

# Classical-Neural and Quantum-Holographic Informatics: Psychosomatic-Cognitive Implications

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**Abstract**—Modeling of psychosomatic-cognitive functions is considered, in the framework of combined hierarchical brain's and body's acupuncture neural networks. It is pointed out that presented models of brain's hierarchical neural networks demonstrate encouraging advances in modeling cognitive functions. However, for modeling most cognitive and psychosomatic functions, the subtle biophysical quantum-holographic microwave Hopfield body's acupuncture neural networks are also necessary. On the one hand, they demonstrate existence of two cognitive modes of consciousness, and on the other hand, they represent natural framework for explaining contemporary meridian (psycho)therapies for very fast removing of psychosomatic disorders, demonstrating close relationship between acupuncture system and consciousness – with significant psychosomatic and transpersonal implications.

**Keywords**—Brain's hierarchical neural networks; body's acupuncture quantum-holographic neural networks; meridian (psycho)therapies; cognitive and psychosomatic implications.

## I. INTRODUCTION

The prevailing scientific paradigm considers information processing within the central nervous system as occurring through *hierarchically organized and interconnected neural networks* [1-8]. It seems that this hierarchy of biological neural networks is going down sub-cellular *cytoskeleton* level, being according to some scientists a kind of interface between *neural* and *quantum* level [9] – the last one having within the Feynman propagator version of Schrödinger equation *analogous* mathematical formalism as the Hopfield associative neural network [10]. The mentioned analogy opens additional fundamental question how *quantum* parallel processing level gives rise *classical* parallel processing one, which is a general problem of relationship between quantum and classical levels within the *quantum decoherence theory* as well [11]; naturally, the same question is closely related to fundamental nature of *consciousness*, whose in-deterministic manifestations of free will [12-14] and other holistic mani-festations of consciousness, like transitional states [14] and altered states of consciousness [15], conscious/unconscious transitions and consciousness pervading body [16] – necessarily imply that some manifestations of consciousness must have deeper quantum

origin, with significant *psychosomatic and transpersonal implications*.

On the other hand, contemporary investigations of psychosomatic diseases imply necessity of application *holistic methods*, oriented on *healing person as a whole* and not disease as a symptom of disorder of the whole, implying their *macroscopic quantum origin* [7,17]. In the focus of these quantum-holistic methods are body's *acupuncture system* and *consciousness*, with surprisingly significant psychosomatic-cognitive implications. The close relationship of *acupuncture system* with *consciousness* and *psychosomatic problems* is implied by novel *meridian (psycho)therapies* [18-20], based on ancient teaching of psychosomatic disorders on the level of *energetic field* in and around human being, proving in practice that many psychological and emotional problems can be successfully treated in quantum leaps, without the need to pass through long and laborious stages of discovery, emoting and cognitive restructuring, often considered to be the trade marks of serious psychotherapy.

Part II of the paper presents the survey of the models of brain's hierarchical neural networks, which demonstrates encouraging advances in modeling cognitive functions. However, for modeling most cognitive and psychosomatic functions, the subtle biophysical quantum-holographic microwave Hopfield body's acupuncture neural networks are also necessary, which is elaborated in Part III.

## II. HIERARCHICAL MODELS OF BRAIN'S NEURAL NETWORKS

Hierarchical models of brain's neural networks are *most promising models in cognitive neurosciences* [5-7], and can be divided into: *self-organizing feature mapping* unidirectionally oriented multilayer neural networks [2], *associative* or *attractor* massively and bidirectionally connected neural networks [3], and *synergetic classical* [4] and *neuro-quantum* [5] multilayer neural networks.

**Kohonen's self-organizing feature mapping networks** [2] are *physiologically-plausible* model of feed-forward neural networks, which can perform self-organizing mappings for modeling *perception* (using sensor maps) and *motor action* (using motor maps).

It should be noted that *topologically-correct mapping* is essential for *localized self-organizing encoding*, i.e. that topological relations are preserved while sensory input-pattern  $\vec{x}$  is transformed into internal representation (*prototype-*

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pattern)  $\bar{w}$ , by forming a state with minimal difference  $\|\bar{w} - \bar{x}\|$ . This mapping also means *dimensionality reduction of the representation space*, as high-dimensional space of input-patterns (of dimension  $n$  equal to the number of excited sensory cells of the input-layer) is reduced to 2D maps of internal patterns (defined by *cardinal neurons* determined by  $x$  and  $y$  coordinates belonging to cortical map).

