



**Kea Joo Lee, PhD**


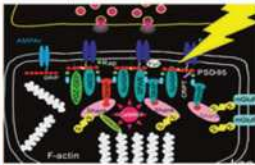

Principal Investigator

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## Structural and molecular mechanisms of synaptic circuit plasticity

The goal of my research is to understand structural and molecular signaling mechanisms underlying experience-dependent synaptic plasticity in physiological and pathological conditions. To investigate this issue, I have studied how activity modulation and/or behavioral training modify the pattern of synaptic connectivity and reorganize molecular composition of excitatory synapses in the brain. I have utilized systematic neurobiological approaches including three-dimensional electron microscopy, live confocal imaging, molecular & cell biology, biochemistry, and behavioral tests with genetically engineered mouse models of neurodegenerative diseases. In long-term perspective, I hope to provide key insights into neuronal circuit plasticity as well as therapeutic regimens for synaptic impairments involved in brain disorders.

Aim	Activity-dependent Synapse Remodeling and its underlying Molecular Signaling Mechanisms		
Tool	3D-EM/CLEM + Molecular Cell Biology + Behavioral tests		
T A R G E T	<b>Circuit remodeling</b> <ul style="list-style-type: none"> <li>Autism model</li> <li>Alzheimer model</li> <li>Decision-making</li> </ul> 	<b>Synaptic Signaling</b> <ul style="list-style-type: none"> <li>LRRTM3</li> <li>MAP2, Cyfip2</li> <li>RapGEF2</li> </ul> 	<b>Behavioral tests</b> <ul style="list-style-type: none"> <li>hTau AD models after compound delivery</li> <li>Aβ mouse models</li> </ul> 

**Curriculum Vitae**

2013~Present : Principal Investigator, KBRI  
 2006~2013 : Postdoctoral Fellow / School of Medicine,  
 Georgetown University, USA  
 2006 : Postdoctoral Fellow / Anatomy, College of Medicine,  
 Korea University

**Academic Credential**

2006 : Ph.D, Neurobiology, Korea Univ.  
 2000 : M.S, Neurobiology, Korea Univ.  
 1997 : B.S, Kinesiology, Korea Univ.

**Awards/Honors/Memberships**

2018~Present : Editor, Microscopy, Japanese Society of Microscopy  
 2018~Present : Review Editor, Frontiers in Molecular Neuroscience  
 2018~Present : Academic & Financial Director, Korean Brain Society  
 2018~Present : Financial Director, Korean Society of Microscopy  
 2017~2018 : Planning & Policy member, Korean Society for Brain/Neural Science  
 2014~Present : HVEM advisory committee, Korea Basic Science Institute  
 2015 : Member, International Collaboration Committee,  
 Korean Society for Brain and Neuroscience  
 2014~2017 : Chair, KBRI Institutional Review Board (IRB)  
 2000~Present : Member, Korean Association of Anatomists  
 2000~Present : Member, Society for Neuroscience

**Research keyword**

Synapse, Neural circuit, Learning and memory, Electron microscopy, Molecular signaling.

**Key techniques**

3D reconstruction of neural circuits using volume electron microscopy, Live confocal imaging, Neuron culture, Molecular cell biology, Biochemistry, Behavioral analysis.

**Research Interests/Topics**

- Molecular signaling mechanisms of experience-dependent synaptic remodeling in physiological and pathological conditions.
- Evaluation of new compounds based on behavioral and neural circuit analysis in AD models.

**Research Publications (selected)**

- Jang H, Ryu JH, Shin KM, Seo NY, Kim GH, Huh YH, Pae AN, **Lee KJ**. Gait Ignition Failure in JNPL3 Human Tau-mutant Mice. *Exp Neurol.*, 28(3):404-413, 2019.
- Kim HW, Oh S, Lee SH, Lee S, Na JE, **Lee KJ\***, Rhyu IJ\*. Different types of multiple-synapse boutons in the cerebellar cortex between physically enriched and ataxic mutant mice. *Microsc Res Tech.*, 82(1):25-32, 2019. (\*co-correspondence)
- **Lee KJ**, Park IS, Kim H, Greenough WT, Pak DT, Rhyu IJ. Motor skill training induces coordinated strengthening and weakening between neighboring synapses. *J Neurosci.*, 33(23):9794-9799, 2013.
- **Lee KJ\***, Queenan BN\*, Rozeboom AM, Bellmore R, Lim ST, Vicini S, Pak DT. Mossy fiber-CA3 synapses mediate homeostatic plasticity in mature hippocampal neurons. *Neuron*, 77(1):99-114, 2013. (\*equal contribution)
- **Lee KJ**, Lee Y, Rozeboom A, Lee JY, Udagawa N, Hoe HS, Pak DT. Requirement for Plk2 in orchestrated ras and rap signaling, homeostatic structural plasticity, and memory. *Neuron*, 69(5):957-973, 2011.