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**ELECTRICAL PROCESSES
IN THE BODY**

Monography based on Ph.D. research data

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Numerous responses to the first edition of the paper in 2008 helped me eliminate uncertainties, outline the hypothesis more clearly and comprehensively. I am grateful to everybody who has sent me his comments and suggestions, especially to Professor V.I.Baev, Doctor of Science, and Lipkin A.I., MD, PhD.

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"... In general, the author's drawing attention to the role of electric processes and phenomena in the body functioning evidently deserves attention. Probably, it would be interesting and useful to listen to the author's report on the subject under discussion at a meeting at the Department of Medical-Biological Science of Russian Academy of Medical Science".

Correspondent member of RAMS, Prof. E.A.Umruikhin, PhD (Biology)

"...The hypothesis suggested by the author helps makes more accurate a number of electrophysiologic approaches and broadens possibilities of aeroionization... the author's hypothesis of "interaction of electric currents and fields in the body" contains a number of suggestions concerning the "internal" electricity... the hypothesis deserves attention and requires further scientific substantiation".

Honored Doctor of RF, Academician of RAMTS, Prof. S.A.Azov

"... experts of the Institute (the State Research Institute of Military Medicine of Ministry of Defense) have read the brochure by M.E.Bocharov, PhD (Engineering), "Electric processes in the body" and hold the opinion that the hypothesis suggested by the author contains some positive aspects which make possible to explain the processes of hemodynamics and breathing in a new way... though ideas expressed in the hypothesis are not indisputable and require experimental testing and confirmation. Nevertheless, they deserve attention and evaluation of their application in military medicine".

Head of SRI of Military Medicine of Ministry of Defense RF I.Bukhtiyarov

Introduction

The environment (the earth and the air) of a living organism is negatively charged which is historically determined. Under evolutionary development "... all liquid media (cell protoplasm, intercellular fluid, lymph and blood) are electrostatic colloids, as their particles are negatively charged. Plasma and all elements of blood (erythrocytes, leucocytes and platelets) are charged the same and it creates an electric thrust (electrical repulsion due to the like charges) between them and prevents them from colliding and aggregation. This creates favorable conditions for blood circulation". [1] The same mechanism of electric repulsion between blood particles is examined in the work by A.A.Mikulín [2].

Electric power is independently produced by the body cells by separating ions and forming a membrane potential. Recent research has shown that field intensity in the cytosol filling the cell, may reach significant values up to 16 million V/m, though until now the potential was thought to exist only on the cell membrane and the field within it was considered to be absent [3]. Still, inner "electricity" (under the term "electricity" we mean electric charges) is not sufficient for a living being, which is most probably caused by the habit to get negative "electricity" from outside. A.L.Chizhevsky (1897-1964) discovered physiological effect of atmospheric "electricity". Chizhevsky's experiments with mice to determine effect of positive and negative ions on the body are well known. The experiments proved that only light negative ions of air oxygen were favorable for a living being and, on the contrary, exhaled air contained a lot of positive ions.

In different periods of time there were hypotheses advanced that could explain the mechanism by which negative ions get into the body and biological effect they produced. So, according to hypothesis by A.L.Chizhevsky and L.L.Vasilyev (b.1930) there is a constant electric exchange, consisting of pulmonary and tissue phases, between the body and the environment. There are also hypotheses by A.R.Kruger (1973) of "serotonin irritability"; by N.I.Goldstein (1982) of activity modulations of the nerve centers and brain structures functionally associated with chemoreceptors of the nose; M.S.Machabeli (1962- 1988) of thrombohemorrhagic syndrome and loss of negative charges preceding cell death; V.L.Voeykov (2002) of variety of rhythms which occur in the processes with "active forms of oxygen" (V.L.Voeykov's terminology), Nevertheless, the role of negative "electricity" and the mechanism of its penetration into the body has not been determined yet.

Researches conducted by biologists from London University College [4] disprove a well-known theory that " ageing occurs due to molecular damages caused by the reactive forms of oxygen". So, the findings [4] prove that "the level of damages caused by reactive forms of oxygen is insignificant and solution of the mystery of ageing must be sought somewhere else".

The hypothesis presented integrates the already known facts and shows the "electrical" aspect in understanding physiological processes in the body. The suggestions and statements do not contradict the basic of electrobiology or electromedicine. The hypothesis takes into consideration the fact that all types of electric conductivity are present in the living organism – ionic, electronic and p-type. The quantitative correlation of the conductivities depends on a certain organ and its function. Of course, the hypothesis needs correction upon additional electrobiological investigation.

