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Neurophysiology of sensory processing

Effective brain function depends upon accurate information transfer from one region of the brain to another through synaptic connections and misconnections frequently lead to the development of neurological disorders. The posterior parietal cortex (PPC) is a multimodal sensory association area that associates various sensory modalities and has high level sensory processing function. Furthermore, a series of electrophysiological studies have shown that the firing rates of the neurons in the PPC, ramp up during the process of decision formation and the slope of the firing rate increase is proportional to the goodness of the evidence. These studies suggest the role of PPC as an evidence accumulator of the brain. However, till now, there is no microcircuit level understanding how sensory information formulates such activity and how the activity is terminated. In our research group, we aim to solve these problems using Ca^{2+} imaging, electrophysiology and high-resolution anatomical tools.

Aim

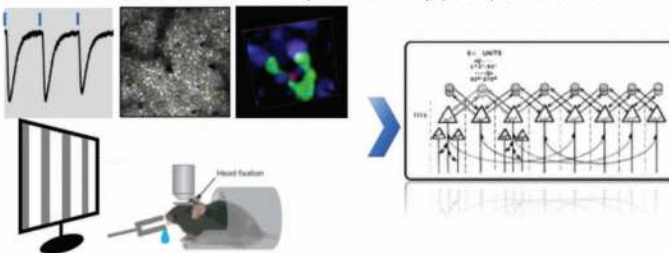
Circuit mechanisms of perceptual decision making

Tool

Electrophysiology + Functional imaging + High-resolution imaging

TARGET

Functional and structural circuit analysis of sensory perception and decision making



Curriculum Vitae

2014~Present : Principal Investigator, KBRI
 2012~2014 : Research Specialist, HMI /
 Janelia Research Campus
 2005~2012 : Visiting Fellow/Research Fellow National Inst.
 Neurol Disorders and Stroke, National Inst Health

Academic Credential

2004 : Ph.D., Neurophysiology, Max-Planck Institut
 für biophysikalische Chemie
 2002 : M.Sc., Pharmacology, Seoul Nat'l Univ. Coll Med
 1999 : B.Sc., Life Science/Chemistry, Sogang Univ

Awards/Honors/Memberships

2018~Present : Planning Director, Korean Society for Microscopy
 2014~Present : Member, Korean Society for Brain and Neuroscience
 2001~Present : Member, Society for Neuroscience
 2013 : Chief Judge, NIH Fellow award for research excellence

Review Board for

– Journal of Pharmacological Science
 – The Neuroscientists
 – Molecular Brain
 – Pharmaceutical Biology

Research keywords

Decision making, Short-term memory, Neural circuit mechanism.

Key techniques

Electrophysiology, Calcium imaging, Array tomography.

Research Interests/Topics

- Understanding circuit mechanism of decision making.
- Dendritic integration in multimodal sensory integration.

Research Publications (selected)

- Yang YS, Son SJ, Choi JH, **Rah JC**. Synaptic transmission and excitability during hypoxia with inflammation and reoxygenation in hippocampal CA1 neurons. *Neuropharmacol.*, 138:20-31, 2018. (corresponding author).
- **Rah JC**, Feng L, Druckmann S, Kim J. From a meso-to-micro-scale connectome: array tomography and mGRASP. *Frontiers in Neuroanatomy*, 9:78, 2015.
- Morita D, **Rah JC**, Isaac JT. Incorporation of inwardly rectifying AMPA receptors at silent synapses during hippocampal long-term potentiation. *Philos Trans Soc Lond B Biol Sci*, 369(1633):20130156, 2013.
- **Rah JC**, Bas E, Colonell J, Mischenko Y, Karsh B, Fetter RD, Myers EW, Chklovskii DB, Svoboda K, Harris TD, Isaac JT. Thalamocortical input onto layer 5 pyramidal neurons measured using quantitative large-scale array tomography. *Front Neural Circuits*, 7:177, 2013. (corresponding author).
- Gerber SH*, **Rah JC***, Min SW, Liu X, de Wit H, Dulubova I, Meyer AC, Rizo J, Arancillo M, Verhage M, Rosenmund C, Sudhof TC. Conformational switch of syntaxin-1 controls synaptic vesicle fusion. *Science*, 321(5895):1507-10, 2018. (*first author).

Patents (selected)

- Yang YS, **Rah JC**. Pharmaceutical composition for prevention and treatment of ischemic brain disease. (10-1936836, 2019.01.03)
- Kim GT, **Rah JC**, Kim JS, Bahn SK. Apparatus for photographing synapse image and operating method thereof. (10-2018-0038831, 2018.04.03)