay@physics.upenn.edu

Tom Lubensky

PhD advisor

University of Pennsylvania

Department of Physics & Astronomy

tom@physics.upenn.edu

Taro Toyozumi

Research mentor

RIKEN Center for Brain Science

Neural Adaptation and Computation Group

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