Findings of engineering research as a hypothesis prototype

The principles of blood flow in the cardiovascular and lymphatic systems, as well as the way the air passes in the respiratory system are known in medicine. Though the findings [5] obtained on studying ionized gases passing through electrically charged conducting and dielectric air ducts make corrections to the well-known processes. Thus, the goal of the research [5] was to reach the natural level of ionization with negative air ions in poultry cages in breathing area of chickens. It is widely known that additional negative air ionization within the breathing area of poultry significantly enhances its productivity. The efficacy is caused by the actual situation in the poultry-house, particularly in the cage, as the breathing area there almost completely lacks negative ions with an excess of positive ones. The problem was that the incoming atmospheric air was almost fully deionised while passing through air ducts, and ionizers were difficult to install in the cage or in the poultry-house because these are high-voltage equipment, which should not be close to the poultry, high cost of the equipment and its maintenance. The only acceptable solution is to ionize the incoming air. But additional centralized saturation of air flow with negative aeroions within the air duct did not produce any effect. Aeroions are absorbed by air duct walls, especially if there are any curves in it or its cross-section changes over its length. The problem was solved by giving a certain electrical potential to the air duct or its conducting layer [6, 7, 8]. The solution

offered significantly decreases the loss of aeroions and thus permits to combine ventilation and forced ventilation. This way is universal, safe and may be applied to any premises (industrial, public or accommodation space), as well as in transport (train and underground carriages, planes, etc.), where there is air intake including evacuation, e.g. in presence of sole exhaust ventilation.

Analogous to the technique discussed above is design of an intransitive transistor, when the voltage of the outer keeper (shaped as brackets) regulates the current passing through a silicon nanowire [44].

The effect obtained may be explained by the fact that the potential given to the inner air duct surface is similarly charged with the ions flow, which provides repulsion of electrically charged particles from the air duct walls under Coulomb's law. A deionized gas layer is formed between the inner surface of the air duct and the ions in the air flow, and due to that the flow of ions gets electrically isolated from the air duct and sets along the axis. Thus, a step was made in application of artificial ionization which permitted to hold an ionizer away from a person, protect an individual against harmful effect of artificial ionization and still produce a sufficient amount of aeroions in the room using a balanced system of ventilation.

Transfer of the above notions to physiology makes it possible to present the function of the body in a different light.

Cardiovascular system and "electrotaxis" of blood

Let us suppose that blood vessels serve as air ducts with circulating blood, which consists of 92 per cent of water and various elements, and the walls of the vessels and elements of blood [1] are (mainly) negatively charged, it permits the blood elements not only to repel from each other, but also from a negatively charged vascular wall, thus forming a deionized layer. The layer does not contain negatively charged particles and provides an electric thrust, vascular tone and a "lubricant" decreasing friction and improving blood flow. Here it goes not only about negative ions (better known as electrolytes of blood), but also about the particles of blood which have an additional charge, such as electron or a neutral particle, but having an electric polarization differentiated according to the volume (an inner positive charge and an outer negative charge of a generally neutral particle).

A suggestion that vascular walls are charged undoubtedly needs experimental testing. But in case it is correct, then, subject to a system of the body, elements of blood are involved in biological processes under a repulsing or touch force. This allows electrostatic force not only to regulate biochemical processes but also to affect blood particles and modify parameters of blood. The examples of such influence occur in practice but cannot be explained only in terms of biology as in [9] and presented below in the chapter "Body cavitation".

Well-known are the factors providing blood flow in the vessels: work of the heart, closed cardiovascular system, different pressure in the aorta and cava, elasticity of a vascular wall, valves of the heart and vessels, muscular layer of the vessels, and intrathoracic pressure. In addition to "hydraulic" factors there are electrocapillary phenomena, hypotheses of electroosmotic and electrophoretic blood supply and cell nutrition [10, 43], as well as other hypotheses [11].

The above-mentioned factors give rise to doubt in their capability to provide the process of blood supply (overcoming friction) and capillary blood flow (especially in the brain). We will try to add a missing link, that is, the principle of electrodynamic movement of blood due to the cellular energy of the vessels and electrostatic "lubricant", decreasing friction of blood particles against a vascular wall under the principle of deionized layer.

