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Molecular mechanisms of learning and memory

Proper regulation of neural circuit formation/elimination & plasticity is essential for normal cognitive functions such as learning and memory. To understand how learning and memory is regulated in the mammalian brain, we are focusing on the role of glia cells, astrocytes, in regulating "neural synapses" in functional and structural levels.

- By searching for **molecules mediating neuron–glia interaction and exploring their physiological roles in modulating learning & memory**, our study will suggest new mechanisms based on neuron–glia "intercellular communication" that is crucial for maintaining normal learning and memory processes.
- Moreover, we next aim to discover **how abnormal cognitive functions are disrupted in the diseased brain** by comparing intercellular communications in the normal brain or brain with neurodegenerative diseases.

Aim	Discovering molecular mediators of neuron–glia interaction regulating cognitive functions
Tool	Molecular biology, electrophysiology, animal behavior tests
TARGET	<div> <div>Functional regulation of synapses (glutamate release)</div> </div> <div> <div>Neuronal factor recycling (uptake/re-secretion of BDNF)</div> </div> <div> <div>Structural regulation of synapses (activity-dependent synapse pruning)</div> </div>

Curriculum Vitae

2015~Present : Principal Investigator, KBRI
NeuroBiology Lab, KBRI /Adjunct Professor,
Department of Brain & Cognitive Sciences,
DGIST

2013~2015 : Associate Specialist,
Univ. of California at Berkeley, USA

2009~2013 : Postdoctoral Fellow, Univ. of California at
Berkeley, USA (Advisor: Dr. Mu-ming Poo)

2007~2009 : Postdoctoral Fellow, Center for Neural
Science, KIST, Korea (Advisor: Dr. C Justin Lee)

Academic Credential

2007 : Ph.D., Biological Sciences, Seoul Nat'l University
(Advisor: Dr. Bong-Kiun Kaang)

2000 : B.S., Biological Sciences, Seoul Nat'l University

Awards/Honors/Memberships

2016 : Travel award, the 39th Annual meeting of the Japanese Neuroscience Society

2007~2009 : STAR-Postdoc. Fellowship, (KIST, South Korea)

2000~2005 : Brain Korea 21 Research Fellowship, (Korea Ministry of Education
& Human Resources Development)

2012 : President, Korean Life Scientists in the bay area (KOLIS)

2004~Present : Member, Society for Neuroscience

Research keywords

Learning and memory, Long-term synaptic plasticity, Neuron-astrocyte interaction.

Key techniques

Electrophysiology (patch clamp, extracellular recording), Fluorescence imaging (wide-field imaging, confocal / multi-photon imaging), General molecular biology tools (related with gene cloning & verification), Animal behavior tests (fear conditioning, morris water maze, serial order task).

Research Interests/Topics

- Studying how astrocyte-mediated synapse pruning regulates long-term synaptic plasticity and hippocampal / striatal learning and memory.
- Identification of novel molecules mediating neuron-glia interaction and studying their roles in long-term synaptic plasticity.

Research Publications (selected)

- Jhang J, Lee H, Kang MS, **Park H**, Han J-H. Anterior cingulate cortex and its input to the basolateral amygdala control innate fear response. *Nature Communications*, 9:2744, 2018 (co-corresponding author)
- **Park H**. Cortical axonal secretion of BDNF in the striatum is disrupted in the mutant-huntingtin knock-in mouse model of Huntington's disease. *Experimental Neurobiology*, 27(3):217-225, 2018.
- **Park H**, Han KS, Seo J, Lee J, Dravid SM, Woo J, Chun H, Cho S, Bae JY, An H, Koh W, Yoon BE, Berlinguer-Palmini R, Mannaioni G, Traynelis SF, Bae YC, Choi SY, Lee CJ. Channel-mediated astrocytic glutamate modulates hippocampal synaptic plasticity by activating postsynaptic NMDA receptors. *Molecular Brain*, Feb 3;8(1):7, 2015.
- **Park H**, Popescu A, Poo MM. Essential role of presynaptic NMDA receptors in activity-dependent BDNF secretion and corticostriatal LTP. *Neuron*, Dec 3;84:1009-22, 2014.
- **Park H**, Poo MM. Neurotrophin regulation of neural circuit development and function. *Nature Reviews Neuroscience*, Jan;14(1):7-23, 2013.