Stanford



Jin Hyung Lee

Associate Professor of Neurology and Neurological Sciences (Neurology Research), of Neurosurgery and of Bioengineering and, by courtesy, of Electrical Engineering

CONTACT INFORMATION

- **Alternate Contact**

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Bio

BIO

The Lee Lab uses interdisciplinary approaches from biology and engineering to analyze, debug, and manipulate systems-level brain circuits. We seek to understand the connectivity and function of these large-scale networks in order to drive the development of new therapies for neurological diseases. This research finds its basic building blocks in areas ranging from medical imaging and signal processing to genetics and molecular biology.

ACADEMIC APPOINTMENTS

- Associate Professor, Neurology and Neurological Sciences
- Associate Professor, Bioengineering
- Associate Professor, Neurosurgery
- Member, Bio-X
- Member, Wu Tsai Neurosciences Institute

HONORS AND AWARDS

- NIH/NIBIB K99/R00 Award, NIH/NIBIB (2008/2010)
- NIH Director's New Innovator Award, NIH (2010)
- Okawa Foundation Research Grant Award, Okawa Foundation (2010)
- NSF CAREER Award, NSF (2011)
- Alfred P. Sloan Foundation Research Fellowship, Alfred P. Sloan Foundation (2012)
- Epilepsy Therapy Project Award, Epilepsy Foundation (2012)
- Alzheimer's Association New Investigator Award, Alzheimer's Association (2013)
- Association of Korean Neuroscientists (AKN) Junior Faculty Research Award, AKN (2013)
- IEEE EMBS BRAIN Grand Challenge Young Investigator Award, IEEE (2014)
- NIH/NIA RF1: Study of Alzheimer's Disease, NIH/NIA (2014)
- NIH/NINDS R01: Study of Traumatic Brain Injury, NIH/NINDS (2014)
- Stanford Bio-X interdisciplinary seed grant, Stanford Bio-X (2014)
- NIH/NINDS R01: Study of Basal Ganglia Circuit Dynamics, NIH/NINDS (2015)

- Beckman Technology Development Grant Award, Beckman Foundation (2016)
- NIH/NIMH BRAIN R01: Cell-type specific contributions to fMRI signals, NIH/NIMH (2017)
- Spectrum MedTech Grant, Stanford (2017)
- Zaffaroni Grant, Zaffaroni Alzheimer's Disease Translational Research Program (2017)
- Lina 50+ Award Grand Prize, Lina Foundation (2018)
- NIH Director's Pioneer Award, NIH/NINDS (2019)

PROFESSIONAL EDUCATION

- BS, Seoul National University , Electrical Engineering
- MS, Stanford University , Electrical Engineering
- PhD, Stanford University , Electrical Engineering (2004)

LINKS

- Lee Lab Page: https://llab.stanford.edu
- Stanford Bioengineering: http://bioengineering.stanford.edu/faculty/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

In vivo visualization and control of neural circuits

Teaching

COURSES

2026-27

- Diagnostic Devices Lab: BIOE 201C, BIOE 301C (Spr)

2025-26

- Diagnostic Devices Lab: BIOE 201C, BIOE 301C (Spr)

2024-25

- Diagnostic Devices Lab: BIOE 201C, BIOE 301C (Spr)

2023-24

- Diagnostic Devices Lab: BIOE 201C, BIOE 301C (Spr)

STANFORD ADVISEES

Doctoral (Program)

EJ Fine, Anton Thieme

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (PhD Program)

Publications

PUBLICATIONS

- **Empathy and prosocial behavior powered by orexin-driven theta oscillations.** *Science (New York, N.Y.)*
  Kim, J. G., Cron, G. O., Kim, M., Hossain, A., Lee, J. H.