On considering a single vessel, it is easy to imagine the work of muscles forcing blood through the vessels or correlation of pressures, providing movement of liquid in the capillary, intracellular space and lymphatic vessels. The principle of a single vessel may be transferred, as a rule, to any organ, which has a great number of multidirectional capillaries, and where the blood flows in different directions. Despite a well-coordinated work of sphincters of arterial capillaries, such capillary network includes all types of capillary blood flow: from evenly fast to reverse. And this is chaos according to hydrodynamic laws, and it inevitably leads to stoppage of any blood flow, though it does not actually happen. So, a widely applied law, saying that the amount of blood passing through the vessels and its velocity depend on difference in pressure at the beginning and at the end of the vessel, is quite correct, but only if we fancy that the vessel is a water pipe with inflexible and stiff walls, and difference in pressures is rather significant. In reality, difference in pressures in a single vessel is small, and besides wall elasticity or work of muscles levels the difference even in

arteries to say nothing of capillaries. Besides, it is impossible to explain the fact of curving and even twisting of erythrocytes (7.5-8.3 μm) instead of creasing while passing through narrow capillaries (4-7 μm) in terms of hydrodynamics. We can rather suggest that excessive pressure will tramp erythrocytes at the narrowest point and completely block the blood flow. Now let us fancy that blood, which elements are in a certain way charged, passes through the vessel, and the vessel itself has a surface (the basal membrane, one of the layers of vessel, or tissues surrounding the vessel) with a like charge. This provides an electric thrust and the charged elements of blood are concentrated along the axis of the vessel, thus decreasing friction against the inner surface of the vessel. Besides, electric charge prevents the blood particles from agglutination and friction against the vessel, and consequently, from clot formation. This is a natural protection against atherosclerotic plaques on the wall of the vessel and therewith the lumen of the vessel, a capillary in particular, remains utmost open due to electric thrust without any additional muscular tension, as in capillaries lacking muscles and in capillaries supplying the walls of medium and large arteries with blood. This is particularly important for tissues containing vessels and exposed to mechanic effects. For example, external (tight clothes or compression), or internal pressure (the work of skeletal muscles) upon the vessels, would inevitably result in significant decrease or even complete arrest of blood flow, if we take into consideration only a "hydraulic" theory. But it does not happen in fact (except the application of a tourniquet). Let us compare two pressure forces a tourniquet and a tonometer cuff exert on the arm (BP measurement based on acoustic registration). In the first case blood supply below the tourniquet is completely absent, and as for the tonometer (sphygmomanometer) cuff, blood supply is absent only in large veins and arteries. Respectively, the force exerted by the tourniquet and the tonometer cuff will be different. But under the laws of physics if a solid with holes of various diameter in its section is under pressure (and the arm presents a solid with vessels and capillaries as holes), then the hole of a smaller diameter will close sooner than the hole of a larger diameter. It occurs under equal pressures within the holes (e.g. vessels and capillaries). In reality the pressures are different and, consequently, the capillaries should close under the pressure of the cuff sooner than vessels. Besides, large vessels have a muscular layer protecting its lumen. Then why is a tourniquet needed to stop blood supply in capillaries? The answer may be simple. The forces of electric thrust act through a short distance and are more noticeable in small vessels

- capillaries. It is only hydraulic blood pressure that resists a pressing force of the tonometer cuff. This pressure is weaker than the electric thrust. To overcome the electric thrust which is more peculiar to capillaries, the force of a tourniquet is required. Application of a tourniquet has a peculiar feature. The electric thrust may exist only in presence of electric charges brought mainly by the blood flow to the spot where the tourniquet is applied. On application there is still the blood flow, that is why a compressing force must be the most. After a while the electric charge providing the electric thrust decreases, so the tourniquet may also be weakened.

Atherosclerotic changes in the inner walls of the vessels with subsequent thrombosis of the arteries will be less probable on corresponding negative charge of blood particles and the wall of the vessel, which provides a reciprocal repulsion of charged particles of lipid (cholesterol) and the wall of the blood vessel. A negative charge of blood particles makes them keep some spacing from each other as well as from the walls of vessels, thus lowering blood clotting and helping fibrinolysis. The evidence supporting this conclusion was obtained on negative aeroion therapy leading to increased negative charge of the body were given in the works by Chizhevsky [12] and Skipetrov [1]. Then while considering characteristics of cholesterol and their division into "good" and "bad" ones, it is important to consider their ability to accept and hold electric charges.

