

BIOPHYSICAL BASES OF THE ACUPUNCTURE AND MICROWAVE RESONANCE STIMULATION

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Abstract. In this paper biophysical bases and frontiers of complementary medicine are considered, and essential significance of its resonance microwave (MW)/ultralowfrequency (ULF) electromagnetic (EM)/ionic nature as well as the quantum-holographic "electrooptical" neural-network-like-function of the acupuncture system are pointed out, as supported by microwave resonance therapy (MRT) of the psychosomatically disordered acupuncture system. At the same time, the non-threshold gap-junction-based self-assembling of the acupuncture system presents an explanation for the extreme sensitivity of the organism upon the influences of weak external MW/ULF EM fields.

Keywords: Acupuncture, microwave resonance therapy (MRT), biophysical bases, electromagnetic/ionic system, quantum-holographic-neural-network function, non-threshold gap-junction self-assembling, anabolic (yin, Shakti, feminine, lunar, alkaline) negative aeroions, catabolic (yang, Shiva, masculine, solar, acidic) positive aeroions.

INTRODUCTION

The yin-yang concept of acupuncture, as a network of energy-information processes of an organism, originating from the very embryological development, represents one of the most specific and most useful segments of the renowned Chinese traditional medicine [1-3]. The Western science has included acupuncture through the World Health Organization, but not its very archaic philosophy. In the definition of contemporary scientific acupuncturology it can be said that acupuncture deals with somatotrophic representation of organs and tissues on the surface of the body, on the extra-bioactive acupuncture (trigger) skin points. By their biophysical activation one can accomplish effects which are manifestation of the nervous (peripheral, autonomous, and central) and endocrine systems, owing to interaction and integration of sensitive stimuli. Out of numerous effects of acupuncture stimulation, the most significant in prevention, therapy, and rehabilitation are analgesia, broncho-vasodilation, and immunological responses.

In Chinese tradition the word acupuncture means insertion (acus - needle), and is related to the insertion of needles in strictly specific locations on the skin (acupuncture points), which regulates the flow of the qi entity within its energy paths (acupuncture channels or meridians), interconnecting appropriate acupuncture points. According to

Beside 12 paired channels, which are great double circulation of the qi entity, Chinese tradition has also depicted 2 middle channels, the back one and the front one, independent of the great double qi circulation. These central meridians do not correspond to organs but their functions, being stimulated in the case the meridians of the organs do not react appropriately upon stimuli.

There are 794 (397 + 397) main extra-bioactive points (acupuncture points) on the body. The points can be stimulated by sticking metallic needles, but also by heat, pressure, magnets, weak laser beam, ultralowfrequency currents, microwave resonance, aeroionic, and biotherapeutic stimulation [1-3].

Indian traditional medicine, and especially one of its most prominent representatives, swara yoga, is also acquainted with an energy system analogous to the Chinese acupuncture system: in Indian terminology the qi entity is known as prana, and meridians as nadis (14 of them being basic, like in acupuncture, although three of them being of special medical and spiritual significance: ida, pingala, and shushumna - being interconnected with brain's limbic system) [4].

The ida activation influences hypothalamus and hypophysis, and thus the hormone growth synthesis and anabolic (Shakti, Fig. 2 left) processes. This channel starts from the spine base, flows upward left to the backbone and terminates in the left nostril, branching into the fine capillars. This channel is active when the left nostril dominantly operates, i.e. when contralateral right hemisphere is more active.

The pingala activation influences hypothalamus and thalamus, but not hypophysis, thus activating catabolic (Shiva, Fig. 2 right) processes. This channel also starts from the spine base, but flows upward right to the backbone and terminates in the right nostril, branching into the fine capillars too. This channel is active when the right nostril dominantly operates, i.e. when contralateral left hemisphere is more active.



Figure 2. The ancient Indian concept of the left-hand side of the body as a female (Shakti) and the right-hand side of the body as a male (Shiva), through the representation of the Hinduistic deity Arda Narishvara [4].

The shushumna is interconnected with corpus callosum (connecting two brain's hemispheres) and cerebellum. This channel also starts from the spine base, being positioned between ida and pingala: its energy flows through the backbone, and terminates on the top of skull at the fontanella (the "soft bone" on the child's skull, which hardens after 3-6 months after birth). Shusumna is active very shortly, in the time intervals of interchanged activities of ida and pingala. Shusumna is the only channel which passes through all chakras i.e. main acupuncture points alongside the backbone, being functionally interconnected with neighbouring endocrine glands.

