

Forming of intelligence that is intermittently opened to the real world

– How a new-born baby acquires primitive intelligence –

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[An overview of the brain mechanism]

How does a neuron of sensory organ react?

A neuron reacts as a threshold logic unit. The neuron outputs an impulse. Direction of propagating impulse is one-way. The meaning of impulse is depended on the sensory cell. The impulse informs the time of occurrence. It represents fulfilling of requirement for the output. The impulses from various sensory organs will be incorporated into brain.

What is the function of a neuron in a brain?

A neuron operates the function of many-to-one. The reaction is element of intelligence. A new reaction corresponds to create a representative. A set of almost simultaneous impulses are memorized as the connecting points of a neuron in the brain. A series of stimuli on an event forms patterns on a network of neurons intermittently along the time progress. Additional neurons in cerebrum are formed by individual concurrent reactions. Here, the same neuron is activated repeatedly at the same pattern of impulses.

How to construct the intelligence in a neural system?

An intelligent element is described as a reaction. It is represented by the rule known as production rule. That is, it will be carried out the reaction, if the preconditions are satisfied. The preconditions are depend on the connection of the neuron. Even one neuron is possible to make an intelligent reaction. The network will form an intelligent behavior as a whole. In the intelligent neural network, there will be many neurons with simple role.

Intelligence is formed by an open-loop control scheme.

The creature lives by interacting with the environment. The situation of creature is changed by the results of reaction. So, the open loop system interacts with the environment dialectically. It could not continue the same reaction. The brain intermittently captures the results of reaction through multiple sensors. The implemented circuits are used for the next reaction. It does not need a feedback circuit, because the renewed operation will be soon processed.

Construction of the world model in a brain.

Human brain is intermittently isolated from the real world. Therefore, the human has created intentional environments. But the operation is carried out by the memory that was implemented through its experiences. The activity of human is biased by a motivation. But the motivation is a current activated state of the brain that involves a model of outer world.

Why a network of neurons forms a layered structure?

There are localized stimuli in a network of neuron. A neuron connects with the axon of cell that relates. So the connections among those neurons form a layered structure. The elements are shared in the specific area of cerebral cortex. The layered configuration brings high usage efficiency and increasing of reliability. The perception is the activation of a part of hierarchical representations.

[How to adjust the timing of operation in a nervous system.]

Timing of impulsive reaction is organized by transmission time. The velocity of impulse on axon is depended on the density of ionic channel.

The cerebellum outputs a set of serial data for a routine action.

The proposing idea on the nerve configuration of cerebellum is shown in Fig. 1. Purkinje cell outputs an inhibitory signal when the excitatory input is absence. The role of each granule cell in this model is a delay element.

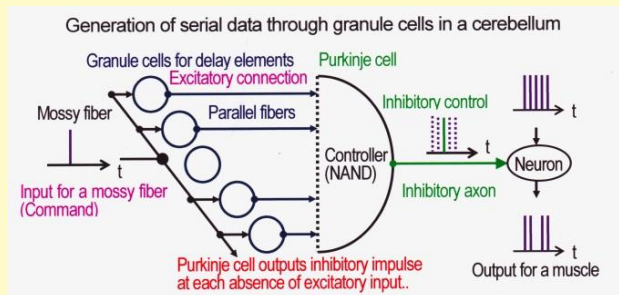


Fig.1 The model of cerebellum that outputs serial impulses.

What is the mechanism of LTP (Long-term potentiation) in hippocampus?

The evidence that the brain memorizes information in the form of a representation of many-to-one is indicated by LTP. Fig.2 is an illustration of the proposing model of LTP. Here, the tetanus stimulation of input (10~100Hz for 1 second, repeated once after 5 seconds) for hippocampus produces an intense increase in the amplitude of excitatory synaptic potentials in the post-synaptic neuron that lasted for days or for weeks.

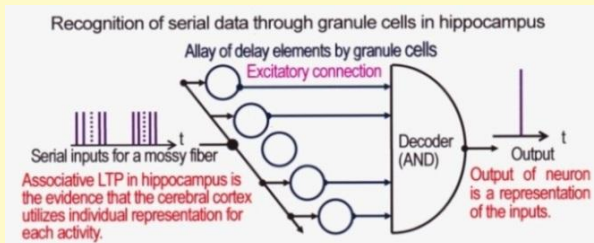


Fig.2 A proposing mechanism of LTP around granule cells in hippocampus

How to activate a representative of activities in a brain

An activation of upper layered element must retain the excitation during appropriate period. The partial activation of neural network is retained by high frequency stimulation. The linkages among neurons are formed through experiences. That is, the linkage among representatives are formed through experiences.

How to control a routine behavior in a brain

The established routine work does not update the information on outer world. A closed loop of delay elements is possible to generate tetanus signals. As shown in Fig.3, the system of closed loop is controlled by excitatory signal together with inhibitory signal.

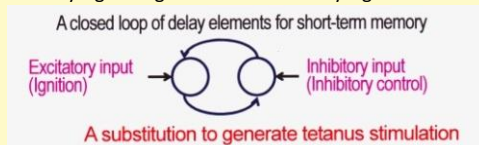


Fig.3 A loop of delay elements for generation of tetanus stimuli

[How to manufacture the impulse driven intelligent system]

The CCD system is a candidate for the impulse circuit. The timing of a nerve system is adjusted automatically at the implementation. But synchronous control circuits are necessary for CCD device. So, some trial manufacturing will be necessary for the circuits.

A trial manufacturing circuit so as to design an open-loop system

Each activated state is transferred to the activated state specified by the impulse that comes from individual input. An asynchronous intelligent circuits were manufactured by using digital IC in order to check the timing control of the system. Here, a mono-stable multi vibrator is used as a delay element. The circuit shown in Fig.4 is an example.



Fig.4 A state transition circuit that is made of mono multi vibrators.