These *2D maps* are mostly located in the *primary zones* of the neocortex, where they perform corresponding *feature extractions*. Examples are *somatotopic map* (in somatosensory cortex) of the skin surface, *tonotopic map* (in auditory cortex) of the ear's cochlea spiral, *retinotopic map* (in visual cortex) of the eye's retina, *aromatopic map* (in olfactory cortex) of the nose's mucous membrane etc. It should be noted that synaptic vectors and cardinal neurons are not genetically predetermined, but evolve gradually upon the selective influence of the environment.

In the neocortex there are *vertical columns*, as a product of self-organized topology-conserving mapping. They are specialized to *extract features of the input-patterns* (orientations, velocities and directions of movements, edges, periodicity, color shades etc.), or to *regulate motor actions* (e.g. innervation of a common muscle). In association zones, columns are densely connected to execute collectively complex tasks like recognition of faces, speech comprehension, planning of arm trajectories etc. Columns provide informational basis for higher brain functions, modeled by attractor neural networks.

**Hopfield's associative networks** [1,3] are *neuropsychologically-plausible* model of neural networks for description and simulation of *associative cognitive processes* (*learning, memorizing, recognition, generalization, extraction of most relevant informational content...*) in secondary, tertiary and prefrontal associative zones of cortex. These processes can be modeled successfully by using *massively and bidirectionally interconnected* Hopfield's neural networks, organized into functional and/or virtual hierarchies, with *Hebb's correlation matrices of the memory synaptic connections*  $\mathbf{J}$ , whose elements  $J_{ij}$  are sum of couplings of  $i$ -th neuron  $q_i^{k_i}$  and  $j$ -th neuron  $q_j^{k_j}$  participating in all  $k_i$  ( $i = 1, \dots, P$ ) memory patterns

of the neural network: 
$$J_{ij} = \sum_{k_i=1}^P q_i^{k_i} q_j^{k_i} .$$

It should be noted that in biological neural networks it is *not necessary* that each neuron is interconnected *directly* with all others, as in the absence of direct connections *it is possible* to establish connections *via a mediator* [21]. Such biological neural networks within corresponding associative zones of the cortex, behave as if *all neurons* of this associative zone are *massively interconnected*. This situation can be *modeled* by Hopfield's associative networks, where various potential wells might appear in energy-configurational space  $E(\bar{q})$ , as *attractor patterns (attractors)* of the collective organization of neural states which attract all other neighbour neural configurations. Once the network 'falls into' such a configuration, all further configuration-changing processes cease until the reception of a new stimulus.

As a response to various changing stimuli, the adaptation of the synaptic strengths of Hopfield's network i.e. *learning* is achieved, when energy of the whole network is decreased and the bottom of potential well is deepened, i.e. *energy-configuration surface changes* in the process. Furthermore, several configurations may converge to the bottom of the same potential well if they are in the basin of attraction of the same attractor. In this manner a neural network realizes *classification*, which enables recognition of an object in slightly different circumstances from those in which one is used to seeing the object in the past. However, perception of an external pattern under new circumstances is accompanied by changes in corresponding internal configurations, as a pattern is synthesized from the outside-world-information, from memory, and from contextual information from the other centers, and then such a *revised and corrected pattern is stored again*. So, *recognition* is also identical with *formation, reconstruction, and short-term memory of the pattern* in a system of bioelectrical processes in neurons.

In the course of long-term memorizing, information is transferred through the process of learning from '*manifest awareness*' (in the neurons – in  $\bar{q}$ ) to '*latent awareness*' (in the synaptic connections – in  $\mathbf{J}$ ). Thus, memorization is a single-valued mapping of some image of an external object into an internal virtual image firstly in the *system of neurons (short-term memory)*, whereupon this image is transferred to the *system of synaptic connections (long-term memory)*. So there can be one pattern at a time in the system of neurons (*in manifest consciousness*), whereas in the system of synaptic connections (*in long-term memory/in latent consciousness/in the subconscious*) there can be several patterns simultaneously, albeit it is necessary to recall them from memory: *through recall a memory is brought from the system of synaptic connections into the system of neurons!* The prompt for this is a similar external stimulus which draws neurons into a 'replication' of the externally-imposed pattern, although such a prompt can come from other cerebral sub-networks too.