2026; 391 (6787): 800-806

- **Effect of combined transcranial direct current stimulation and cognitive training on brain microstructure and network homogeneity in late-life depression: a pilot study.** *Journal of affective disorders reports*
  Ha, J., Fang, Y., Kittur, C., Cron, G. O., Song, O. K., Park, J. Y., Lee, J. H.
  2025; 21

- **Substantia nigra modulates breathing rate via locus coeruleus.** *iScience*
  Gu, B. M., Kim, J. G., Hossain, A., Cron, G. O., Lee, J. H.
  2025; 28 (5): 112423

- **Quantitative 3D histochemistry reveals region-specific amyloid-β reduction by the antidiabetic drug netoglitazone.** *PloS one*
  Catto, F., Kirschenbaum, D., Economides, A. E., Reuss, A. M., Trevisan, C., Caredio, D., Dadgar-Kiani, E., Mirzet, D., Frick, L., Weber-Stadlbauer, U., Litvinov, S., Koumoutsakos, P., Lee, et al
  2025; 20 (5): e0309489

- **Neuromodulation modifies α-synuclein spreading dynamics in vivo and the pattern is predicted by changes in whole-brain function.** *Brain stimulation*
  Dadgar-Kiani, E., Bieri, G., Melki, R., Hossain, A., Gitler, A. D., Lee, J. H.
  2024

- **In patients with late-life depression and cognitive decline, adding tDCS to cognitive training does not significantly affect depressive symptoms but shows potential benefits on cognition as measured by fMRI.** *Brain stimulation*
  Ha, J., Fang, Y., Cron, G. O., Heo, J., Jung, E., Lee, D., Kim, H., Kim, E., Park, J. Y., Lee, J. H.
  2024

- **Hemispherically lateralized rhythmic oscillations in the cingulate-amygdala circuit drive affective empathy in mice.** *Neuron*
  Kim, S., Kim, M., Baek, J., Latchoumane, C., Gangadharan, G., Yoon, Y., Kim, D., Lee, J. H., Shin, H.
  2022

- **Whole-brain microscopy reveals distinct temporal and spatial efficacy of anti-Abeta therapies.** *EMBO molecular medicine*
  Kirschenbaum, D., Dadgar-Kiani, E., Catto, F., Voigt, F. F., Trevisan, C., Bichsel, O., Shirani, H., Nilsson, K. P., Frontzek, K. J., Paganetti, P., Helmchen, F., Lee, J. H., Aguzzi, et al
  2022: e16789

- **Mesoscale connections and gene expression empower whole-brain modeling of alpha-synuclein spread, aggregation, and decay dynamics.** *Cell reports*
  Dadgar-Kiani, E., Bieri, G., Melki, R., Gitler, A. D., Lee, J. H.
  2022; 41 (6): 111631

- **Solving brain circuit function and dysfunction with computational modeling and optogenetic fMRI.** *Science (New York, N.Y.)*
  Lee, J. H., Liu, Q., Dadgar-Kiani, E.
  2022; 378 (6619): 493-499

- **Distinct local and brain-wide networks are activated by optogenetic stimulation of neurons specific to each layer of motor cortex.** *NeuroImage*
  Chan, R. W., Cron, G. O., Asaad, M., Edelman, B. J., Lee, H. J., Adesnik, H., Feinberg, D., Lee, J. H.
  2022; 263: 119640

- **Optogenetic Stimulation Effects On Cortico-thalamic Circuit Plasticity After Stroke**
  Chiang, T., Vahdat, S., Pendharkar, A., Harvey, S., Uchino, H., Cao, Z., Kim, A., Choy, M., Chen, H., Lee, H., Cheng, M. Y., Lee, J., Steinberg, et al
  LIPPINCOTT WILLIAMS & WILKINS.2022

- **Repeated hippocampal seizures lead to brain-wide reorganization of circuits and seizure propagation pathways.** *Neuron*
  Choy, M., Dadgar-Kiani, E., Cron, G. O., Duffy, B. A., Schmid, F., Edelman, B. J., Asaad, M., Chan, R. W., Vahdat, S., Lee, J. H.
  2021

- **High-sensitivity detection of optogenetically-induced neural activity with functional ultrasound imaging.** *NeuroImage*
  Edelman, B. J., Ielacqua, G. D., Chan, R. W., Asaad, M., Choy, M., Lee, J. H.
  2021: 118434

