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SCIENTIFIC SEMINAR

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Unique Dynamics of Inhibitory Synaptic Vesicles for Fast and Efficient Synaptic Transmission

Neurons in the network can either excite or inhibit innervated neurons by releasing excitatory or inhibitory neurotransmitters stored in vesicles in the presynaptic terminals. The balance between neuronal excitation and inhibition plays an important role in processing complex cognitive tasks such as learning and memory. Inhibitory synaptic transmission plays a crucial role in sustaining this balance. The dynamics of inhibitory synaptic vesicles in presynaptic terminals have been poorly understood because of practical limitations such as the lack of specific labelling tools of inhibitory single synaptic vesicles. We specifically labelled single GABAergic (inhibitory in mature neurons) synaptic vesicles in presynaptic terminals of cultured rat hippocampal neurons by loading quantum dots (QDs) and traced them in three dimensions using a real-time three-dimensional microscopy setup based on dual-focus optics. In comparison with Syt1-QD-loaded synaptic vesicles mostly derived from excitatory synapses, we found that inhibitory synaptic vesicles tend to travel shorter distances before fusion and move more straightly with a shortened fusion latency. Also, kiss-and-run fusion was more prevalent among inhibitory synaptic vesicles than the excitatory vesicles. Furthermore, a substantial amount of spontaneously labelled inhibitory synaptic vesicles undergo exocytosis under stimulation. Taken together, the observed unique dynamics and exocytosis of inhibitory synaptic vesicles allow for fast and efficient inhibitory synaptic transmission.

Thursday, 1.6.2023, 14:00

Host: Jeongseop Rhee

Lecture Hall, City Campus

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