So, in neural networks of the associative zones of cortex, the main factors determining direction of *mental associative processes* are *attractor patterns*, not single neurons and synapses, and thus even huge injuries of the cortex *do not destroy functionality* of the associative memory if only *attractor structures are preserved!* If associative neural network has *symmetric connections* (synapses equally permeable in both directions,  $J_{ij} = J_{ji}$ ), then the network can form *stable attractors* in energy-configurational space, which represent *implicate order* and determine formations of further *virtual mental structures*.

**Haken's classical synergetic networks** [4] are *neurocognitively-plausible* model of neural networks for description of *collective virtual cognitive processes*. Synergetic networks unite multi-layer neural networks with associative neural networks, through intra- i inter-layer connections. Each layer is its own associative network which can have functional interpretation (*cardinal neurons* in the second layer) or virtual interpretation (*cardinal domains* as order parameters  $c_{k_i}$  in the second layer, or *attractor patterns*  $\bar{q}^{k_i}$  in the third layer). In Haken's network order parameters  $c_{k_i}$  measure the *overlap* of

an attractor pattern  $\bar{q}^{k_i}$  with the actual memory state  $\bar{q}$  of the network, i.e. they act as coefficients in the series  $\bar{q} = \sum_{i=1}^P c_{k_i} \bar{q}^{k_i}$ .

In modeling higher brain functions, synergetic neural networks with *generalized interpretation of neurons and connections* may be used: *generalized neurons* may be *cardinal neurons*, *cardinal domains*, *cortical columns* or *virtual attractor patterns* of various order, while *generalized connections* may be large-scale physiological connections or virtual connections between cortical areas. *Higher order virtual attractor patterns contain lower-order patterns*, with large hierarchy which is sensitive, flexible and mobile!

The network with *asymmetrical generalized connections* ( $J_{ij} \neq J_{ji}$ ) forms constant potential gradient, along which the network descends faster from one configuration to another, with larger associative context through its connections with other patterns which are within the range of attraction of the observed dynamic pattern, forming *associative chains of flow of thought*. If individual *nonlocal* attractor patterns are connected with their *localized* cardinal neurons or corresponding order parameters in *speech centers* (Wernicke area), then such a train of thought is encoded or *symbolized*, and it is possible to be *verbalized* (Broca area).

**Peruš's neuro-quantum synergetic networks** [5] are *quantum extrapolation* of Haken's classical synergetic networks, applied for modeling *higher brain's functions* and *processual bases of consciousness*, uniting brain's neural and virtual processes with subcellular and quantum processes. In this way it is possible to model *associative*, *intuitive* and *semantic* processes, although for modeling higher *symbolic*, *syntacting* and *logical* processes it is necessary to apply their *hybrid combining* with symbolic models of *artificial intelligence*.

Then it is pointed out that brain-mind is necessarily multi-level phenomenon, with overall scheme: pure consciousness is of quantum nature; virtual representations are associated with neuronal patterns; external objects are of classical nature – so that only hierarchically united interaction of brain's neural and virtual processes with subcellular and quantum processes might produce effects of conscious experience, like final interconnection of perceptual patterns into united holistic qualitative experience (manifestly conscious state).

Peruš has demonstrated direct mathematical parallels between quantum processes in Feynman's version of quantum mechanics and neuro-informational processes in Hopfield's associative neural networks. Although basic elements of quantum versus neural system (modeled by formal neurons and connections) are very different, their collective processes obey similar laws. So Hebb's correlation matrix of memory synaptic connections in Hopfield's associative neural networks, corresponds to Green's function (quantum propagator) in Feynman's version of Schrodinger equation:

$$G(r_2, t_2; r_1, t_1) = \sum_{i=1}^P \phi^{k_i}(r_2, t_2) \phi^{k_i*}(r_1, t_1) \\ = \sum_{i=1}^P A_{k_i}(r_2, t_2) A_{k_i}^*(r_1, t_1) e^{\frac{i}{\hbar}(\alpha_{k_i}(r_2, t_2) - \alpha_{k_i}(r_1, t_1))},$$

where  $\phi^{k_i}$  is *i-th quantum memory attractor* (i.e. explicate short-term memory of *i-th quantum state/attractor*), and  $G$  is *quantum-holographic memory* (i.e. implicate long-term memory of all  $P$  quantum states/attractors in quantum memory) of such informationally interpreted (any) quantum system  $S$ ! Then, (re)construction of quantum attractor patterns, i.e. transformation of the representation of *long-term memory* (of quantum latent consciousness/the subconscious) into representation of the *recall/short-term memory* (of quantum manifest consciousness), is analogous to the wave-function collapse.