Through its interrelation with endocrine glands, these three nadis influence biochemistry of the whole organism. Also, these channels are interconnected with the sympathetic and parasympathic autonomous nervous system, which implies that the acupuncture mechanism, initiated by acting upon the acupuncture points at the skin surface, is achieved via activation/deactivation of the autonomous nervous system, spine and brain.

ACUPUNCTURE SYSTEM AS AN ELECTROMAGNETIC/IONIC QUANTUM-HOLOGRAPHIC ELECTROOPTICAL NEURAL NETWORK

Besides its practical medical aspects, Chinese traditional medicine is deeply colored with mystical connotations, which was one of the reasons why Western science has been hardly accepting experiences of Eastern tradition. The second reason was that within the 12 visceral organs corresponding to the 12 paired channels, Chinese tradition has not included the brain and endocrine glands: however, in the past few decades it has been found that the acupuncture system is in close functional interaction with both central nervous system and endocrine system, as well as with peripheral and autonomous nervous systems [1-3]. The final reason was a lack of clear anatomical basis of the Chinese acupuncture system: however, new investigations of specific intercell channels (so called gap junctions (GJ), Fig. 3, an evolutionary older type of intercell communications, transporting ionic electrical signals between excitable cells, whose conductivity can be modulated by intracellular pH-factor, Ca²⁺-ions, neurotransmitters and second messengers, and even by voltage [5]) have shown their ~ 10 times increased concentration inside the acupuncture points [6]. A better organization of cell structures and an ionic basis of the qi entity of the acupuncture system is also suggested by ~ 10 times higher skin electrical conductivity of the acupuncture points in respect to the surrounding tissue, as well as much higher reabsorption of aeroions in these points [2]. It should be added that the flow of acupuncture ionic currents through GJ-channels is presumably converted in charged solitonic transport alongside microtubular cytoskeleton [7] being again converted in ordinary ionic electrical signal at the GJ-channels of the opposite side of cell membrane.

Ionic acupuncture currents, and accompanying electromagnetic (EM) fields, have ultralowfrequency (ULF) and microwave (MW) components, i.e. the very fast MW component is modulated by significantly slower ULF component [8-11], this being in overall agreement with the frequency and power windowing in tissue interactions with weak EM fields [12].

In support to the ULF nature of ionic currents in acupuncture channels, one can cite the resonance ULF stimulation of the acupuncture analgesia endorphin (at ~ 4 Hz) and serotonin and/or norepinephrine (at ~ 200 Hz) mechanisms [13], as well as the efficiency of the German school of the resonance ULF therapy [14].

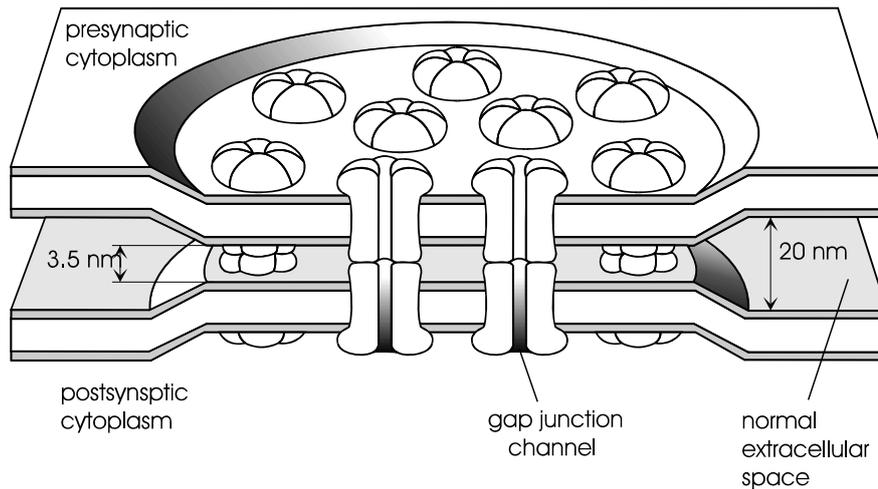


Figure 3. A three-dimensional model of the gap junction channel based on X-ray diffraction studies [5]. Each apposite cell contributes half of a channel (hemi-channel) called a connexon. Each connexon (~ 1.5 nm in diameter) is formed from six hexagonally arranged protein subunits (~ 7.5 nm in length) called connexins. At gap junctions the cells are only ~ 3.5 nm apart, in contrast to normal separation of ~ 20 nm.

