YDLODEOHRQOLQHDW www.ijmrhs.com

ISSN No: 2319-5886

HRR HHHM RIH HH

Metasystem-Synergetic Approach To the Architectural and "Platform" Organization of the Brain's Neural Network

Lupu Grigory Leonidovich

Biologist-Specialist, Fedkovich Chernivtsi State University, Chernivtsi, Ukraine

**Corresponding e-mail: zeta-13@bigmir.net*

HFHLYHGUFFULSWRUF (GLWRULHUF

3UH1R3 HLHHUF1R

HLH UFFULSW1R 3EOLHUF-

LRLFH-

ABSTRACT

The brain is considered as having several homologous meta-levels of an organization (neuron substructures, neurons, microcolony, cortical macro modules, "classical" nerve centers, analyzers, the central nervous system of individuals), each of which, in its characteristic time range, is arranged and operates as a learning neural network (from the "details" of the previous level of organization)-hierarchical synergetic crystal; based on which various levels are classified: neuro structures, "stages of memory" and their duration, types of higher nervous activity, levels of the psyche and self, and levels of organization of various aspects and manifestations of functioning of neuro structures-an analog of the "periodic table" for neuroscience. Whole-cortex Learning Neural Network (LNN) model is proposed. The physical-cybernetic nature of the subjective psychic is considered.

Keywords: Learning neural network, Meta-"ring-armor", Reflex ring, Cortex, Meta-model, Meta-modeling, Circuitry reproducibility of the brain

INTRODUCTION

Current State of Neuroscience: Circuit Design Aspect

It is known that there is a significant gap between the 'computational abilities' (complexity of neuropsychic functions) of biological neural networks being trained and their technical analogs. There are no satisfactory (i.e. technically suitable) explanations for this, even though the circuitry properties of the bio-neuron and techno neuron can be very close, as well as those for small and medium-sized bio and techno-neuron networks. At the same time, with an increase in the quadratic index of the brain, its 'computational abilities' increase almost exponentially, and with an increase in the number of neurons in a technical neural network above a certain limit, the increase in 'computational abilities' first slows down, and then practically stops [1]. Since the properties of a system, including a system of neurons, is determined not so much by its elements as by its connections between elements, we can conclude that in the brain, above a certain limit (the level of a small network), the connection scheme of elements changes qualitatively (exponent and saturation curve). Indeed, the scheme of connections of microcolumns (small, 110-neuron networks) in the macro module is also a small (and reciprocal) network (according to Mountcastle and Sentagotai, Arbib), but the network is no longer neuron-based, but a microcolumn-based neural network of the second order [2].

Recently, several works of metasystem-predictive type have appeared about the subject under study-"periodic tables" of inventions and discoveries (in particular, devoted to deciphering the general mechanisms of gene-epigenetic control in eukaryotes). This scientific work is devoted to the architectural and "platform" (in computer engineering terminology) organization of the neural network of the brain. It is time to move from a more and more exhausting analytical approach, losing in the infinite branching of cognition's Fourier series, to a synthetic

one, combined with the combination of a synergetic approach with a system-hierarchical; in other words, it is advisable to collect disparate details of various levels of the organization into a single whole-based on the combination of system-hierarchical and synergetic positions (as in most consistent with the modern scientific paradigm). In this regard, it would be advisable to create a similar "periodic table" for the subject of neuroscience, which would make it possible to determine the next steps.

The perceptronicity of the structure and functioning of all screen centers of the brain in the EEG-synchronized state from the frontal cortex to the cerebellar cortex can be considered a proven fact, while the question remains open about the nature of working in asynchronous mode, which is so prevalent that it has generated rumors about 2% (0.1%, 5%, up to 20% depending on the author) efficiency of the brain. While the connection of such asynchrony (chaotically) with the perceptron mechanism is intuitively clear (chaotically of the projections of the sensor layer and the main part of the connections in the perceptron), it is not clear (at the same time) how exactly this is implemented. In the theory of "neural ensembles", the latter function as active (semi) autonomous units (autonomous and dialog modes are absolutized, to the detriment of network ones, etc. as a result of which several important phenomena, for example, hypnotic states, become completely incomprehensible) and their functioning as elements of a system, closely related parts of a single whole, is much less (and not enough) considered. In addition, unlike the perceptron theory, the circuit design aspect is very poorly developed, and the technological principles of the "neural ensemble system" are completely invisible behind the abundance of data. In the classical theory of learning neural networks and its modern modifications with all its advantages, the perceptron (as well as the association with a Learning Neural Network (LNN) is usually considered as a hierarchically one-level network, while for one of the classes of models of the nervous system the trained matrix (according to Steinbuch), it is known that when its implementation transitions from one-level to multi-level, it becomes capable of: the development of conditioned reflexes, as well as pattern recognition and several other functions (in general) to psychosexual activity i.e., to the formation of models of objects and processes (and the interaction of individuals with them) of objective reality and their complex purposeful activity) [3]. Neurosinergetics pays insufficient attention to the structure of the synergetic environment, and its super-complex topology (which is more likely even circuitry) [4].