By using these analogies in *neuro-quantum synergetic networks*, it is possible to achieve information processes with *large hierarchy of patterns*, consisted of a set of *functional levels* and *virtual levels of abstraction*: neurons (first biological level); patterns (second biological level – first virtual level, generalized neurons); higher-order patterns (schemes, categories, meta-representations, symbols); dynamic pattern-sequences (associative chains, episodes, trains of thought); pattern manifolds (combinations of higher patterns of various types and origins, with some common feature); semantic, symbolic or conceptual networks; global attractor conglomerates (personality, ego); and consciousness (in multi-level interaction with sub-cellular and quantum levels).

### III. QUANTUM AND CLASSICAL BODY'S HIERARCHICAL NEURAL NETWORKS: COGNITIVE AND PSYCHOSOMATIC IMPLICATIONS

In the context of contemporary *investigations of quantum-holographic bases of consciousness and their fundamental cognitive-epistemological and psychosomatic-religious implications*, the *association of individual consciousness to manifestly-macroscopic-quantum acupuncture system*, and *application* of theoretical methods of *associative neural networks* and *quantum neural holography* and *quantum decoherence theory*, imply *two cognitive modes of consciousness*, according to the coupling strength consciousness-body-environment [6,7,22-24]:

- *weakly-coupled quantum-coherent direct one* (in religious/creative transitional and altered states of consciousness, like prayer, meditation, creative dozes, lucid dreams...), and
  - *strongly-coupled classically-reduced indirect one* (in perceptively/rationally mediated normal states of consciousness, like sensory perception, logical and scientific thinking...),
- with conditions for mutual transformations – and significant *religious and epistemological implications* related to re-gained strong coupling of quantum-holographic contents of consciousness with bodily-environment, classically-reducing directly obtained quantum-coherent informational content – thus explaining *in principal non-adequate informational rationalization* of any direct quantum-holographic spiritual/religious *mystical experience* (as a general problem of the quantum theory of measurement, of reduction of implicate order of quantum-coherent (quantum-holographic) superposition into explicate order of measured projective quantum and mixed classical states [7,12]!).

So it seems that science is closing the circle, by *re-discovering two cognitive modes of consciousness* and at the same time by imposing its own *epistemological limitations* – as it was preserved for millennia in *shamanistic tribal traditions* [25], or as it was concisely described by Patanjali in

*Yoga Sutras*, pointing out that mystical experience (samadhi) is 'filled with truth' and that 'it goes beyond inference and scriptures' [26,27], or as this difference between faith and knowledge was formulated at the beginning of the last century by Berdyaev in his *Philosophy of Freedom* as the difference of two modes of cognition, prayer-mediated 'comprehension of the affairs invisible' and rationally-mediated 'comprehension of the affairs visible' [28]!

It should be pointed out, that in the context of *necessary conditions for decoherence* [29], defining of open quantum system and environment is – *simultaneous process* – so that in the context of universal validity of quantum mechanics *consciousness is relative concept*, non-locally also influenced by farther parts of existing observing universe (and *vice versa*!) [30], simultaneously creating conditions for the process of decoherence in the context of *existing relative borderline*:

$$|\Phi\rangle_S |\Psi\rangle_E \equiv /(\text{partial})\text{individual}/\text{collective consciousness}\rangle_S \\ /(\text{complement})\text{environment}\rangle_E.$$

This is fully in accordance with the idea of *collective consciousness* as a possible *ontological property of the physical field itself* [7,14,22-24], with different micro-quantum and macro-quantum (both non-biological and biological, real and virtual) excitations. Then, as *cosmic collective consciousness*  $|\Phi\rangle_S \sim \prod_k |\phi^k\rangle_{S_k} = \sum_i c_i |\Phi_i\rangle_S$ , coincident with the 'field' of

Universe, has its *complement 'particle' cosmic environment*  $|\Psi\rangle_E = \sum_i c_i |\Psi_i\rangle_E$ , their strong-interaction-coupling affects

*decoherence of the 'field' of cosmic collective consciousness* into stationary *classically-reduced (observing) stochastic state*,  $\hat{\rho}_S = \sum_i |c_i|^2 |\Phi_i\rangle_{SS} \langle \Phi_i|$  (and reciprocally, decoherence of the

cosmic-consciousness-observable classically-reduced stochastic state of the complement "particle" cosmic environment  $\hat{\rho}_E = \sum_i |c_i|^2 |\Psi_i\rangle_{EE} \langle \Psi_i|$ , with probabilities  $|c_i|^2$  of

realizations of corresponding classically-decoherent states of cosmic collective consciousness. However, *cosmic composite quantum state*  $|\Phi\rangle_S |\Psi\rangle_E$  *evolves without collapse (due to absence of the complement outside-cosmic environment!)*, which implies that *Universe as a whole might be considered as quantum hologram* subject to deterministic Schrödinger evolution [7,23,24]!

