

Personal Information

Name: Guoshi Li

Work Address: CB# 7513, Bioinformatics Building, 130 Mason Farm Road, Chapel Hill, NC, 27599

Work Phone: 919- 966-4397

Education

- PhD in Electrical Engineering December 2009
University of Missouri-Columbia, Columbia, MO (GPA: 4.0/4.0)
Dissertation: “Computational modeling of the fear circuit: a systems approach to understanding fear and anxiety disorders”
- MS in Mechanical Engineering September 2003
State University of New York at Buffalo, Buffalo, NY
- BEng in Automatic Control July 2001
Xiamen University, Xiamen, China

Professional Experience

Assistant professor (tenure-track) September 2024 -
Department of Radiology, UNC-Chapel Hill

Research instructor February 2021- August 2024
Department of Radiology, UNC-Chapel Hill, Supervisor: Prof. Pew-Thian Yap

- Develop multiscale neuronal models based on fMRI and diffusion MRI data to investigate the pathophysiological mechanisms of major depressive disorders and Alzheimer’s disease
- Create normative reference charts of excitation-inhibition balance over human lifespan

Postdoctoral research associate July 2018 – January 2021
Department of Radiology, UNC-Chapel Hill, Advisors: Prof. Pew-Thian Yap & Prof. Dinggang Shen

- Identified abnormal causal interactions of large-scale brain networks in major depressive disorders using dynamic causal modeling of resting-state fMRI data
- Developed an original multiscale neural model inversion (MNMI) framework to delineate aberrant circuit dynamics in major depression and Alzheimer’s disease

Postdoctoral research associate August 2014 - June 2018
Department of Psychiatry, UNC-Chapel Hill, Advisor: Prof. Flavio Fröhlich

- Developed biophysical thalamocortical models to examine the cellular and circuit mechanisms of distinct brain oscillations
- Studied the impact of brain stimulation on thalamocortical dynamics
- Extended an existing biophysical model of the olfactory bulb to examine the dynamical mechanisms of external tufted cells in olfactory information processing

Postdoctoral research associate

January 2010 - July 2014

Department of Psychology, Cornell University, Advisor: Prof. Thomas A Cleland

- Developed biophysically realistic models of neurons and networks in the olfactory bulb
- Studied cholinergic and noradrenergic regulation of olfactory computation
- Investigated the circuit mechanisms and functional roles of gamma oscillations generated within the olfactory bulb.

Research assistant

August 2004 - December 2009

Department of Electrical & Computer Engineering, University of Missouri-Columbia, Advisor: Prof. Satish S Nair

- Developed biophysically realistic computational models of neurons and networks in the amygdala
- Analyzed the neural mechanisms of fear acquisition, extinction and recovery
- Examined the impact of infralimbic cortex stimulation on fear suppression

Honors

- Selected for Oral Presentation, Annual Meeting of Human Brain Mapping, 2023.
- Top Cited Article 2020-2021, Human Brain Mapping, Wiley. April 2022.
- Top Downloaded Paper 2018-2019, Human Brain Mapping, Wiley. April 2020.
- Featured Article with Press Release, Radiological Society of North America (RSNA). December 2019.
- Student Travel Award, American Control Conference, New York, NY. July 2007.
- Student Travel Award, ASME International Mechanical Engineering Congress and Exposition, Chicago, IL. November 2006.
- Student Travel Award, ASME International Mechanical Engineering Congress and Exposition, Orlando, FL. November 2005.
- Student Travel Award, First Biologically Accurate Modeling Meeting, San Antonio, TX. April 2005.

Bibliography and products of scholarship

Submitted

- **Li G**, Thung KH, Taylor HP, Huynh KM, Lin W, Ahmad S, Yap PT. Charting effective connectome over the human lifespan. (under review).
- **Li G**, Hsu LM, Wu Y, Bozoki AC, Shih YY, Yap PT. Excitation-inhibition imbalance in Alzheimer's disease using multiscale neural model inversion of resting-state fMRI. *MedRxiv*, <https://doi.org/10.1101/2022.10.04.22280681>, submitted to *Communications Medicine* (in revision).