On the other hand, the evidence for the MW component of ionic acupuncture currents is provided by the efficiency of the Ukrainian-Russian school of the resonance MW (~ 50-80 GHz) therapy [15,16], implying that acupuncture system is a dynamic structure differentiated at the locations of maximums of three-dimensional standing waves, formed as a result of the reflection of coherent microwave (~ 100 GHz [17]) Frohlich excitations of molecular subunits in the cell membranes, proteins, microtubules etc. - supported also by other investigations which have demonstrated that differentiation of gap junctions (of higher density at acupuncture points) is sensitive to voltage [5].

In this context the explanation for efficiency of the microwave resonance therapy (MRT), as noninvasive nonmedicamentous medical treatment, should be sought [8-11]: some disorders in the organism give rise to deformation in the standing wave structure of EM field of the organism in MW region, which influences corresponding changes in spatial structure of the acupuncture system, and consequently the resonant frequencies of its channels, resulting in some disease. During the therapy, applying the MW sound at corresponding acupuncture point the excited acupuncture channels of the patient are relaxing to the previous healthy condition, while reaching their normal resonant frequencies response upon the wide spectrum MW source - and following to physiological mechanisms of the acupuncture regulation [1-3] the organism biochemically overcomes the disease.

The quantum-like coherent characteristics of the MRT (sharply-resonant sensory response of the disordered acupuncture channels, extremely low-intensity and low-energy non-thermal biologically efficient MW EM radiation, and negligible MW energy losses down acupuncture channels) should be also pointed out [15,16], which might be viewed as a consequence of the existence of Sit'ko's nonlocal selfconsistent biological macroscopic quantum potential, which might give rise to nonlinear coherent EM MW long-range maser-like excitations of biological nonlinear absorption medium with the cells as active centers - with acupuncture channels related to eigenfrequencies and spatio-temporal eigenwaves distributions of every individual biological quantum system.

This suggests that healthy state might be considered as an absolute minimum (ground state) of the nonlocal selfconsistent macroscopic quantum potential of the organism, some disorders of an acupuncture system corresponding to higher minima of the (spatio-temporally changeable) potential hypersurface in energy-configuration space [8,11], which possibly explains the higher sensory responses of the more disordered acupuncture system (with higher and deeper minima, from which the system has to traverse into the ground state by the applied MW energy) and weak MRT sensory response of the healthy acupuncture system being already in the ground state (cf. Fig. 4). Such a picture is very close to those of associative neural networks in their energy-configuration spaces [8,11], and to pattern recognition as convergence of the neural networks to the bottoms of the potential hypersurfaces, being the attractors of neural networks memory patterns [18,19]. This similarity of the neural network and quantum pictures might not be only superficial, as the (real-valued) mathematical formalism of Hopfield's associative neural network models [18] is analogical [19] to the (complex-valued) mathematical formalism of Feynman's propagator version of the Schrodinger equation [20]. In support to this, there are strong indications [21] that biological neural networks essentially cooperate with quantum networks in the brain.

This also supports the EM/ionic MW/ULF quantum-holographic function of the acupuncture system (like complex oscillatory holographic Hopfield neural network [19]), and its essential relation to (complex-valued quantum relativistic) consciousness, as strongly suggested from modeling of altered and transitional states of consciousness [8-11]. It should be added that the displaced part of ionic acupuncture structure in these states would have a function of an "optical" MW sensor, which can extrasensory perceive an environment, as reported by patients reanimated from clinical death [22]. In the same context, the qi entity has its theoretical interpretation in ions, out of which the positive ions having catabolic influence (yang, Shiva, masculine, solar, acidic [4]) flowing predominantly through the right circulatory part of the acupuncture system, while the negative ions having anabolic influence (yin, Shakti, feminine, lunar, alkaline [4]) flowing predominantly through the left circulatory part of the acupuncture system [8-11], with information contents coded in the form of spatio-temporal patterns of currents and MW and ULF EM fields.