- **Brain-wide neural dynamics of poststroke recovery induced by optogenetic stimulation.** *Science advances*
  Vahdat, S., Pendharkar, A. V., Chiang, T., Harvey, S., Uchino, H., Cao, Z., Kim, A., Choy, M., Chen, H., Lee, H. J., Cheng, M. Y., Lee, J. H., Steinberg, et al
  2021; 7 (33)
- **Predicting Successful Generation and Inhibition of Seizure-like Afterdischarges and Mapping Their Seizure Networks Using fMRI.** *Cell reports*
  Duffy, B. A., Choy, M., Lee, J. H.
  2020; 30 (8): 2540
- **Diagnostic Accuracy of Quantitative Multi-Contrast 5-Minute Knee MRI Using Prospective Artificial Intelligence Image Quality Enhancement.** *AJR. American journal of roentgenology*
  Chaudhari, A. S., Grissom, M. J., Fang, Z. n., Sveinsson, B. n., Lee, J. H., Gold, G. E., Hargreaves, B. A., Stevens, K. J.
  2020
- **Utility of deep learning super-resolution in the context of osteoarthritis MRI biomarkers.** *Journal of magnetic resonance imaging : JMRI*
  Chaudhari, A. S., Stevens, K. J., Wood, J. P., Chakraborty, A. K., Gibbons, E. K., Fang, Z., Desai, A. D., Lee, J. H., Gold, G. E., Hargreaves, B. A.
  2019
- **Thalamic Input to Orbitofrontal Cortex Drives Brain-wide, Frequency-Dependent Inhibition Mediated by GABA and Zona Incerta.** *Neuron*
  Weitz, A. J., Lee, H. J., Choy, M. n., Lee, J. H.
  2019
- **Carbon monofilament electrodes for unit recording and functional MRI in same subjects.** *NeuroImage*
  Chuapoco, M. R., Choy, M., Schmid, F., Duffy, B. A., Lee, H. J., Lee, J. H.
  2018
- **A guide to using functional magnetic resonance imaging to study Alzheimer's disease in animal models.** *Disease models & mechanisms*
  Asaad, M., Lee, J. H.
  2018; 11 (5)
- **Super-resolution musculoskeletal MRI using deep learning.** *Magnetic resonance in medicine*
  Chaudhari, A. S., Fang, Z., Kogan, F., Wood, J., Stevens, K. J., Gibbons, E. K., Lee, J. H., Gold, G. E., Hargreaves, B. A.
  2018
- **Optogenetic FMRI and the Investigation of Global Brain Circuit Mechanisms**
  Lee, J.
  CELL PRESS.2018: 401A
- **Deep Learning Super-Resolution Enables Rapid Simultaneous Morphological and Quantitative Magnetic Resonance Imaging**
  Chaudhari, A., Fang, Z., Lee, J., Gold, G., Hargreaves, B.
  edited by Knoll, F., Maier, A., Rueckert, D.
  SPRINGER INTERNATIONAL PUBLISHING AG.2018: 3–11
- **Illuminating Neural Circuits: From Molecules to MRI** *JOURNAL OF NEUROSCIENCE*
  Lee, J., Kreitzer, A. C., Singer, A. C., Schiff, N. D.
  2017; 37 (45): 10817–25
- **Comparison of fMRI analysis methods for heterogeneous BOLD responses in block design studies.** *NeuroImage*
  Liu, J., Duffy, B. A., Bernal-Casas, D., Fang, Z., Lee, J. H.
  2017; 147: 390-408
- **Studying Brain Circuit Function with Dynamic Causal Modeling for Optogenetic fMRI.** *Neuron*
  Bernal-Casas, D., Lee, H. J., Weitz, A. J., Lee, J. H.
  2017; 93 (3): 522-532 e5
- **High spatial resolution compressed sensing (HSPARSE) functional MRI.** *Magnetic resonance in medicine*
  Fang, Z., Van Le, N., Choy, M., Lee, J. H.
  2016; 76 (2): 440-455