Books and Chapters

- **Li G**, Cleland TA (2018) Generative biophysical modeling of dynamical networks in the olfactory system. In: Simoes de Souza F., Antunes G. (eds) *Olfactory Receptors. Methods in Molecular Biology*, vol 1820, pp. 265-288 (24 pages). Humana Press, New York, NY.

- **Li G** (2017) Computational models of the amygdala in acquisition and extinction of conditioned fear, *The Amygdala - Where Emotions Shape Perception, Learning and Memories*, Dr. Barbara Ferry (Ed.), InTech, pp. 235-258 (24 pages) DOI: 10.5772/67834.
- Fröhlich F, Alagapan S, Boyle MR, Hamilton F, **Li G**, Lustenberger C, Schmidt SL (2016) Target engagement with transcranial current stimulation. In: Brunoni A, Nitsche M, Loo C (Eds.) *Transcranial Direct Current Stimulation in Neuropsychiatric Disorders*, Chapter 11, pp. 197-222 (26 pages), Springer International Publishing Switzerland, DOI: 10.1007/978-3-319-33967-2_11.
- **Li G** (2015) Biophysical models of olfactory mitral and granule cells. In: Jaeger D, Jung R. (Eds.) *Encyclopedia of Computational Neuroscience*, pp. 393-399 (7 pages), Springer-Verlag New York, DOI: 10.1007/978-1-4614-6675-8.
- Mohan A, Pendyam S, Gall J, **Li G**, Kalivas PW, Nair SS (2008) Computational models of neuronal networks- modeling neuroplasticity in PFC-NAc Glu transmission due to cocaine. In: Yoshida M, Sato H (Eds.) *New Research on Neuronal Networks*, Chapter 3, pp. 65-107 (43 pages), Nova Science Publishers, Inc.

Refereed Journal Papers

- Peace ST, Johnson BC, **Li G**, Kaiser M, Fukunaga I, Schaefer AT, Molnar AC, Cleland TA (2024) Coherent olfactory bulb gamma oscillations arise from coupling independent columnar oscillators. *Journal of Neurophysiology* 131: 492-508 (17 pages).
- Jiang W, Zhou Z, **Li G**, Yin W, Wu Z, et al. (2023) Mapping the evolution of regional brain network efficiency and its association with cognitive abilities during the first twenty-eight months of life. *Dev Cogn Neurosci* 63: 101284 (12 pages).
- Ghanbari M, **Li G**, Hsu L-M, Yap PT (2023) Accumulation of network redundancy marks the early stage of Alzheimer's disease. *Human Brain Mapping* 44: 2993-3006 (14 pages).
- **Li G**, Yap PT (2022) From descriptive connectome to mechanistic connectome: Generative modeling in fMRI analysis. *Front Hum Neurosci* 16: 940842 (17 pages).
- Ma L, Lian C, Kim D, Xiao D, Wei D, Liu Q, Kuang T, Ghanbari M, **Li G**, Gateno J, Shen SG, Wang L, Shen D, Xia JJ, Yap PT (2022) Bidirectional prediction of facial and bony shapes for orthognathic surgical planning. *Medical Image Analysis* 83: 102644 (10 pages).
- **Li G**, Liu Y, Zheng Y, Wu Y, Li D, Liang X, Chen Y, Cui Y, Yap PT, Qiu S, Zhang H, Shen D (2021) Multiscale neural modeling of resting-state fMRI reveals executive-limbic malfunction as a core mechanism in major depressive disorder. *Neuroimage: Clinical* 31: 102758 (20 pages).
- Hu D, Wang F, Zhang H, Wu Z, Zhou Z, **Li G**, Wang L, Lin W, Li G, UNC/UMN Baby Connectome Project Consortium (2021) Existence of functional connectome fingerprint during infancy and its stability over months. *The Journal of Neuroscience* 42: 377-389 (13 pages).
- **Li G**, Liu Y, Zheng Y, Li D, Liang X, Chen Y, Cui Y, Yap PT, Qiu S, Zhang H, Shen D (2020) Large-scale dynamic causal modeling of major depressive disorder based on resting-state fMRI (**top cited article**). *Human Brain Mapping* 41: 865-881 (17 pages).
- **Li G**, Henriquez CS, Fröhlich F (2019) Rhythmic modulation of thalamic oscillations depends on intrinsic cellular dynamics. *Journal of Neural Engineering* vol. 16: 016013 (23 pages).