The "pure" circuit approach often suffers from extreme reductionism, and tends to "rigid" schemes, as a result of which it is unable to explain the higher functions and so-called "redundancy" of the nervous system [5]. The above-mentioned errors are repeated at the next software stage by the concept of "nefi" which focuses on genetically determined information processing, and learning, and even more so self-learning is almost not considered, reducing the entire complexity of neurodynamic processes to neural, more precisely, intra-neural processes, and represents the brain as a whole as a network genetic automaton, it is suitable, perhaps, only for unconditionally reflex-instinctive circuits of the nervous system. Ignoring qualitative development leads to an "Internet-like" model and absurd conclusions like "at every moment, consciousness is located inside one of the neurons" [6-8].

In addition, the classical theory of neural networks does not provide an answer to how cortical neural networks interact with each other, and the answer to the theory of "neural ensembles" is suspiciously similar to the notorious "autonomous evolution" and both of them practically ignore the morphology of the nervous system: the presence of structural (and especially functional) levels above the chosen (in theory)-main one. The holographic concept absolutizes one of the types of signal interaction in the nervous system ("holographic"), completely rejecting the rest. In addition, to obtain any high-quality hologram, extremely high stability of the carrier frequency is necessary, which is achieved only in lasers, while even for pacemakers of the brain, a certain frequency lability and plasticity are characteristic. In addition, the common reduction of the stereogram (memory)-to a hologram is reductionism, which ignores such important properties of the stereogram as the ability to self-repair and develop. In other words, having played a significant positive role in its time (1970-the and 80s), the holographic concept has now become a reductionistic brake on the path of further knowledge [4]. Some researchers make attempts to consider the functioning of a large group of LNN in the so-called "information field" and there is a qualitative leap in the functioning of the system compared to a single LNN – but, unfortunately, without specifying the circuit implementation of the "information field".

LITERATURE REVIEW

Circuit Analysis of Architectural and "Platform" Organization of the Brain

According to the scheme, the scheme of connections in the 1st layer of the cerebral cortex (Large Hemispheres, LHS) is very close to the matrix, and some of the neural circuits of other layers of the LHS cortex are very similar to matrix-like; in addition, "input" neural circuits of analyzers are matrix-based. In this regard, it is worth noting that the effectiveness of one of the types of learning neural networks the "learnable matrix" (LMS) significantly increases in the multi-level version of its implementation: LMS becomes capable not only of pattern recognition but also of psychosexual activity to the formation, like the development of CR-s by neurons, of models of objects and processes (and interaction with them) of objective reality and their complex purposeful activity [3].

At all levels of the CNS organization: elements (neurons, microcolumns, 750-micron macromodules nerve centers, form networks, there is a closure and a change in the "weight"-of inter-element connections (learning), the flow of conditioned reflexes. In addition, as is known from sociology, the structure of connections at the inter-individual level is also a network, although, relatively speaking, "software" not hardware; conditioned reflexes can include more than one individual (the so-called "super reflexes"). In addition, at the neuroprotein level, , both chemoreceptive (C-elements) and electro-excitable nonlinear (E-elements) elements of the neurolemma form a network of binary elements (C-elements are critically equivalent to the 1st layer, E-elements to the 2nd) of the binary perceptron, learning network if at least one of the synapses within the neurolemma receives a training (reinforcement) signal [5].

The sub-neuronal level is also organized according to the network principle: a large neuron with a developed dendritic tree can be considered, according to Savelyev, as a network of elementary neurons [6]. Also, a group of authors developed the concept of an intra-neural quantum hypersonic holographic computer based on a network of myofibrils critically equivalent to a complex perceptron based on binary elements (a network of neural cytoskeletons together with the immediate environment of the latter) with an "each-to-each" communication scheme that recognizes images presented to neurons [7,8].

Therefore, we can assume that the brain is a multi-level Learning Neural Network (LNN), each of the levels of which is similar to the usual technical LNN. Moreover, if we compare the average linear dimensions (diameter) of structural elements at different levels of organization of the cerebral cortex (neuroprotein, neuro organelle, neuron, microcolumn, macro module, nerve center, analyzer, and CNS as a whole) and the duration of the corresponding memory formation stages, we get the following (Table 1).