- **Activation of Direct and Indirect Pathway Medium Spiny Neurons Drives Distinct Brain-wide Responses.** *Neuron*
  Lee, H. J., Weitz, A. J., Bernal-Casas, D., Duffy, B. A., Choy, M., Kravitz, A. V., Kreitzer, A. C., Lee, J. H.
  2016; 91 (2): 412-424
- **Optogenetic study of networks in epilepsy.** *Journal of neuroscience research*
  Choy, M., Duffy, B. A., Lee, J. H.
  2016
- **Combining optogenetic stimulation and fMRI to validate a multivariate dynamical systems model for estimating causal brain interactions** *NEUROIMAGE*
  Ryali, S., Shih, Y. I., Chen, T., Kochalka, J., Albaugh, D., Fang, Z., Supekar, K., Lee, J. H., Menon, V.
  2016; 132: 398-405
- **Probing Neural Transplant Networks In Vivo with Optogenetics and Optogenetic fMRI** *STEM CELLS INTERNATIONAL*
  Weitz, A. J., Lee, J. H.
  2016
- **Optogenetic Functional MRI.** *Journal of visualized experiments : JoVE*
  Lin, P., Fang, Z., Liu, J., Lee, J. H.
  2016
- **Frequency-selective control of cortical and subcortical networks by central thalamus** *ELIFE*
  Liu, J., Lee, H. J., Weitz, A. J., Fang, Z., Lin, P., Choy, M., Fisher, R., Pinskiy, V., Tolpygo, A., Mitra, P., Schiff, N., Lee, J. H.
  2015; 4
- **Frequency-selective control of cortical and subcortical networks by central thalamus.** *eLife*
  Liu, J., Lee, H. J., Weitz, A. J., Fang, Z., Lin, P., Choy, M., Fisher, R., Pinskiy, V., Tolpygo, A., Mitra, P., Schiff, N., Lee, J. H.
  2015; 4: e09215
- **MRI compatible optrodes for simultaneous LFP and optogenetic fMRI investigation of seizure-like afterdischarges.** *NeuroImage*
  Duffy, B. A., Choy, M., Chuapoco, M. R., Madsen, M., Lee, J. H.
  2015; 123: 173-184
- **Direct in vivo assessment of human stem cell graft-host neural circuits** *NEUROIMAGE*
  Byers, B., Lee, H. J., Liu, J., Weitz, A. J., Lin, P., Zhang, P., Shcheglovitov, A., Dolmetsch, R., Pera, R. R., Lee, J. H.
  2015; 114: 328-337
- **Reduction of Surface Roughness in Epitaxially Grown Germanium by Controlled Thermal Oxidation** *IEEE ELECTRON DEVICE LETTERS*
  Jung, W., Nam, J. H., Pal, A., Lee, J. H., Na, Y., Kim, Y., Lee, J. H., Saraswat, K. C.
  2015; 36 (4): 297-299
- **Optogenetic fMRI reveals distinct, frequency-dependent networks recruited by dorsal and intermediate hippocampus stimulations.** *NeuroImage*
  Weitz, A. J., Fang, Z., Lee, H. J., Fisher, R. S., Smith, W. C., Choy, M., Liu, J., Lin, P., Rosenberg, M., Lee, J. H.
  2015; 107: 229-241
- **In vivo imaging of transplanted stem cells in the central nervous system.** *Current opinion in genetics & development*
  Duffy, B. A., Weitz, A. J., Lee, J. H.
  2014; 28: 83-88
- **High-throughput optogenetic functional magnetic resonance imaging with parallel computations** *JOURNAL OF NEUROSCIENCE METHODS*
  Fang, Z., Lee, J. H.
  2013; 218 (2): 184-195
- **Informing brain connectivity with optogenetic functional magnetic resonance imaging** *NEUROIMAGE*
  Lee, J. H.
  2012; 62 (4): 2244-2249
- **Methods for registration of magnetic resonance images of ex vivo prostate specimens with histology** *JOURNAL OF MAGNETIC RESONANCE IMAGING*

Kimm, S. Y., Tarin, T. V., Lee, J. H., Hu, B., Jensen, K., Nishimura, D., Brooks, J. D.
2012; 36 (1): 206-212

- **Analysis of the BOLD characteristics in pass-band bSSFP fMRI** *INTERNATIONAL JOURNAL OF IMAGING SYSTEMS AND TECHNOLOGY*
Kim, T. S., Lee, J., Lee, J. H., Glover, G. H., Pauly, J. M.
2012; 22 (1): 23-32

- **Analysis of the BOLD Characteristics in Pass-Band bSSFP fMRI.** *International journal of imaging systems and technology*
Kim, T. S., Lee, J., Lee, J. H., Glover, G. H., Pauly, J. M.
2012; 22 (1): 23-32

- **SNR Dependence of Optimal Parameters for Apparent Diffusion Coefficient Measurements** *IEEE TRANSACTIONS ON MEDICAL IMAGING*
Saritas, E. U., Lee, J. H., Nishimura, D. G.
2011; 30 (2): 424-437

- **Tracing activity across the whole brain neural network with optogenetic functional magnetic resonance imaging.** *Frontiers in neuroinformatics*
Lee, J. H.
2011; 5: 21-?