- **Li G**, Henriquez CS, Fröhlich F (2017) Unified thalamic model generates multiple distinct oscillations with state-dependent entrainment by stimulation. *PLoS Comput Biol* 13: e1005797 (46 pages).
- **Li G**, Cleland TA (2017) A coupled-oscillator model of olfactory bulb gamma oscillations. *PLoS Comput Biol* 13: e1005760 (36 pages).
- **Li G**, Linster C, Cleland TA (2015) Functional differentiation of cholinergic and noradrenergic modulation in a biophysical model of olfactory bulb granule cells. *Journal of Neurophysiology* 114: 3177-3200 (24 pages).
- **Li G**, Cleland TA (2013) A two-layer biophysical model of cholinergic neuromodulation in olfactory bulb. *The Journal of Neuroscience* 33: 3037–3058 (22 pages).
- Sethupathy P, Rubin DB, **Li G**, Cleland TA (2013) A model of electrophysiological heterogeneity in periglomerular cells. *Frontiers in Computational Neuroscience* 7: 49 (9 pages).
- **Li G**, Amano T, Pare D, Nair SS (2011) Impact of infralimbic inputs on intercalated amygdala neurons: a biophysical modeling study. *Learning & Memory* 18: 226-240 (15 pages).
- **Li G**, Nair SS, Quirk GJ (2009) A biologically realistic network model of acquisition and extinction of conditioned fear associations in lateral amygdala neurons. *Journal of Neurophysiology* 101: 1629-1646 (18 pages).
- **Li G**, Nair J, Quirk GJ, Nair SS (2008) Computational modeling: A tool for new psychiatric medication development. *Psychiatric Annals* 38: 296-304 (9 pages).

Refereed Conference Papers

- **Li G**, Thung KH, Taylor HP, Wu Z, Li G, Wang L, Lin W, Ahmad S, Yap PT (2024) Development of effective connectome from infancy to adolescence. *Medical Image Computing and Computer Assisted Intervention – MICCAI 2024*. Lecture Notes in Computer Science (accepted).
- **Li G**, Liu Y, Zheng Y, Wu Y, Yap PT, Qiu S, Zhang H, Shen D (2019) Identification of abnormal circuit dynamics in major depressive disorder via multiscale neural modeling of resting-state fMRI. In: Shen D. et al. (eds) *Medical Image Computing and Computer Assisted Intervention – MICCAI 2019*. Lecture Notes in Computer Science, vol 11766, Pp. 682-690 (9 pages). Springer, Cham.
- Huang P, Li D, Jiao Z, Wei D, **Li G**, Wang Q, Zhang H, Shen D (2019) CoCa-GAN: Common-feature-learning-based context-aware generative adversarial network for glioma grading. In: Shen D. et al. (eds) *Medical Image Computing and Computer Assisted Intervention – MICCAI 2019*. Lecture Notes in Computer Science, vol 11766, Pp. 155-163 (9 pages). Springer, Cham.
- Jiang W, Zhang H, Hsu LM, Hu D, **Li G**, Wu Y, Shen D (2019) Early development of infant brain complex network. In: Shen D. et al. (eds) *Medical Image Computing and Computer Assisted Intervention – MICCAI 2019*. Lecture Notes in Computer Science, vol 11765, Pp. 832-840 (9 pages). Springer, Cham.
- **Li G**, Quirk GJ, Nair SS (2008) Regulation of fear by amygdala intercalated cells in a network model of fear acquisition and extinction. *Proceedings of the ASME 2008 Dynamic Systems and Control Conference*. ASME 2008 Dynamic Systems and Control Conference, Parts A and B. Ann Arbor, Michigan, USA. pp. 1475-1482 (8 pages). ASME.

