

Research Theme: Neuroscience
Research Project Title: Electrophysiological investigation of the function of new neurons in adult hippocampus.
Principal Investigator/Supervisor: Asst/Prof Ayumu Tashiro
Project Description
<p>a) Background</p> <p>New neurons are continuously generated in certain regions of adult mammalian brain. One of those regions is the dentate gyrus, a subregion of hippocampus, which is essential for memory formation. These new neurons in the adult dentate gyrus have been suggested to have an important role in learning and memory. However, it is largely unclear how new neurons are involved in information processing and storage underlying memory. Therefore, it is important to determine how new neurons are activated during memory-related behavior. However, because new neurons constitute a minor portion of intermingled local neuronal population, simple application of conventional electrophysiological techniques such as single-unit extracellular recording does not allow us to monitor the activity of newly-generated neurons.</p> <p>b) Proposed work</p> <p>In this project, we aim to overcome this technical limitation by combining unit recording technique with an optogenetics-assisted method of neuronal type identification. We will establish a transgenic mouse line expressing a light-sensitive channel, Channelrhodopsin-2, specifically in new neurons, making new neurons responsive to light stimulation. In this way, we can electrophysiologically identify new neurons by examining light-induced neuronal firing in behaving mice. Then using this method, we will determine the activity of new neurons during spatial exploration and memory-related behaviors, which would give us valuable insights into the role of new neurons during memory-related behaviors. The project involves cutting-edge genetic and electrophysiological techniques.</p> <p>Reference:</p> <p>Science. 2007, 315:961-6. Nat Rev Neurosci. 2007, 8:577-81. Science. 2013 340:1232627. Eur J Neurosci. 2011, 33:1094-100.</p>
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