Title	神経細胞の情報伝達機構に基づくシナプス可塑性モデル
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A model for the synaptic plasticity based on the mechanisms underlying neuronal communication

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Abstract

The plasticity phenomenon of a neuron is considered as a leading factor for memory management and learning in a brain. However, investigation on this phenomenon has been sparse. In order to investigate this subject, it is necessary to study the mechanism of information representation and processing in a brain. In the present study, the mechanisms related to synaptic plasticity are thoroughly investigated and a scientific model for neural information processing has been proposed. The analyzed result is to be investigated for developing a learning method related to information transfer mechanism. In the present study, apart from the experimental results, a model for synaptic plasticity is also proposed.

In order to explore the transfer function of a nervous system, it is necessary to analyze the results that have been achieved through electro-physiological experiments. Quantal analysis is well know for these kind of data analysis. However, this method is very sensitive to noise and the precision is not good. Hence, an attempt has been made to modify MEND (Maximum Entropy Noise Deconvolution), which is considered to be one of the best method for quantal analysis. In the modified model, an extremely precise integration function is included for an efficient utilization of the essence of the original information that lies underneath the discrete experimental data. Compared to the conventional statistical methods, the proposed improved MEND gave better results.

Presently, the input information of a neuron is considered to be the average number of pulses reaching a cell body. However, there are chances that information in the cell body is being coded in the form of a rhythm or oscillation like factor. In the present approach, pulses with different intervals are used for expressing information and the method has been experimented on rat cerebellum. The experimental results show that it is possible to express information by providing different stimulating patterns with an average frequency. The proposed method has been applied for the analysis of data achieved from the experiments on rat cerebellum. The analyzed result is to be investigated for developing a learning method.

Key Words: quantal analysis, noise deconvolution, synaptic plasticity, temporal coding, hippocampus, cerebellum, patch-clamp