Let us come back to the erythrocyte curling while passing through the capillaries. Suppose that on decreasing the diameter of the capillary to the size of the erythrocyte each point on the erythrocyte surface will be repelled from the inner like charged walls. There will appear forces directed to bending resulting in torsion. Besides, a charges biconcave erythrocyte is most suitable for its electrostatic torsion. The superficial charge of the erythrocyte is most probable to redistribute. On torsion a thicker edge gets nearer to the central depression and the reverse reflectivity of the edges and the center provide equidistance that means equal force of repulsive interaction of the twisted erythrocyte. Electrostatic effect on the blood flow increases as the diameter of the vessel decreases. Here we can recall the fact proved by Chizhevsky of erythrocytes rouleaux passing along the blood of healthy people. Since that time this property of erythrocytes has been called as "Chizhevsky's phenomenon".

Electrodynamic passage of blood through the vessels is based on changes in the charge along the vessel in response to the pulse wave which is similar to the muscular vaso-

motor effect or an action potential associated with activation and inactivation of ion membrane canals. Besides, the problem of electrodynamic blood flow in the muscular tissues is most probably imposed on the somatic nervous system using tangent synapses which are responsible for "a wave" of an action potential similar to the excitement of a nerve fiber or the "local current" theory.

Like electrostatics, electrodynamic effect influences more markedly peripheral blood flow. Effect of the electric field upon charged blood particles is the same as the work of a device known as a linear electric motor, in which electromagnetic field while moving along the linear stator also moves the rotor along its case. In doing this, the ring electric field moving along the vessel exerts a mechanical action both on charged and neutral particles, thus polarizing them and involving in movement. For the capillary blood flow inclination of sodium and potassium ion canals in the cell membrane in the line of the blood flow or against it may be significant. Ions passing into the cell or coming out of it may increase capillary blood flow.

It was Du Bois-Reymond in the 19th century [13] who spoke of chains of "electromotor" molecules to explain an injury potential. Unfortunately, imperfect electric devices did not allow him to obtain the necessary findings and his suggestion was later rejected.

Though, if the principles of potential electrodynamics in the cells are studied enough, the mechanism of electric field forming which "runs" along the vessel is more complicated and ambiguous. Sometimes its impairment may be diagnosed as the "pulse deficit". Alongside with the known means the electric "running" pulse wave may be formed by the mechanic potential gradient of pulsating blood acting directly upon voltage-sensitive ion canals of the walls. The examples of the like processes are mechanosensitive canals of auditory hair cells as well as ion theories of excitement (based on the suggestion that excitement is caused by changes in ion concentration within and outside the cell). Blood flow in this case will be as follows – a mechanic blood impulse (from a larger vessel) triggers the mechanism initiating changes in the membrane potential (due to the inner cell energy), and a successive electric pulsations of cell membranes along capillaries provides and increases blood flow in them. So mechanic pressure of pulsating inflowing blood provokes a response of endothelial cells, which membrane is turned into the interior of the vessel, causing electric pulsation of the membrane potential. It is intracellular energy that accounts for little power expenditures

to form capillary blood flow, particularly in capillaries without a muscular layer. Then, blood flow is formed mainly due to intracellular energy and not to the difference in pressure at the beginning and the end of the vessel or any other factors providing blood flow. This factor adds to the mechanism of electrosmosis and to an outer "running" electric potential created by the heart and nervous system for the vessels without a muscular layer and direct contact with vasoconstrictive and vasodilating nerves and may be defined as "electrotaxis".

We can not exclude the possible feedback, that is, electric pulsation of vascular cells, provoked by blood pulsation, overcomes a potential threshold of its outer membranes and provokes in turn successive additional (except a direct influence via vascular nerves) contractions of capillary muscles (microvibration analogous to the vibration theory by Arinchin [11]). Contractions of the muscles occur naturally with a short time lag from electric pulsation that serves an additional forcing-through factor of blood movement. Evidently, it is this process that may be noticed at an additional dicrotic wave of peripheral pulse. In this case the process of mutual regulation becomes clear. The stronger is the primary mechanic stimulus starting with a larger artery (e.g. on abrupt jump of loading), the stronger the secondary potential of electric pulsation and resulting muscular contractions. Here we must come back to curving or twisting of the erythrocyte while passing through a small capillary. One can suggest that a mechanic pressure the edges of the erythrocyte exert when touching the vascular wall causes an additional repulsive electrical impulse on the inner surface of the vessel aimed at "electrostatic" curving or twisting, and the amount of the response depends on the amount of mechanical pressure the erythrocyte exerts.