- **Li G**, Quirk GJ, Nair SS (2007) Modeling acquisition and extinction of conditioned fear in LA neurons using learning algorithm. *2007 American Control Conference*, New York, NY, pp. 552-557 (6 pages).
- **Li G**, Cheng S, Ko F, Raunch SL, Quirk GJ, Nair SS (2006) Computational modeling of lateral amygdala neurons during acquisition and extinction of conditioned fear using Hebbian Learning. *Proceedings of the ASME 2006 International Mechanical Engineering Congress and Exposition. Dynamic Systems and Control, Parts A and B*. Chicago, Illinois, USA. pp. 731-739 (9 pages). ASME.
- **Li G**, Cline HC, Blier P, Nair SS (2006) Computational studies of gain modification by serotonin in pyramidal neurons of prefrontal cortex. *Proceedings of the ASME 2006 International Mechanical Engineering Congress and Exposition. Dynamic Systems and Control, Parts A and B*. Chicago, Illinois, USA. pp. 741-748 (8 pages). ASME.
- **Li G**, Nair SS, Lees SJ, Booth FW (2005) Regulation of G2/M transition in mammalian cells by oxidative stress. *Proceedings of the ASME 2005 International Mechanical Engineering Congress and Exposition. Dynamic Systems and Control, Parts A and B*. Orlando, Florida, USA. pp. 647-656 (10 pages). ASME.

Refereed Conference Abstracts/Presentations

- **Li G**, Boerwinkle V, Yap PT (2024) Accurate localization of seizure onset zone using multiscale neural model inversion of resting-state functional MRI. *2024 Annual Meeting of the American Epilepsy Society*. Los Angeles, CA.
- **Li G**, Yap PT (2024) A large multiscale neural model inversion framework for quantifying excitation-inhibition balance. *OHBM*, June 23-27. Seoul, Korean.
- **Li G**, Taylor HP, Thung KH, Wu Y, Wu Z, Li G, Wang L, Lin W, Ahmad S, Yap PT (2023) Development of effective connectome from infancy to adolescence. *The SfN Annual Meeting*, November 11-15, Washington, D.C.
- **Li G**, Taylor HP, Wu Y, Ahmad S, Thung KH, Wu Z, Li G, Wang L, Lin W, Yap PT (2023) Effective connectome over the human lifespan. *OHBM*, July 22-26. Montreal, Canada (**selected for oral presentation**).
- **Li G**, Taylor HP, Wu Y, Ahmad S, Thung KH, Wu Z, Li G, Wang L, Lin W, Yap PT (2022) Charting excitation-inhibition balance over the human lifespan. *The SfN Annual Meeting*, November 12-16, San Diego, CA.
- **Li G**, Taylor HP, Wu Y, Ahmad S, Thung KH, Wu Z, Li G, Wang L, Lin W, Yap PT (2022) Cortical hierarchy in the infant brain revealed by a large-scale neural circuit model. *OHBM*, June 19-23. Glasgow, Scotland.
- Ghanbari M, **Li G**, Taylor HP, Ahmad S, KH Thung, Wu Z, Li G, Wang L, Lin W, Yap PT (2022) Brain network redundancy across the human lifespan. *OHBM*, June 19-23. Glasgow, Scotland.
- **Li G**, Taylor HP, Wu Y, Ahmad S, Wu Z, Wang L, Li G, Lin W, Yap PT (2021) Excitation-inhibition balance in the infant brain, *OHBM*, Virtual Meeting, June 21-25.
- Ghanbari M, **Li G**, Taylor HP, Ahmad S, Wu Z, Wang L, Li G, Lin W, Yap PT (2021) Resilience of the Infant brain. *OHBM*, Virtual Meeting, June 21-25.

