Synaptic plasticity

Synaptic plasticity by two ways: chemical synapses by neuromodulators and electrical synapses through gap junctions

Signal transmission among neurons is performed in the two ways: one is through chemical synapses where chemical substrates, neurotransmitters are delivered from the presynaptic nerve endings to synaptic receptors on the postsynaptic sites then to generate next neuronal excitability. The other is electrical transmission or electrotonic transmission at the sites of electrical synapses. These synapses are gap junctions, specialized intercellular contacts with aggregates of transmembrane channels. Chemical substrates, neuromodulators perform synaptic plasticity which can plastically change the efficiency of synaptic transmission through signal transduction by intracellular pathways or production of second messengers to activate protein kinases in cortical neurons. These neuromodulators involve glutamate, acetylcholine, serotonin and dopamine, and so on. On the other hand, neuronal networks in the cortex provide direct electrotonic transmission through electrical synapses where electronic currents pass into neighboring connected neurons to propagate action potentials or neural spikes to these neurons. Passage of the electrical currents in electrical synapses between the neurons is performed through gap junction channels composed of intercellular membrane channels with channel subunit protein called connexins. Individual gap junctions express specific subunit connexin types. Localization of gap junctions in cortical neurons and identification of connexin types expressed in these neurons are important for study of signal transmission. Currently interactions of neural chemical modulation and electrotonic transmission via electrical synapses in the cortex gain lots of interest. Details of synaptic plasticity mechanisms and roles of electrical synapses are measured by electrophysiological experiments including patch-clamp recordings and neurobiological/molecular biological studies. The cortical plasticity mechanisms can be resolved by these experimental procedures. Knowledge of neuronal synaptic plasticity and electrical synapses is accumulated. In this section, we are welcoming papers concerning cortical neuronal synaptic plasticity, localization of gap junction connections and electrical synapses through gap junctions between cortical excitatory and/or inhibitory neurons.

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Contact us: JINeditorial@imrpress.org