So, it can be said that beside brain's hierarchical electrochemical neural network there exists acupuncture electromagnetic/ionic microwave/ ultralowfrequency modulated quantum-holographic electrooptical neural network, with brainwaves being both the interface between them and ULF modulating factor of MW acupuncture network, implying also biophysical basis of psychosomatic disorders i.e. influence of psyche on the body [8,11]. At the same time this presents explanation [8,11] for the sensitivity of the organism on the influences of extremely weak external MW/ULF EM fields [12], through MW/ULF EM induction within EM/ionic circulatory acupuncture system, thus modulating acupuncture currents by external EM fields, without any limitations by threshold potentials which do not even exist within gap junction electrical synapses of the acupuncture system [5].

This is in accordance with the enhanced cell growth toward (negative) cathode and reduced cell growth toward (positive) anode in small continuous, pulsed or focal electric fields [22,23], in consistence with the model that the mechanism underlying acupuncture is similar to that of growth control, acupuncture points being the organizing centers in morphogenesis [24]. Such an interpretation is additionally supported by electropuncture therapy, where negative pulse stimulation of a point tonifies its corresponding function while positive pulse stimulation sedates the function [25], implying that a tonification of the

organ is related with its regenerative anabolic yin overall function while the sedation is related with its degradative catabolic yang overall function. Therefore, the role of acupuncture stimulation might be the balancing of activity of the positive and negative ions within the body, corresponding to healthy functioning. Besides, it seems that the external qi gong treatment [26] or healing process [27] might be related with the ionic diffusion between the healer and healee and/or information transfer of the MW/ULF EM patterns responsible for normal functioning of acupuncture system and overall health [8,11].

This also implies the significance of aeroionic balance [8-11,28,29] and regular rhythmical breathing, recognized in Indian tradition: according to swara yoga [4] the rhythmical breathing through nose is especially important, in order to inhale as many as possible aeroions (prana) within the two (out of three) most significant nadis (the left ida and the right pingala, with their entrances in corresponding nostrils). This is recommended in fresh and nonpolluted air, when even some excess of negative ions exists, with the relaxing healthy influence on the body; in the same context, in closed environments a microclimate engineering can be recommended by applying aeroionizers which produce an excess of negative ions [8,28].