Table 1 Data is taken from open sources, data tabulation is the author's

M, level number	Type of Neuro-structures	Dimensions diameter) of structures	Xn /X n-1	Time of the memory stage ti	type of Memory	Stimulus	Type of HNA	Biocybernetic	Level of the psyche	Yogic aspect[3]
7	Specie	≈ 10-12 (individuals)[1]	10	50-100 years	the generation memory	Philoso-pneuma	Philo-sophy		Ontological consciousness	Atmanic (Sahasrara)
6	individual CNS	≈262.5 cm^2 ± 87.5 cm^2	10	5-10 years	Tertiary (constant)	Ideolo-geme	Belief, ideology		Ideological consciousness	Buddhic (Ajna)
5	Analyzers	≈ 26¼ cm ± 8¾ cm	35	182.3-364.6 days	Secondary	Meta-theory	Meta-theory, ideas	Meta-theory	Creative superconsciousness	Sacral/Nirvanic (Vishuddha
4	Nerve centers	7.5 mm ± 2.5 mm	10	5 days 5h-10 days 10h	Intermediate	concept	Concepts, theories	Meta-concept	Self-consciousness	Causal (Anahata)
3	Macro-modules	750 ± 250 microns	25	12.5-25h	Buffer	word	Word concept[4]	Meta-model	Con-science	Mental (Manipura)
2	Micro-columns	30 microns	60	45 mins ± 15 mins to 90s	Operational	image	Model	Meta-program (model)	sub-conscious	Astral (Svadhisthana)
1	Neurons	3 microns	10	45 s ± 15 s to 90s	Short-term	stimulus	Reflexes	program	Un-conscious	Etheric (Muladhara)

0	Neuro-organelles	0.3 microns [5]	20	4.5±1.5 s to 90s	Primary	element of the stimulus	Intra-reflex connections	sub-program	Instinctive	Biological ("tail", "zero chakras")
-1	Neuro-proteids	15 nm	-	225 ± 75 (up to 450) ms	Iconic	Sensory quantum	"neuro bit"	elementary com-mand	genetic	Physical ("string", "grounding")

"The theory of 6 handshakes" after 5-6 handshakes, you are familiar with every person on the planet.
The equivalent surface diameter of the brain (≈220000 mm^2 given that 2/3 of its surface is hidden in the convolutions).
Subtle body and (chakra) subjective and phenomenological content of autohypnotic practices.

- An adequate model of a small and medium-sized neuron (on the neural and large ranges of characteristic time) will be discussed at the end of the first chapter.
- Stage of memory is, in fact, the characteristic time of self-organization of neuropsychic processes of a given level of complexity.

Linking (levels of CNS organization to the corresponding levels of subtle bodies) based on the correspondence of "the type of HNA the genus of the subtle body and its chakra. Even when learning such a relatively simple skill as singing, teachers and students often focus on subjectively perceived processes and structures that have no scientific justification, but work and are effective in mastering such skills. It is possible that in both cases we are dealing with the subjective virtual interface of associative design created by the subconscious mind.
Basis of the 2nd signal system.
The average diameter of the soma (body) of a neuron.
*60 since there are 6 neural layers in the microcolumn (the 1st of 7 cortical neural layers contains almost no neurons), 10×6=60.
Interestingly, the linear dimensions of different levels of neuro structures correlate in the same way as the durations of different stages of memory (corresponding to neuro structures), for example, iconic memory is signal on neuroproteins; primary memory synaptic, etc. organellar processes; short-term memory neurons.
In this connection, the author introduces the concept of a meta-network (whole-cortex LNN-model), i.e. a homological multilevel hierarchical neural-glial network, in which an element of any of the levels is a system (network) at the level preceding this one and is included at this level in the system (network) which is already an element at the next level, and the levels are homologous to each other.
It is interesting that if we move from the levels of the CNS organization to the corresponding levels of the so-called "subtle bodies" of yoga, then the value of the M, M-vector coincides with the internal dimension for the subtle body. Based on this, it can be assumed that (starting from the neuro organellar level) the "M-vector" (see Table 1, 1st column) of the neural-glial meta-network is one of the integral aspects of its architecture.
A system of stimulus elements forms a stimulus, a system of stimuli forms an image (of the 1st signal system); a system of concrete images forms a notion (element of the 2nd signal system), a system of notions (words) forms a conception (theory), etc. at the same time, a conditioned reflex stimulus corresponds to a reflex (and a neuron as the most complex type of HNA for a single neuron), while the Conditioned Reflex (CR) is bio-cybernetically a program. In the bio-cybernetic aspect, the model is a metaprogram relative to the CR program. In the same way, the model correlates with the word (notion) of the second signal system and intra-reflex (function of neural organelles) connections (connections between elementary components of a stimulus or reaction, axon-reflex, etc.) with simple CR. At the same time, a neural network (30-micron column) is a meta-network relative to a neuro organellar network, a macro module is also a meta-network relative to a 30-micron column, and so on.
Corresponding relationships also exist for memory stages that correlate with geometric parameters (Table 1).
In other words, we have a multidimensional correspondence, the neurological substrate, the characteristic time of self-organization of its neuropsychic processes, the neuropsychic processes themselves, the type of data processed by the latter, the type of HNA corresponding to them, the bio-cybernetic aspect, the psychological and yogic aspects (respectively) various aspects of the unified process, hierarchical and multilevel structural and functional (system)