Disturbance of the above processes is one of the causes of vascular hypertension with subsequent illness, and correspondingly it triggers atherosclerosis and various impairments of local blood flow. More precise researches demand a technique which incorporates the elements of ECG, EEG, sphygmography and rheography. This part of electrophysiology needs additional research, still one can already suggest that an electric pulse wave originating in the heart and being registered with ECG on the surface of the body carries an additional (and above mentioned) load forming "electrodynamic blood flow".

At the same time it is necessary to mention that by changing the charge of a capillary wall one can also change metabolism through the layer of endothelial cells, this regulating cell nutrition (see details below).

More complicated processes from the viewpoint of electrical charges interaction take place in a damaged vessel on hemostasis with further healing and regeneration of tissues. Damage to the wall, and what is more, a rupture of the vessel results in damaged equipotential surface of the inside of the wall, and therefore decreases the electric thrust of the lumen of the vessel that causes an electrostatic attraction of its damaged walls. As for normal blood flow the induced negative charge on the vascular wall (inner membranes of endothelial cells) creates a neutral or even a positive charge on the outer surface of endothelial cells or a basal membrane due to polarization. Rupture or damage to the vessel results in interaction of coulomb forces between negatively charged blood particles (including thrombocytes), the edge of endothelial rupture or positively charged surrounding tissues (as the outer vascular layers are positively charged). That is, it is possible that electric attraction of tissues with different electric charges contracts the edges of a ruptured vessel. Such manifestation of electrotaxis may provoke angiospasm.

The same "loss" of a charge in the aeroion flow was observed on research into air ducts of forced ventilation. Rupture of the equipotential conducting surface of the air duct results in an abrupt decrease in aeroions concentration in the air flow, even if the air duct remains intact as in the form of dielectric insert.

The mechanism of "electrostatic" healing of wounds needs additional research, but nevertheless it must be considered alongside with already known factors of blood clotting. In other words, positive "electricity" added to the wound result in lesser blood loss and triggers the mechanism of endothelium and blood elements activation. To be applied in practice, positive ions may be used while treating open wounds, to stop bleeding and applying bandages, particularly while rendering emergency aid in field environment.

Similar 'instructions' for application of "dead" and "live" water may be found in myths. If we assume that positive ions prevail in "dead" water and negative – in "live" water, then this way of healing wounds is easy to explain. "Dead" water stops bleeding and then "live" water adds energy to the body and activates its forces leading to cure. Russian epic heroes gained their strength (negative energy) by pressing themselves to the earth or embracing trees, mainly oak trees. Isn't it regaining negative electric charge of the body by contact electric exchange? The same effect has walking barefoot, especially on morning dew. All said above, alongside with aeroionization, present various ways to

enhance the negative charge of the body.

In spite of all above statements concerning general negative electric charge of blood, the fact is that blood, as well as some organs, contain large amounts of positive ions. But under the Coulomb's law, a single positive ion within a negatively charged circle (e.g. a small vessel section) will be attracted to each point on its inner surface and it equalize attracting forces from each point on the circumference. If negatively charged ions are concentrated along the axis inside the vessel, then positive ions will be arranged both in the flow among negative ions and inside a deionized (because of negative ions) layer of plasma. In this case ions are all the particles with a certain electric charge (due to a joint or removed electron) or a surface electric charge of a neutral particle (due to volumetric redistribution of electric charges). Of course, charges recombine by giving an electron when they collide. Besides, positive ions may retain their charge, being inside various volume-polarized molecules, such as hemoglobin. The above mechanisms are conventional enough, but still, due to them positive ions coexist with negative ions and play its role in the blood flow. This makes possible to explain a general negativeness of the body and simultaneous coexistence of both negative and positive charges making the foundation of electric balance of the body.

Electric negativity in some organs may be weakened or be completely absent depending on their function, and the organ itself or a part of it may even have a positive charge. Evidently, these are the heart, lungs, sudoriferous and salivary glands, kidneys, urinary bladder and GIT.