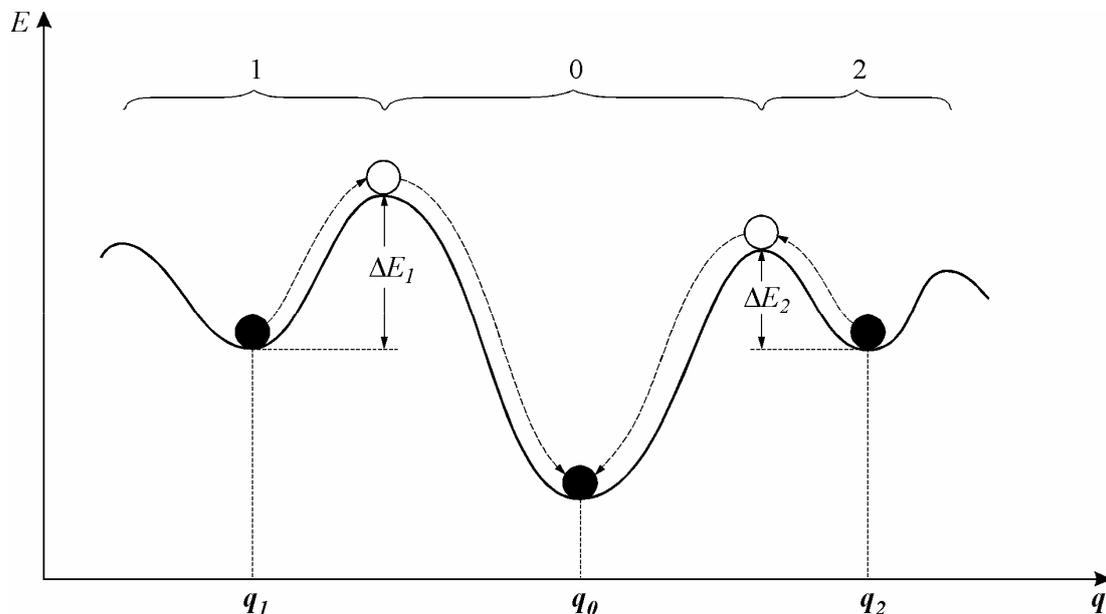


Figure 4. Schematic presentation of the potential hypersurface of nonlocal selfconsistent macroscopic quantum potential of the acupuncture system of an organism in energy-configuration (E,q) space: 0 - basin of attraction of the ground (healthy) state q_0 ; 1 and 2 - basins of attraction of the two excited (disordered) states q_1 and q_2 . It should be pointed out that energy surface changes gradually during the MRT treatment, by decreasing the potential barriers ΔE_1 and ΔE_2 (and corresponding MRT sensory responses) of the potential wells 1 or 2, to be overcome in traversing to the 0 basin of attraction of the ground (healthy) state, when organism gradually recovers by further spontaneous approaching the healthy state q_0 (with poor MRT sensory response, as already being in the ground-state). Such a picture is very close to the associative neural networks ones in their energy-configuration spaces, and to pattern recognition as convergence of the neural networks to the bottoms of the potential hypersurfaces, being the attractors of neural networks memory patterns q_0, q_1, q_2 .

Physiological significance of the chemical nature of aeroions is still not clear. Russian investigations showed [28] that functional effect of ions of the same polarity but different chemical composition (small gaseous anions O_2^- , O_3^- , H_2O^- , ... and cations NO^+ , H_2O^+ , CO_2^+ , ..., heavy aqueous complexes of anions $O_2^- (H_2O)_n$, ... and cations $H_3O^+ (H_2O)_n$, ..., etc.) is basically equal, implying that aeroionic action is achieved by yielding its charge to biological object. However, it was also shown [30] that negative ions have physiological influence on the increase of tracheal ciliary rate in rabbits only in presence of O_2 in air, while positive ions have physiological influence on the decrease of tracheal ciliary rate in rabbits only in presence of CO_2 in air - implying possibly physiological significance of O_2^- and CO_2^+ aeroions in nostrils, as necessary precursors for dominating inhaling of negative aeroions by ida and positive aeroions by pingala (in their alternating ~ 1 hour active phases, respectively) [8,11], with their corresponding terminations in left and right nostrils, in swara yoga physiology [4]. So, in nasal ida-phase (Shakti), with left nostril activated, and whole left half of the body and right brain hemisphere too), in exhaling through (anabolic) ida in its nasal vicinity should dominate gaseous phase with less exhaled CO_2 and therefore relatively more gaseous O_2 therein, which additionally stimulates dominant absorption of negative aeroions by active left nostril, supporting ida-phase backward; on the other hand, in nasal pingala-phase (Shiva), with right nostril activated, and whole right half of the body and left brain hemisphere too), in exhaling through (catabolic) pingala in its nasal vicinity should dominate gaseous phase with more exhaled CO_2 and therefore relatively less gaseous O_2 therein, which additionally stimulates dominant absorption of positive aeroions by active right nostril, supporting pingala-phase backward. This picture is in accordance with the viewpoint of successive dominant flow of (negative) anions through the left circulatory part of the acupuncture system, and (positive) cations through the right circulatory part of the acupuncture system [8-11], with normal ultradian periodicity ~ 2 hours (i.e. ~ 1-hour dominance for left and right phases, alternately: ida-pingala-...[4]). Although this rhythm is not apparently in phase with ~ 24-hour acupuncture rhythm of successive dominance of 12 paired acupuncture channels (i.e. ~ 2-hour dominance for each organ-related channel with corresponding yin or yang functions in the following order: yin-yin-yang-yang-...[1-3]), it might be that every ~ 2-hour organ-related acupuncture phase (either yin or yang) needs complete ~ 2-hour nasal phase (ida-pingala) in order to balance activities of the corresponding organ-related pair of symmetrical left and right acupuncture channels [8,11], to enable both regenerative (anabolic, ida-like left meridian) and degradative (catabolic, pingala-like right meridian) organ functions, contributing finally to either yin or yang overall corresponding organ-effect from the viewpoint of Chinese traditional medicine [1-3]. This ionic interpretation of acupuncture system can be tested, in principle, by subtle electric and magnetic differences between the left and right symmetrical channels of the acupuncture system, and modulation in their electrical activities with ultradian rhythm periodicity, as stated above.