unity. With each subsequent meta-level, qualitatively new information processes and psycho-structures appear (Table 1).

The most complex form of HNA for a single neuron or a small group of them is the closure-opening of temporary connections, i.e., a Conditioned Reflex (CR). A network of neurons (including technical perceptrons, associations, etc.) is also capable of pattern recognition (which is nothing more than the operation of a network of elementary sensory and conditioned reflexes to elementary stimuli, stimuli that make up the image).

The structure of the type of multi-level learning matrix of Steinbuch is capable not only of pattern recognition but also of psychonervative activity and to form, like the development of CR-s by neurons, models of objects, processes (and interaction with them) of objective reality and their complex purposeful activity.

As a result of the process of self-organization (occurring in the aggregate) of temporary connections (in turn, also conditioned-reflex), such a model (a system of object-specific temporary connections) in the process of its functioning and adaptation generates new CR in new situations (for this model), manages and coordinates the work of CR in its composition (and partially related to the latest CR from other models).

Consequently, a learning neural-glial meta-network (a meta-network, i.e., a hypernet consisting of networks of several meta-levels homologous to each other, where a network of any level is an element of the network of the next level and a meta-network for the network of the previous one is a self-similar network) corresponds to a conditional-reflex meta-network (like the hardware of an analog computer to programs of an analog computer), which corresponds to a hierarchy of (meta) types of input data (stimuli), and a hierarchy of neural-glial meta structures corresponds a hierarchy of CR-megastructures and a hierarchy of memory stages (stages of development, consolidation of the CR structure of a particular meta-level). Therefore, neurological memory, i.e. the totality of information accumulated in neural-glial networks of the brain, can be considered neuro cybernetically as a Database (DB), more precisely a complex multi-level and multi-user internally-branched database of a hierarchical network organization.

A meta-network, strictly speaking, is a neural-glial network, and not just a neural network since gliocytes perform not only feeding and supporting functions about neurons. The neuroimmune nature of the neurological memory implemented with the participation of gliocytes is indicated by Ashmarin. There is a Galambos and Roitbak hypothesis about the learning function of gliocytes about neurons, which recently found new confirmation: according to Melkonyan, the change in time of the Slow Negative Potential (SNP) of gliocytes adjacent to a given neuron is opposite in sign, magnitude, and direction to the change in the neuron potential. As is known from the cybernetics of neural networks, this is precisely the nature of the signal change in time in technical neural networks: on the training element and the trained decision element (technical neuron), respectively.

Table 1 also shows that the duration of the memory stage of any level is directly proportional to the linear dimensions of the microstructure of this level. Therefore, the average rate at which information is captured in the nervous tissue is constant and is 0.5 μm/min-1 μm/min which is slightly lower than the growth rate of a nerve fiber (1 mm/day-2 mm/day) probably, the participation of gliocytes in this process introduces a delay. (It is logical to assume that such capturing is a single process for all meta-levels.)

Also, Table 1 shows that in the brain there is a time-scale hierarchy of synergistic processes (HNA phenomena), their characteristic times of self-organization (stages of memory formation), and the size of the environments (neural network structures) in which such processes occur, and, also, a vertical homology, (respectively, homologous: metasystems ("neighbor from above"), systems (this structure), and subsystems (neighbor from below). Thus, the biological neural network of the cerebral cortex is a hierarchical crystal (or Peano lattice), the cell node of which is both a neural network in the usual sense and (as at the analog computer: scheme is also its program) the semantic network of the psyche.

In addition, the geometrically three-dimensional neural network of the central nervous system is four-dimensional, where the fourth dimension is the characteristic time of self-organization (time of the memory stage) for a neuro structure of these dimensions, the time of fixing the HNA type of this microstructure. This, in particular, explains the phenomenon of so-called preventive impulsing: when the stimulus is part of a temporary pattern that began and was recognized before the given stimulus; when the appearance of the stimulus is predicted due to causal relationships in the pattern (of which it is a part), preventive impulsing appears.