- **Li G**, Liu Y, Zheng Y, Wu Y, Yap PT, Qiu S, Zhang H, Shen D (2020) Aberrant limbic - executive rather than default mode - salience system in major depressive disorder. *OHBM*, June 27-30, Montreal, Canada.
- **Li G**, Liu Y, Zheng Y, Wu Y, Yap PT, Qiu S, Zhang H, Shen D (2019) Multiscale modeling of intra-regional and inter-Regional connectivities and their alterations in major depressive disorder. *105th RSNA Scientific Assembly and Annual Meeting*, Dec 1-6, Chicago, USA (**selected for press release**).
- **Li G**, Liu Y, Zheng Y, Hsu LM, Zhang H, Shen D (2019) Large-scale dynamic causal modeling of major depressive disorder based on resting-state fMRI. *OHBM*, June 9-13, Rome, Italy.
- **Li G** (2018) Biophysical models of cholinergic neuromodulation in olfactory bulb. *AChemS XL Conference*, April 16-20, Bonita Springs, FL.
- **Li G**, Henriquez C, Fröhlich F (2016) State-dependent entrainment by stimulation and the emergence of an asymmetric arnold tongue in a biophysical thalamic network model. *The 46th SfN Annual Meeting*, November 12-16, San Diego, CA.
- Rapp CD, Fröhlich F, Cleland TA, **Li G** (2016) Dynamic regulation of mitral cell spike synchronization and phase-locking by external tufted cells in a glomerular network model. *The 46th SfN Annual Meeting*, November 12-16, San Diego, CA.
- Henriquez C, **Li G**, Fröhlich F (2016) Entrainment of thalamocortical networks by tACS is modulated by intra-area coupling. *The 46th SfN Annual Meeting*, November 12-16, San Diego, CA.
- **Li G**, Fröhlich F (2015) Biophysical thalamic network model of alpha, gamma, and spindle oscillations dependent on cholinergic neuromodulatory state. *The 45th SfN Annual Meeting*, October 17-21, Chicago, IL.
- Lewis M, Peace ST, **Li G**, Cleland TA, Linster C (2015) Serotonergic modulation of olfactory bulb network dynamics. *The 45th SfN Annual Meeting*, October 17-21, Chicago, IL.
- **Li G**, Cleland TA (2014) A coupled-oscillator model of olfactory bulb gamma oscillations integrating both PING and STO mechanics. *The 44th SfN Annual Meeting*, November 15-19, Washington, DC.
- **Li G**, Cleland TA (2011) A biophysical model of cholinergic modulation in the olfactory bulb. *The 41st SfN Annual Meeting*, November 12-16, Washington, DC.
- **Li G**, Pare D, Nair SS (2009) Role of short-term plasticity in maintaining stability of firing patterns in amygdala intercalated neurons: A computational study. *The 39th SfN Annual Meeting*, October 17-21, Chicago, IL.
- **Li G**, Pare D, Quirk GJ, Nair SS (2009) Biophysical modeling of the amygdala network in acquisition and extinction of conditioned fear. *The 39th SfN Annual Meeting*, October 17-21, Chicago, IL.
- **Li G**, Quirk GJ, Nair SS (2008) Regulation of fear by intercalated cells in a computational model of the fear circuit. *The 38th SfN Annual Meeting*, November 15-19, Washington, DC.
- **Li G**, Nair SS (2006) Computational modeling of lateral amygdala pyramidal neuron response to tone and shock inputs. *The 36th SfN Annual Meeting*, October 14-18, Atlanta, GA.

Other products of scholarship

- **Li G** (2009) Computational modeling of the fear circuit: a systems approach to understanding fear and anxiety disorders. PhD Dissertation, University of Missouri – Columbia (237 pages).