At the same time, the *analogy between mathematical formalisms of Hopfield's associative neural network and Feynman's propagator version of the Schrödinger equation* [10] additionally implies that *collective consciousness* is possible *ontological property of the physical field itself* with various micro-quantum and macro-quantum (both non-biological and biological) excitations [7,14,22], which is widely spread thesis of *Eastern esoteric/religious traditions* [31] – and then *memory attractors of the quantum-holographic space-time network of collective consciousness* can be treated as *psychosomatic collective disorders* representing *generalized (quantum)holistic field records* – which might represent *biophysical basis of (quantum) holistic global psychosomatics* [7,14,22,23], with *religious/social implications*

on necessity of *transpersonal spiritual quantum-holographic removing* [31] of all unwilling collective memory attractors.

The same might be related to *lower hierarchical quantum-holographic macroscopic open quantum acupuncture system/individual consciousness*  $S_k$ , with memory attractors  $\phi^{(k_i)}$  in the energy-state  $E_{S_k}(\phi^{k_i})$  hypersurface and *its quantum-holographic memory/propagator*, which might represent *biophysical basis of (quantum)holistic local psychosomatics* [7,14,22].

It should be pointed out that *quantum decoherence* might play *fundamental role in biological quantum-holographic neural networks*, through *energy hypersurface*  $E_{S_k}(\phi^{k_i})$  *shape adaptation* (in contrast to *low-temperature artificial qubit quantum processors* where it must be *avoided* until the very read-out act of quantum computation [32]!) – which implies that Nature presumably has chosen elegant *room-temperature solution for biological quantum-holographic information processing*, permanently *fluctuating between*

*quantum-coherent states*  $|\phi^k(t)\rangle_{S_k} = \sum_i c_{k_i}(t) |\phi^{k_i}\rangle_{S_k}$  and

*classically-reduced states*  $\hat{\rho}_{S_k}^k(t) = \sum_i |c_{k_i}(t)|^2 |\phi^{k_i}\rangle_{S_k} \langle \phi^{k_i}|$

*of acupuncture system/consciousness*  $S_k$ , through non-stationary interactions with out-of-body farther environment and through decoherence by bodily closer environment [7,23].

The same might be related to *lower hierarchical quantum-holographic macroscopic open quantum cellular enzyme-gene level*, which might be also functioning on the level of permanent *quantum-conformational quantum-holographic like* molecular recognition (through changes in operator of macromolecular electronic-conformational density of states  $\hat{\rho}_e(t)$ ) – so that *quantum neural holography* combined with *quantum decoherence* might be very significant element of the feedback *bioinformatics*, from the level of cell to the level of organism [7,23,33,34].

All this additionally implies that the *whole psychosomatics is quantum hologram* [7,22-24], both on the level of *individual and collective consciousness*, which resembles on Hinduistic relationship *Brahman/Atman* ('*Atman is Brahman*' [26,27]), as wholeness and its part which bears information about wholeness. The mentioned quantum-holographic picture also implies that quantum-holographic hierarchical parts carry information on wholeness, enabling *quantum-holographic fractal coupling of various hierarchical levels in Nature*:

- Quantum-holographic coupling with evolving state of collective consciousness: (i) locally, via (non)intentionally mentally-addressed states of acupuncture system/consciousness [35], with significant psychosomatic implications (due to subsequent acupuncture-based quantum-informational control of ontogenesis and morfogenesis, starting from the first fertilized cell division which initializes differentiation of the acupuncture system of (electrical synaptic) "gap-junctions" [22,23,35], also supported by experimentally demonstrated thought-emotional language-influence on the genes expression [36]), as well as cognitive-creative implications (Tesla i Mocart as extraordinary examples of miraculous creativity [23,37]), and (ii) globally, via advancing individual and collective events [38] (whose memory attractors might be reprogramed by

hesychastic prayer for the others thus removing interpersonal loads of the quantum-holographic Hopfield-like neural network of collective consciousness – *via* prayer-induced hypothetical macroscopic vacuum non-loaded spiritual excitations, as indeterminate intervention in otherwise deterministic evolution of the quantum-holographic evolution of collective consciousness (and complement "particle" environment of the advancing individual and collective events!) which thus provides essentially new non-Schrodinger boundary conditions [22]!). This leaves room for free will and influence on future preferences, and implies indispensable personal role and care for collective mental environment;