The brain, especially the cerebral cortex, is a hybrid system in its architecture: partially meta-network, partially somatotopic priority-proportional. Both principles are combined in every CR-able brain structure. At the same time, the more evolutionarily developed a vertebrate is, the more this system is telencephalic (in humans, almost everything is projected onto the cortex). Moreover, the ancient opposite principle the metameric organization of the nervous system, which is close to that of annelids and arthropods is smoothed out and hidden. Thus, this principle itself is influenced by 2 evolutionarily opposite sub-principles. As for the network architecture, the situation is similar: the sub-principles of the multi-layer perceptron and the trained multi-level Steinbuch matrix (the LHS cortex is a hybrid (matrix-perceptron) meta-neural network that combines the advantages of both architectures: the perceptron and the "trained matrix" according to Steinbuch).

In other words, the brain is a poly hybrid system.

It is interesting that, as Yuzvishin notes, for example, the universe, the reality surrounding us (as well as information) is organized as a multi-level cellular network. Probably, the brain, developing in the course of evolution as an organ of neuropsychic reflection of reality, reflected this organization in its structure (evolutionary optimization of the structure for the object of function, its structure). Even microcolumns and macro modules are located in the cortex hexagonally symmetrically. Any of the levels of a neural-glial network in its organization and wiring diagram is (to a first approximation) a cocrystal, but, taking into account continuous growth and self-organization (as a process and principle of functioning), it is a synergetic crystal.

As for the architectural and organizational principles, the biological brain and the digital computer are opposite: whereas the PC is a computer with negative feedback with sequential information processing and an architecture based on the principle of order, the brain is a computer with predominant positive feedback with parallel information processing and an architecture based on the principle of chaos. No less fundamental is the difference in the specialization: code processing, mainly in numerical form in a digital computer, and processing sensory signals in the form of patterns in the biological brain. As for epistemology, predictability of the system, while the PC requires predictability for the engineer, for the user from a living creature in the course of evolution, it was mainly required unpredictability for predators, for competitors, etc. (rare exceptions: coordinated actions in a pack, protective coloration of many poisonous organisms, etc. only confirm the rule). In addition, in the case of a PC, computing devices are organized into a network the network consists of computing devices; in the case of the brain, on the contrary, the "computing device" consists of networks. (Somewhat less significant are such differences as biological regeneration, adaptation, training of biological systems, poorly recreated technically, almost not recreated self-reliability, and still not recreated self-learning; but except the last 3 properties, this is a question of structural material). From the above, all further differences in systems arise.

An ordinary technical neural network can recognize images, transform them, and even perform dependent generation. The concept of a learning meta-neural network allows you to understand how the human brain processes complex multi-level composite images (look around, and then try to analyze them in such detail that the result is understandable to Fine Reader-level AI. Remember that the visible space is only a small part of the city where you live, and the city is only a small part of the known universe. At the same time, the human brain supports working with the above in real-time ahead of time) of any level of complexity and generalization. This concept (multi-level structuring meta-network) provides not only a proper scientific, circuit-based understanding of psychic phenomena of any level of complexity, but their multilevel nature in the functions and capabilities of the natural mind (in contrast to the currently dominant humanitarian quasi-"understanding" with a slight touch of mysticism), but also allows us to solve the problem in general terms implementation of the latter in hardware or virtual neural network of artificial intelligence, as well as to understand, even if schematically, the functioning of this system as a whole in all its complexity.

The multiplicity of 5 for values of hierarchical proportionality Xn/(n-1) is noteworthy. As is well known, living things (as opposed to non-living things) are characterized by 5 fold symmetry; in this case, the latter is observed in hierarchical time.

Interestingly, at the neuro organellar level, interelement communication is 0-directional (no directivity), at the neural level it is 1-directional, at the micro-column level it is 2-directional (reciprocal), and at the macro module level it is 3-directional (pre and postsynaptic contacts), i.e. communication becomes controllable for the "third party"

