Roles of Neuroligin Associated Protein in Synapse Formation and Function

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Synapses are highly specialized structures where one neuron contacts another neuron. There are two major types of synapses, the excitatory and inhibitory synapses, based on the types of neurotransmitters released from presynaptic terminals and neurotransmitter receptors at the postsynaptic terminals. In the brain, the excitatory synaptic transmission is mainly mediated by glutamate and its receptors, while the inhibitory synaptic transmission is mainly mediated by GABA and its receptors. The molecular mechanism responsible for the recruitment and regulation of receptors at postsynaptic terminal is not fully understood. Neuroligins, a family of transsynaptic cell adhesion molecules, were found to localize at synapses and capable of inducing synapse formation. Interestingly, different neuroligins were found to induce the formation of different synapses. For example, neuroligin-1 was found to induce the formation of excitatory synapses, while neuroligin-2 induces the formation of inhibitory synapses. To provide insight into the formation and regulation of inhibitory synapses, we performed an extensive proteomic analysis of synaptic proteins by immunoprecipating proteins associating with different neuroligins. We identified a number of proteins that specifically located at different synapses. Detailed analysis found that some of these proteins are critical for synapses formation, maintaining excitatory and inhibitory synapses balance, and neuronal network activity. Their deficiency could lead to abnormal synaptic transmission and potential brain disorders.