- *Meridian (psycho)therapies*, with very fast removing of traumas, persistent phobias, allergies, post-traumatic stress and other psychosomatic disorders [18-20], *via* simultaneous effects of *visualization of the psychosomatic problems* and *tapping/ touching of some acupuncture points*, which might be interpreted as 'smearing' and *associative integration of memory attractors* of the psychosomatic disorders through successive imposing of new boundary conditions in the energy-state space of acupuncture system/consciousness during visualizations of the psychosomatic problems (cf. Fig. 1), which can be additionally accompanied by discharge of memory attractors of psycho-somatic disorders – thus demonstrating close relationship between consciousness and acupuncture system! Having in mind very high efficiency of transpersonal circular meridian (psycho)therapeutic processes, i.e. from all relevant mentally-addressed viewpoints of other persons involved in the treated trauma, this implies that these interactions of the trauma-related persons have quantum-gravitational transpersonal origin [7,14,20,39].

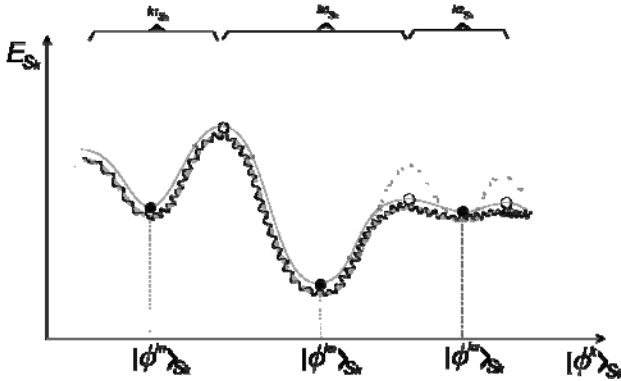


Fig 1. Schematic presentation of 'smearing' and associative integration of the memory attractor of psychosomatic disorder  $\phi^{k_2}$  into normal ego-state  $\phi^{k_0}$ , via simultaneous effects of *visualization of the psychosomatic problems* and *tapping/ touching of some acupuncture points*, in *meridian (psycho)therapies* – which might be interpreted as successive imposing of new boundary conditions in the energy-state space of acupuncture system/consciousness  $E_{S_k}(\phi^{k_i})$  – when memory attractor of the initial psychosomatic disorder  $\phi^{k_2}$  (dashed line) becomes shallower and wider (full line), with greater overlap and followed associative integration into memory attractor of normal ego-state  $\phi^{k_0}$ .

#### IV. CONCLUSIONS

It is evident that some biocybernetic models of brain's hierarchical neural networks, presented in Sect. II (*self-organized mapping* neural networks, *associative* or *attractor* neural networks,

and classical and neuro-quantum *sinergetic* neural networks), demonstrate encouraging advances in modeling cognitive functions – which is not surprising having in mind that information processing on the level of central nervous system is going *via* hierarchically organized and interconnected neural networks. However, for modeling most cognitive functions the subtle biophysical Hopfield-like quantum-holographic body's acupuncture neural networks are necessary as well, combined with quantum decoherence theory, as presented in Sect. III.

On the one hand, they demonstrate existence of two cognitive modes of consciousness (direct religious/creative one, characteristic for quantum-coherent transitional and altered states of consciousness, and indirect perceptively/rationally mediated one characteristic for classically-reduced normal states of consciousness) – together with conditions for their mutual transformations. On the other hand, they represent natural framework for explanation of contemporary meridian (psycho)therapies for fast removing of numerous psychosomatic disorders (traumas, phobias, allergies, post-traumatic stress...), demonstrating that acupuncture system is closely related to consciousness – with significant psychosomatic and transpersonal implications. Fundamental bases of quantum-holographic paradigm are considered too, with implication that whole *psychosomatics is quantum hologram*, both on the level of *individual and collective consciousness*.

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