EVOLUTION OF INTELLIGENCE IN A NETWORK OF CHAIN REACTIONS. S. Karasawa[1], [1]Affiliation (Miyagi National College of Technology; Prof. Emeritus, 1-3-6 Oyama Natori Miyagi Japan Zip code 981-1233, E-mail shinji-karasawa@ biglobe.jp).

Introduction: This paper describes a concept of network of chain reactions which represents activities. That is, the organism is a network of chain reactions. Principle of brain mechanism is possible to describe as systematic activities in a network of chain reactions. Concurrently activated portions in a network of neurons are able to link by intermolecular bond via thermal motion of molecules. The thermal motion is able to exchange neighboring atoms, and the electronic state is able to adapt to the surroundings. This mechanism creates a system of molecule. In such way, the first organism was born in soup of birth of organism. The generation of the first organism is a very small probability, but it increases via a reproduction system accompanied with. The mechanism of metabolism is able to maintain the body, and also to append functions. The metabolism and replicator must coexist at the birth of organism. The intelligence is a system to replay similar reaction. It makes possible to generate a system of replication.

Mechanism of intelligence in a brain: The mechanisms in a nerve system are helpful to understand the organization of a network of chain reactions. The nerve system sends an exited state of a plus impulse from sensor to actuator. Each neuron acts as representative of an action. The meaning of an impulse itself is excitation of the neuron.

The concurrently activated portions are able to link by intermolecular coupling. Remains of the activities have the effect of learning. The meaning of a sequence of voice sound depends on the experience of language use similarly to the bell for Pavlov's dog. Although eyes and ears are different, those concurrent excitations in a nerve system are able to link by an annex neuron. The layered networks are linked to the real world via sensors and actuators [1]. The intelligent system of representatives is an annex system in the brain. It makes possible to replay similar behavior.

Linkages in a network of chain reactions: An action makes change of a state. The result causes the next reaction. The route of reactions is possible to form the memory on a process of chain reactions. The concurrently activated portions of a chain reaction are able to link by intermolecular coupling. There is a possibility to make a loop of chain reactions. The excitation in a looped chain reaction is able to continue by circulation of reaction.

An equilibrium state can be kept by reaction of opposite directions. But a neuron is not possible to react opposite direction. In visual information processing of retina [2], there is combination of antagonized reaction. There is a checkered pattern of response called as ON-areas and OFF-areas. The antagonized change is carried out via abolishing of the activation [3]. The adjacent antagonistic region is derived from the relation of demand and supply in the biochemical reaction. The combination of antagonistic reaction makes possible to return to initial state easier.

The first system of replication: The replication takes place at the change of a generation. The organization of molecules that includes with organized parts contributes to the evolution of the chain reaction. Since intermolecular force is emphasized via the membrane, almost all the molecular arrangement will decompose at collapse of the membrane. Although most of chain reactions on the membrane will decompose at collapse of the membrane, some chain of reactions included on a part of membrane can be included in a renewed cell.

Synthesis of structural protein on a membrane: Protein is a chain of amino acids. Although amino acid is soluble in water, side chain of the amino acid attaches to a membrane. Thermal motion of these amino acids is suppressed by the connection. And it suppresses decomposition of the connection. So, the binding of amino acids are continued.

There is the possibility that the intermolecular bond is changed to the chemical bond at interface of the membrane [4]. Although tremendous kinds of protein are possible to generate, there is natural selection. The membrane becomes robust by the structural protein. Moreover, the part of membrane with protein is able to have a special form and function. The thread of protein with membrane will be produced with linking to the same real world concurrently. The membrane with a series of amino acids is able to record the trace of series of reactions along a time progress.

Record of chain reaction by representative of activities: Operation of individual reaction in a chain reaction is transferred along the time progress. The elements of a chain reaction are located in space, and it is possible to link to other reactions to form a circuit.

It is known that DNA gene system consists of genetic code. In general, the code is a characteristic of representatives for information processing. A system of overlapped representatives is able to achieve reliable information processing. The layered system of representatives is able to economize the circuit. So,

evolved information processing becomes an overlapping layered system of representatives.

Memorizing of the serial data of a protein by a linear polymer of nucleotides: A system for replication of protein was formed as an annex system in a network of chain reactions. The record of reactions must have the circuit in which a series of activated states are aligned along time progress.

Phosphodiester bond of nucleotides and peptide bond of amino acids are fairly different structure. The elements of nucleotide and amino acid are also different. But amino acid of a protein and an activated portion of the nucleotide chain are able to correspond along the same time progress.

There exists a protein of a poly-ribo-nucleotide RNA chain. The linear polymer of nucleotide is available as a record for production of a protein, if the specified amino acid is linked to specified portion of nucleotides. That is messenger RNA (m-RNA). On the other hand, transfer RNA (t-RNA) binds at one end to a specific codon in the m-RNA and it binds at the other end to the amino acid specified by that codon. The size of t-RNA is small. The small size of t-RNA is convenient for transferring.

Establishment of DNA codon gene system [5]**:** Both DNA and RNA are linear polymers of nucleotides. RNA differs from DNA. It exists as a single strand rather than a double stranded helix [6].

DNA is very stable and it is able to replicate RNA easily. But DNA cannot be the template of protein. On the other hand, RNA is not as stable as DNA. But RNA has functions for processing of synthesis. M-RNA is used as an element of short-term memory. T-RNA is available to assign amino acid during protein synthesis. Francis Crick referred to this pathway as the central dogma [7]. That is, DNA functions as the template for RNA molecules. RNA determines the arrangement of amino acids within protein.

DNA and RNA consist of 4 kinds of building blocks. But the amino acids to be distinguished are over 20. So, combination of 3 pieces of bases is used for to assign one amino acid.

Control of overlapped network of chain-reactions: The structure of a network of representatives for behavior control is overlapping of layered structure. An approach for a mobile robot is layered control system [8]. The network of neuron in a brain is overlapping of layered structure. The f-MRI of a brain indicates concurrent existence of plural activations.

DNA system of central dogma requires an extensive array of chain reactions for production of protein. The evolutionary rate of the important part of gene is slow is, but evolutionary rate of the portion not important is fast. This difference on change of gene indicates overlapping of layered structure.

Memory for a long series of amino acids will be divided to many elements. The system with segmentation has the merit that elements are available for the other part. An evolved intelligent system possesses with segmentation, and it needs the mechanism to control the other segments.

An annex system makes possible to control such network. That is, a representative in upper layer of the network must be activated during the period as needed. There are start codon and stop codon in DNA gene system. These signals are available to activate the representative of reaction that makes possible to suppress the other activation. In order to keep the activations in such layered structure of representatives, a loop of chain reactions is required. Organisms have the mechanism to maintain the chain of reactions.

If there are plural of candidates for an output, the decoder to select next reaction is necessary at the junction. A specific decoder is necessary for each situation.

Conclusion: The organism is a network of chain reactions. The first life was born by metabolism. It includes mechanism of replication and intelligence. Today's organism has been evolved extremely. DNA gene system of "central dogma" is an amazing system for evolution of innate intelligence. A signal processing concept of a network of representative of activities i.e. network of chain reactions is useful to describe evolution of intelligence, and it will provide guidance to explore the organism in the universe.

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