The above biophysical ionic interpretation of the acupuncture system can account for the origin of Chinese therapeutic yin-yang/tonification-sedation rules through the type/rotation of the needles [8,11]: yin syndrome (excess of negative ions in some left acupuncture channel) is tonified by taking in positive ions from air or taking off negative ions from the channel (through Ag needles working as anode) i.e. by rotating needles in counterclockwise direction on the left channel (thus closing its gap junctions for flow of negative ions) or clockwise direction on the corresponding right channel (thus opening its gap junctions for flow of positive ions); and yang syndrome (excess of positive ions in some right acupuncture channel) is sedated by taking in negative ions from air or taking off

positive ions from the channel (through Au needles working as cathode) i.e. by rotating needles in counterclockwise direction on the right channel (thus closing its gap junctions for flow of positive ions) or clockwise direction on the corresponding left channel (thus opening its gap junctions for flow of negative ions).

On the other hand, some other Chinese therapeutic rules need taking into account functional physiological interactions between acupuncture system and nervous and humoral systems [8,11]. For instance, Chinese therapeutic husband-wife rule (yang-yin/left-right) [3] is apparently opposite to Indian functional rule (Shakti-Shiva/left-right) [4] or our biophysical ionic rule (negative-positive/left-right), presumably as a consequence of the acupuncture therapeutic action on the one side of the body to produce effect on the other side by affecting the phase of (brain and nasal) ultradian rhythm, followed by subsequent intermediate contralateral brain-body neurophysiological effect. Regarding some other Chinese therapeutic rules (five elements, mother-child/regulation cycle/Sheng, destruction cycle/Ko, middle day-middle night, centrifugal-centripetal meridians etc.) [3], they are presumably based on intermediate humoral physiological effects between spatio-temporal nonsubsequent meridian-related organs.

Finally, from the functional viewpoint [3,4], it seems that Chinese ren and du central acupuncture channels correspond to Indian ida and pingala nadis respectively [8,11], which start and intersect upward (with shushumna nadi in Indian tradition too, having not its Chinese counterpart meridian!?) in Indian chakras [4]. Also, 14 Chinese meridians (12 paired and 2 central) might be functionally related to 7 Indian chakras [8,11]: (1) ren meridian vs. muladhara chakra; (2) kidney/bladder meridians pair vs. svadhishtana chakra; (3) spleen/stomach meridians pair vs. manipura chakra; (4) heart/small intestine & pericardium/triple energizer meridians pairs vs. anahata chakra; (5) lung/large intestine meridians pair vs. vishuddha chakra; (6) liver/gallbladder meridians pair vs. ajna chakra; and (7) du meridian vs. sahasrara chakra.

CONCLUSION

In this paper biophysical bases of acupuncture-based stimulation were considered, and essential significance of its resonance MW/ULF EM/ionic nature was pointed out, as well as biophysical bases of psychosomatic disorders on the level of acupuncture system.

Particularly, the macroscopic quantum-like coherent characteristics of the Microwave Resonance Therapy (MRT) of the disordered acupuncture system suggest that healthy state might be considered as an absolute minimum (ground state) of the nonlocal selfconsistent macroscopic quantum potential of the organism, some disorders of an acupuncture system corresponding to higher minima of the (spatio-temporally changeable) potential hypersurface. in energy-configuration space.

Such a picture is very close to the associative neural networks ones in their energy-configuration spaces, and offers a new insight in the mechanisms of the more abundant dynamic assembling of the gap junction hemichannels and hence acupuncture points and channels - upon the internal microwave MW electromagnetic field spatio-temporal maxima at the temporary position of the acupuncture system, modulated also by ultralowfrequency ULF brainwaves EM fields - and hence the very biophysical nature of the temporary psychosomatic health or disease.

At the same time this presents explanation for the extreme sensitivity of the organism upon the influences of weak external MW/ULF EM fields, through the MW/ULF EM

induction within EM/ionic circulatory acupuncture system, thus modulating acupuncture currents by external EM fields, without any limitations by threshold potentials which do not even exist within gap junction electrical synapses of the acupuncture system.

Also, the different ionic nature of the left and right circulatory parts of acupuncture system was pointed out, reconciling Chinese and Indian traditions as well as the author's biophysical ionic interpretation of qi, according to which the positive ions have catabolic influence (yang, Shiva, masculine, solar, acidic) and flow predominantly through the right circulatory part of the acupuncture system, while the negative ions have anabolic influence (yin, Shakti, feminine, lunar, alkaline) and flow predominantly through the left circulatory part of the acupuncture system.

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