Towards input-specific photoinactivation of neuronal networks in the hippocampus

Haruyuki Kamiya

Department of Neurobiology, Graduate School of Medicine, Hokkaido University, Sapporo, Japan. kamiya@med.hokudai.ac.jp

Neurons in the central nervous system receive numerous excitatory and inhibitory inputs. Spatial as well as temporal profiles of activity of individual inputs are integrated in the postsynaptic neurons and enable coding of dynamic neural information. However, experimental approach for elucidation of the roles of a certain input in complex brain circuitry is still missing. Therefore we attempted to develop the method for inactivation of specific input in living brain circuitry. For this purpose, we adopted photochemical inactivation approach using ANQX, a novel photoreactive blocker of AMPA-type glutamate receptors which mediate most excitatory synaptic transmission in mammalian brain. ANQX forms cross-link with the ligand-binding site and irreversibly blocks cell surface AMPA receptors upon UV illumination. Because of irreversible nature of the reaction, application of ANQX with UV illumination is supposed to block glutamatergic excitatory synaptic transmission. In fact, local application of ANQX with a brief UV illumination in mouse hippocampal slices successfully suppressed transmission at several representative excitatory synapses in the hippocampus. This approach may help to clarify roles of specific neuronal inputs in information processing within complex brain circuitry.