arbitrariness, learning able self-awareness (as we know from psychology, awareness of the mental process means its controllability); at the level of self-awareness, this is already mutual learning (4-directional), and so on.
Relative to the meta-network, the 2nd signal system is, in fact, a descending hierarchical loop (from the third and higher levels) to the 2nd (for the visual and temporal cortex), which creates opportunities for high-quality (sometimes repeatedly repeated) compression of concrete-imaginative information in verbal code (and, accordingly, saving system resources), abstractions, distractions, generalizations, development of logic, etc.
The basis of circuit dynamics of neural learning systems of the brain is the principle of sequentially-parallel tunable work, in which the cerebral cortex works both as a sequential and as a parallel circuit simultaneously and alternately. Different areas of the cortex, different microcolumns, and macro modules can process information both in parallel and sequentially, being (EEG-synchronisation ally and electrotonically) at different hierarchical levels of functioning. The essence of the principle is that the meta-network recognizes not only the actual "input" pattern but also both: the hierarchical level (at which recognition will be performed) and the involved configuration of connections between cortical regions (which will recognize). The interconnectedness and interaction of cortical regions are determined not so much by their actual physical connections (which are redundant) but by the level of synchronization of their signal and the interlayer transitions of the latter (synchronization unites "disparate" cortical regions into a functionally unified whole working on one task, i.e., the commutation process).

Neuron as a Synergistic Modeling Device

Also, regarding the neural layer of the meta-network organization, it should be noted that:

- Based on the increasing computational abilities of a technical and computer-modeled (virtual) neural network, and approaching the properties of biological neural networks in proportion to the departure from the concept of a network based on formal trigger neurons, in favor of synergetic processes (At present, it is obvious that biological neural networks are synergetic computational (more precisely, modeling) processes structures).
- Higher levels of brain organization than the neural network are also characterized by synergy and self-organization as essential properties.
- Neuro column and sub-neuronal (neuroprotein, , and neuro organellar, according to Savelyev), as well as super-neuro column levels, are organized as learning self-organizing networks of active excitable elements [6,7].
- large neurons are multicellular multi-element network structures (circuitry is relatively simple neural networks (on small neurons)), i.e. a de facto large neuron is a synergistic computing device.
- as is known, during the transition from small neurons to large ones, there are no phenomena of segmentation or mesmerization, the formation of any internal partitions, or the like of an analog of multi-core syncytium (rather, something principally similar to psilophyte growth is observed), quantitative changes with an increase in the size and number of branching of dendrites do not turn into fundamental ones. In other words, an increase in the size of a neuron for the cell itself and its function is a quantitative change, growth, but no fundamental changes occur (except the circuitry aspect, since the function passes from the neural range of the characteristic time to the neuro columnar, higher neighboring hierarchical range). Based on the above, as well as Table 1, it is obvious that the neural level of brain organization is not fundamentally different from the higher and lower levels: not only the form (and content!) of the neural network (and meta-neural network) should be synergistic, but also the essence of its elements. Then, biological neurons, regardless of size, circuitrically and cybernetically is synergistic computing (more precisely, modeling) devices.

Self-organization of neurons occurs not only in space but also in time: a critically, small neuron (on the neural and large ranges of characteristic time) is a trainable (partially) dependent generator on unsteady processes, with a pulse output (the simplest technical implementation of the generator on "unsteady processes" is an unregulated blocking-generator).
Synergetic computations, , are analog and subthreshold, each bit of information entering the neuron is processed, and not just over threshold signals; and if the signal is not critical ('s estimates, these are ≈2% of all signals/inputs), the

response is delayed, sometimes very significantly, in time (quasi-spontaneous activity). , only the output characteristic of a neuron has a threshold-trigger character, but not the input one.

It should be noted that synergistic calculations in the neuron are "implemented" on a combination of self-organization: transmembrane potentials of the neuro membrane, biochemical auto waves of the cytoplasm (with an admixture of participation in fibrillar-circulatory activity), and hypersonic diffraction on the fibrillar skeleton of the cell in other words, on the dialectic of biochemical, ion-current and hypersound-diffractive synergetic of nerve cells [7].

In connection with the above, it is worth emphasizing that the so-called unreliability of the neuron is an apparent effect, or rather, incorrectly classified. After all, since:

- In living nature (and not only), in contrast to technology, even a precisely repeated event also does not mean the same thing as its prototype.
- In the neurons of the cortex, in general, in the brain, there is constant learning, and therefore (also) the response to even an accurately repeated event is not reproduced exactly,
- In conditions of confrontation, the template is the path to ruination, and wildlife is precisely a confrontation (predators and victims, competing individuals of the same or similar species among themselves, all of them unfavorable eco-climatic conditions, etc.) that would seem, the unreliable, the unstable behavior of a neuron that never repeats itself exactly is not faulty or poor-quality, but on the contrary, correct, optimal and adaptive behavior.

Consequently, the phenomenon that seems to be unreliable in the work of a neuron is, in fact, mistakenly classified, it is a manifestation of the self-organization of the first, its training and adaptation. Evolution produces structures that are surprisingly reliable and efficient (the wings of birds and insects, the skeleton of an armored shrew (Scutisoricinae), dolphin skin, and muscles with an efficiency of 50%-60%), so it would be a big mistake to think that in such an extremely important area as the nervous system, it will be different.