Teaching Activities

- Mentor March 2015 - May 2017
UNC-Chapel Hill, Mentored and advised an undergraduate trainee on modeling olfactory bulb networks
- Guest Lecturer Fall 2014 & Spring 2017
UNC-Chapel Hill, Gave lectures on compartmental modeling of neurons (NIBO 890.003 *Network Neuroscience* by Dr. Fröhlich), Fall 2014 and Spring 2017.
- Teaching Assistant 2007-2009
University of Missouri – Columbia, Assisted in teaching computational neuroscience courses and gave lectures on neuronal modeling.
- Coordinator & Mentor 2005-2006
University of Missouri – Columbia, Directed lab sessions for students in the Research Experience for Undergraduate (REU) Program and mentored four undergraduate students on modeling fear conditioning

Grants

ACTIVE

- **1R21AG083589-01** (MPI: **G. Li** (Contact); Yi Shih; **34/9%**) 9/1/2023-8/31/2025
National Institute of Aging (NIH/NIA)
Accurate and Individualized Prediction of Excitation-Inhibition Imbalance in Alzheimer's Disease using Data-driven Neural Model
Total funding: \$ 427,625
Role: Contact PI; 30% effort
- **1R01MH133845-01A1** (PI: L Wang) 2/1/2024-12/31/2028
National Institute of Mental Health (NIH/NIMH)
Computational Neuroimaging MRI for Studying Early Brain Development with Autism
Total funding: \$2,606,830
Role: Co-Investigator; 5% effort
- **5R01EB008374-11** (PI: P Yap) 9/21/2021-6/30/2025
National Institute of Biomedical Imaging and Bioengineering (NIH/NIBIB)
Longitudinal Mapping of Human Brain Development in the First Years of Life
Total funding: \$ 1,979,348
Role: Co-Investigator; 10% effort

PENDING

- **1R01AG088393-01A1** (PI: **G Li**) 04/01/2025-03/31/2030
National Institute of Aging (NIH/NIA)
Charting Excitation-Inhibition Balance for Human Lifespan
Total funding: \$3,662,082

Role: PI; 33% effort

- **1R01NS138967-01A1** (MPI: **G Li(Contact)**; V. Boerwinkle)

04/01/2025-03/31/2030

National Institute of Neurological Disorders and Stroke

Accurate Localization of Seizure Onset Zone via Multiscale Neural Model Inversion of Resting-state fMRI

Total Funding: \$3,558,120

Role: Contact PI; 50% effort

- **1R21MH138896-01** (PI: **G Li**)

In revision for resubmission

National Institute of Mental Health (NIH/NIMH)

Identification of Pathophysiological Mechanisms of Major Depressive Disorder via Multiscale Modeling

Role: PI

- **1R01AG090783-01** (PI: **G Li**)

In revision for resubmission

National Institute of Aging (NIH/NIA)

Mechanistic Identification of Excitation-Inhibition Imbalance in the Pathophysiology of Alzheimer's Disease using Multiscale Modeling

Role: PI

COMPLETED

- **5R03DC013872-03** (PI: **G Li**; 30)

12/2014-11/2018

National Institute on Deafness and Other Communication Disorders (NIH/NIDCD)

Dynamical Mechanisms of External Tufted Cells in Olfactory Information Processing

Total funding: \$300,000

Role: PI; 100% effort

Professional Service

- Review Editor, *Frontiers in Human Neuroscience* (2023-)
- *Ad hoc* manuscript reviewer

Frontiers in Human Neuroscience (2023, 2024); *Computers in Biology and Medicine* (2024); *Neural Networks* (2023); *Physical Biology* (2023); *PLOS One* (2017, 2023, 2024); *Medical Image Analysis* (2022); *Brain Connectivity* (2022); *IEEE Transactions on Cybernetics* (2021); *Neural Computation* (2021); *IEEE Transactions on Biomedical Engineering* (2020); *IEEE Transactions on Neural Networks and Learning Systems* (2019); *MICCAI* (2019); *PLOS Computational Biology* (2017, 2018); *Journal of Computational Neuroscience* (2012, 2017); *Journal of Neurophysiology* (2017); *Neural Processing Letters* (2017); *Biomarker Insights* (2015); *Pharmacology Research & Perspectives* (2015); *Neurocomputing* (2013)

- Program committee

International Conference on Informatics in Control, Automation and Robotics (2016, 2017, 2018)

Professional Membership

- Society for Neuroscience

- American Physiological Society
- Organization for Human Brain Mapping
- MICCAI