Role of activity-dependent gene expression in the brain

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Recently, it has become evident that maternal cares in the rat are transmitted from mother to female offspring through DNA methylation and chromatin that are underlying epinetics. This fact indicates that gene expression is playing a critical role in transforming the environmental stimuli to the behaviors of animals; that is, environmental information could be converted to the genetical information required for constructing or remodeling neuronal networks at the level of gene expression in neurons. It has already been suggested that the disruption of gene expression in neurons could lead to neuropsychiatric or developmental disorders.

From such a point of view, we have been studying the regulation of gene expression in neurons, whose activity is controlled by neuronal activity evoked via environmental stimuli, particularly focusing on the long-term responses of neurons at the level of gene expression in terms of synaptic plasticity. In this study, we are now attempting to know the cellular and molecular mechanisms for converting the environmental information from neuronal activity to gene expression in neurons. We are also looking for some chemical substances that affect the process for converting the information at the level of gene expression, as a drug for protecting the brain from neurodegenerative disorders.