Neuroapoptosis Explanation and Calculation of Parameters

Interestingly, the point in time after which the process of capturing information in the nervous tissue, which began at an arbitrary point in the cortex (shortly before the birth of an individual), covers and "fills" the entire cortex, is 10 years $*\pi \approx 31$ years. This point in time is known as the age (after 30 years), from which the natural death of cortical neurons sharply accelerates (on average, 50-100 thousand neurons per day, the answer to why such a harmful effect is needed and why this particular number of neurons dies has not yet been found). Within the framework of this model, this is intuitively clear: firstly, 50-100 thousand neurons is an approximate estimate of the number of neurons in a macro module (the daily stage of memory), and secondly, after the capacity of any type is filled, with continued "filling" it increases sharply pressure, structural defects appear in the capacity, and also to "record" something in such a situation, it is necessary to delete something. (The minimum value for the moment of fullness of the entire cortex: 5 years $*\pi \approx 15$ years also coincides with the other moment of intensification of neuronal death in adolescents.)

Neural Network Model of the Frontal Cortex: Meta-Ring-mail and its Functioning

The frontal cortex consists mainly not of micro-columns but of so-called neural traps (according to Lorente De Noh, neural networks whose elements are connected in intertwining, intersecting rings (strictly speaking, this is no longer a network, but a network-like structure, which is more suitable for the name ring-mail). At the present stage, considering neural traps only as signal delay lines (especially just excitations) is as primitive as considering the non-specific nuclei of the thalamus as just mechanical relays-switches (this function is far from the only one, and not purely mechanical).

The totality of all functions of the frontal cortex, according to the author, boils down to the fact that it is a strategic cortex, a strategic behavioral analyzer, and a brain lobe (even the so-called active thinking zone is a strategic reserve for "if something happens").

The solution to the ever-memorable paradox of the reflex ring (so similar to the neural trap) at one time turned out to be the position of bio-cybernetics on regulation by closed (homeostasis) and open (behavior) circuits; moreover, the regulated object can also be a part of the nervous system. In addition, if we consider a complex conditioned reflex as

an information processing scheme, it should be noted that the signal in it can flow along any (including ring-like) trajectory that is appropriate for signal processing; at the same time, information enters the ring from the outside, is output from the outside, and the ring is also trained from the outside.

The reflex ring of the frontal cortex is a kind of higher homolog of the classical scheme (which controls the choice of behavior type) of 4 columns of the reticular formation in the brainstem a scheme of the same class, but of a different type in contrast to the reticular-formational, not with “sealed” energetic, but with trainable Conditionally Reflective, (CR) semantic voting.

The author believes that, based on the general logic of the dependence of the properties of neural networks on their architecture, it can be assumed that the meta-"ring-mail" is a meta-neural network for recognition, transformation, and so on regulation processes as such (in the reflex rings of the brain, Closed and Open Circuits of Control (COCC), built on top of the latter, as well as images, patterns of the environment in which the time component (their processing is a function of only delay lines). Thanks to the latter, the frontal cortex is the chronal cortex.

From an algorithmic point of view, the reverberation rings of the frontal cortex are responsible for cyclic algorithms for processing information (in the language of Pavlovian metaphors, these are step-relay seekers that switch the conditioned reflex systems of the rest of the cortex among themselves (a step forward compared to the telephone exchange).

Also, reverberation rings implement the principles of a conveyor and the natural cyclicity of environment and time (humans got out of the influence of natural selection when still being a Cro-Magnon, which slowed down biological evolution extremely; and among Cro-Magnons, the search for prey, for example, cyclically changed by chasing it, chasing fight, fight eating, eating rest, rest then still primitive creativity, but hunger again pushed to search for prey, etc.), which close to the cyclical function of processing rhythms. Internal branching of neural traps is responsible for switching between different cycles (processing the branching of the event line).

Due to the physicality of the repeated course of the signal (that is, inter cyclic synchronicity, the signal is self-coherent), the topological meta-ring-mail in the electrophysiological aspect is similar to (and difficult to distinguish from) a perceptron with synchronous signal transitions between layers, ring-mail-it has little effect on the nature of the impulsion.

The geometrically-threedimensional frontal cortex is neurodynamically-fourdimensional (at least), and in fact-five-dimensional (processing the branching of the event line, eternal questions, philosophy, etc.). Moreover, the structure of neural connections in neural traps, according to the author, resembles a four-dimensional one, collapsed into three-dimensional physical space. In other words, a reflex circuit made up of neural traps is a four-dimensional reflex circuit (which also covers the time dimension).