- **Global and local fMRI signals driven by neurons defined optogenetically by type and wiring** *NATURE*
Lee, J. H., Durand, R., Gradinaru, V., Zhang, F., Goshen, I., Kim, D., Fenno, L. E., Ramakrishnan, C., Deisseroth, K.
2010; 465 (7299): 788-792

- **High-Contrast In Vivo Visualization of Microvessels Using Novel FeCo/GC Magnetic Nanocrystals** *MAGNETIC RESONANCE IN MEDICINE*
Lee, J. H., Sherlock, S. P., Terashima, M., Kosuge, H., Suzuki, Y., Goodwin, A., Robinson, J., Seo, W. S., Liu, Z., Luong, R., McConnell, M. V., Nishimura, D. G., Dai, et al
2009; 62 (6): 1497-1509

- **Non-contrast-Enhanced Flow-Independent Peripheral MR Angiography with Balanced SSFP** *MAGNETIC RESONANCE IN MEDICINE*
Cukur, T., Lee, J. H., Bangerter, N. K., Hargreaves, B. A., Nishimura, D. G.
2009; 61 (6): 1533-1539

- **Fat/Water Separation Using a Concentric Rings Trajectory** *MAGNETIC RESONANCE IN MEDICINE*
Wu, H. H., Lee, J. H., Nishimura, D. G.
2009; 61 (3): 639-649

- **DWI of the spinal cord with reduced FOV single-shot EPI** *MAGNETIC RESONANCE IN MEDICINE*
Saritas, E. U., Cunningham, C. H., Lee, J. H., Han, E. T., Nishimura, D. G.
2008; 60 (2): 468-473

- **Full-brain coverage and high-resolution Imaging capabilities of passband b-SSFP fMRI at 3T** *MAGNETIC RESONANCE IN MEDICINE*
Lee, J. H., Dumoulin, S. O., Saritas, E. U., Glover, G. H., Wandell, B. A., Nishimura, D. G., Pauly, J. M.
2008; 59 (5): 1099-1110

- **Synthesis and characterization of PVP-coated large core iron oxide nanoparticles as an MRI contrast agent.** *Nanotechnology*
Lee, H. Y., Lee, S. H., Xu, C., Xie, J., Lee, J. H., Wu, B., Koh, A. L., Wang, X., Sinclair, R., Wang, S. X., Nishimura, D. G., Biswal, S., Sun, et al
2008; 19 (16): 165101

- **MRI using a concentric rings trajectory** *MAGNETIC RESONANCE IN MEDICINE*
Wu, H. H., Lee, J. H., Nishimura, D. G.
2008; 59 (1): 102-112

- **FeCo/graphitic-shell nanocrystals as advanced magnetic-resonance-imaging and near-infrared agents** *NATURE MATERIALS*
Seo, W. S., Lee, J. H., Sun, X., Suzuki, Y., Mann, D., Liu, Z., Terashima, M., Yang, P. C., McConnell, M. V., Nishimura, D. G., Dai, H.
2006; 5 (12): 971-976

- **Broadband multicoil imaging using multiple demodulation hardware: A feasibility study** *MAGNETIC RESONANCE IN MEDICINE*
Lee, J. H., Scott, G. C., Pauly, J. M., Nishimura, D. G.
2005; 54 (3): 669-676

- **Fast 3D imaging using variable-density spiral trajectories with applications to limb perfusion** *MAGNETIC RESONANCE IN MEDICINE*
  Lee, J. H., Hargreaves, B. A., Hu, B. S., Nishimura, D. G.
  2003; 50 (6): 1276-1285

- **Noninvasive measurement of extraction fraction and single-kidney glomerular filtration rate with MR imaging in swine with surgically created renal artery stenoses** *RADIOLOGY*
  Coulam, C. H., Lee, J. H., Wedding, K. L., Spielman, D. M., Pelc, N. J., Kee, S. T., Hill, B. B., Bouley, D. M., Derby, G. C., Myers, B. D., Sawyer-Glover, A. M., Sommer, F. G.
  2002; 223 (1): 76-82