Based on the same logic of the dependence of the properties of neural networks on their architecture, from the standpoint of the classical reflex theory, in the meta-ring-mail one part of each reflex ring controls, regulates, etc. according to the usual CR-COCC mechanisms another, and that, in turn, the 1st (in addition to controlling the external controlled object itself); (two (at least) parts, three, four, cross, cross-network, and control from neighboring rings, including with the participation of external elements, neural networks, ring mail neighboring i.e. something like systems of Ashby homeostat's (but homeostat's of dynamics) with a ring-mail topology of connections (and a slightly different principle of a point of calm, equilibrium); each of these rings is trained by an external signal about the effectiveness of its work, as in any learning neural network). Such a ring-mail architecture contributes to maximum self-organization neurodynamics (including maximum complexity) since these processes are conditioned reflexes, and also are under the control of selection this leads to self-organization (and generation) of adaptive and effective behavioral programs.

In the cybernetic aspect, the cerebral cortex is similar to the Universal Modeling System (UMS) according to Fatkin and Chekalina. In the absence of a ready-made formula for the solution block (granular cortex), the problem is transferred to the modeling block (agranular, frontal cortex), which solves a much more complex meta-problem (task Cauchy) of modeling, for which the formulas of the decision block (including missing ones) are only special cases; the developed formula is then used by the decision block (and stored in memory). Curiously, the UMS includes a self-model and the term consciousness is mentioned about it. Within the framework of this hypothesis, the problem of a

supreme control post, a little man at the console is solved without ignoring the phenomenon (necessity) of a single supreme control center and reducing the latter exclusively to the natural self-regulation of subordinate neural networks, as, for example, in and it is clear why and how the meta-ring-mail the frontal cortex is highly capable of self-management, and its "software" of self-meta-programming and why the latter is the highest center of regulation and self-regulation, management and self-management.

CONCLUSION

From the above, it can be concluded that the hypothesis proposed by the author in this article provides an answer to the fundamental question of theoretical neuroscience about the general architectural platform structure of the neural-glial network of the brain, its principle uniting all levels of the brain organization. According to the first, the brain is a biological computer on a hierarchical multilevel scalable self-organization (high-selforganizing self-similar processing and signal generation). Consequently, the system of neural glial networks of the cerebral cortex is a meta-network, a hierarchical crystal, the cell of which is well-studied, technically recreated, and strategically significant a learning neural network from neural-like elements, and with a basic level, the basic floor 2nd levels of the organization below the actual neuronic one. The architecture of the "network of networks" type is extremely promising in itself (for example, the Internet), and being repeatedly repeated, it can work with complex images of the reality of any complexity, and if will be some additions to the physical basis of the mind.

Moreover, the number of active elements of a given meta-network is often lower than that, for example, in the schematic diagram of a large server cluster or supercomputer. Modern technical neural networks allow us to implement the most complex functions of bio-neurons, including the germination of new dendrites and axons (programmable common data bus of the microcircuit).

In addition, this hypothesis illustrates the need at the present stage of the development of neuroscience to change the path of development from analytical to synthetic.

This paper shows the architecture and circuit reproducibility of the human brain, which opens up significant prospects in the field of creating "strong AI" and artificial intelligence.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

[1] Dorogov, A. Yu. "Morphological model of self-similar multilayer neural networks." *Procedia Computer Science,* Vol. 186, 2021, pp. 366-73.

[2] Lisin, Valery Viktorovich. "Conceptual model of the brain mechanism of image formation." Complex Systems, Vol. 1, 2021, pp. 35-55.

[3] Steinbuch, Karl, and Karl Steinbuch. "machine and human." *Springer Berlin Heidelberg*, 1965, p. 323.

[4] Szentagothai, J. "The ‘module-concept’in cerebral cortex architecture." *Brain research,* Vol. 95, No. 2-3, 1975, pp. 475-96.

[5] Yoshikawa-Ebesu, et al. "Tetrodotoxin." *Foodborne disease handbook*. 3rd edn, *CRC Press*, 2018, pp. 253-86.

[6] Viktorovich, S. Alexander. "Philosophical and methodological foundations of neurocomputing" *Electronic library of dissertations,* 2008, pp. 1-26.

[7] Liberman, E. A., S. V. Minina, and N. E. Shklovskii-Kordi. "The role of the electromechanical and reaction-diffusion system of intraneuronal information processing in brain function." *Biofizika,* Vol. 31, No. 2, 1986, pp. 298-303.

[8] Seligman, M. E. P. "The new positive psychology: a scientific perspective on happiness and the meaning of life, translated from English, Sofia, Moscow." 2006.