Conditions on which ions of Na^+ , K^+ , Ca^{2+} and Mg^{2+} join or give an electron are well-known, but their direction and intensity in the body and various organs may be regulated by means of different mechanisms, including the autonomous nervous system. The process of giving an electron (ionization) may take place in the organ which needs certain positive ions. For example, the heart needs ions of potassium and magnesium for its normal functioning. It's highly probable that atomic (or as a compound easy for ionization) potassium and magnesium is ionized and gives an electron, getting into the heart (which has a positive charge). The larger the positive charge of the heart, the more ions of potassium and magnesium may be discharged from the blood passing through it. And what does increase of a positive charge in the heart mean? For some reason it is an attempt to form an "electric clot" (this notion will be discussed in details later). That is, the cardiac muscle needs more K^+ и Mg^{2+} to

cope with the load and concentration of these ions increase in proportion to a positive electric charge of the heart. So, local changes of electric field strength in an organ or in a vessel allow to isolate a necessary amount of ions from blood by means of ionization. What is peculiar about the work of the heart is its closed electrical principle formed by localized electric impulses. For that reason the effect of fields and charges foreign to the heart are especially significant. The work of a defibrillator is based on depolarization of muscular cell membranes (sarcolemma) that provide their synchronous operation on subsequent depolarizations. In other words, a defibrillator eliminates an "electric clot" of different degree of its manifestation: from rhythm disturbances to cardiac arrest.

To relieve ventricular tachycardia it is recommended [14] to cough for some time, though nobody knows the mechanism of cough effect on the work of the heart. "...Cough is probably able to create a sufficient mechanic-electric energy to cause depolarization of the heart" [14].

This mechanism is probably the suggested inner electric exchange of charges. The effect of an electric charge leading easily to an "electric clot" will be discussed below. But the inner electric exchange may be regulated externally. For the heart the example is a defibrillator and different ways of temporary electric cardiac stimulation (cutaneous and transesophageal). Cutaneous method which is applied nowadays may be more effective when electromagnetic resonance is used with a required point of action upon the heart [15]. The principle of action in this case is creating a required level of action in the body due to resonance summation of a few signals directed from outward at a required point. Such an effect is possible to take; it is less traumatic, easier to survive by patients and have a shorter rehabilitation period.

"Sherbak's ion reflex" is known when galvanic current is applied to the skin of the left shoulder together with administration of drugs in order to change the functional state of the heart and lungs.

In most cases the vessels of the body and blood are more negatively charged than other tissues. Still, there are exceptions, such as excretory organs, in which blood and vessels may be neutral or positively charged, especially where the body releases positive electricity. Such a release occurs when excreted substances are given a positive charge. For example, positively charged carbon dioxide is exhaled, kidneys excrete not only metabolites and ex-

cessive water, but also positive electricity by excreting H^+ and decreasing pH. Neutral or even positive electric charge in kidneys is proved by the way kidneys pump blood through the nephron capillaries, particularly the Bowman's capsule as a kind of a "receiver" with afferent and efferent glomerular arterioles of different diameter. In this case the kidney may not electrodynamically support (due to its absence) the blood flow. Instead, additional hydraulic support is used which increases local blood pressure, thus maintaining the blood flow.

So the mechanism of electrostatic and electrodynamic action of electric charges upon the cardiovascular system lets us see some known processes of blood circulation in a different way.

But still, how does negative electricity get into blood and how is positive electricity eliminated? Let us consider this process in details by the example of the main "supplier" of negative electricity – respiratory system.

Electrical component of the respiratory system

As we know, the process of breathing is ensured by mechanical changes in the volume of the chest. When we inhale the following happens: the diaphragm and intercostals muscles increase the volume of the chest and exert a certain expanding effect on the lungs. The partial pressure of carbon dioxide releasing from blood dilates alveoli, and adhesiveness of their walls (viscosity of mucus) decreases surfactant protein. So it happens but only if a certain rhythm is followed. In other words, normal breathing is possible only within a certain range of alternating inhalations and exhalations. But how does gas exchange increase while running? Certainly, it happens because spare alveoli are enabled, and since the diaphragm moves more actively and blood flow increases, they are better filled with gas and release it. Though, this process is limited. For example, how can we accelerate chemical reactions with a surfactant or enhance its mobilizing capacity if physical activity increases abruptly? You can not achieve it only with exercise. Besides, diffusion of gases through the alveoli walls, as well as the amount of surfactant lipids, are limited. Moreover, intense activity of the diaphragm and intercostals muscles affects contraction of alveoli more than their dilation. It is well known that exhaled carbon dioxide is positively charged and we can not neglect an electrostatic component of breathing process. Then, what is the true mechanism?

Transfer of neutral oxygen into blood and discharge of positively charged carbon dioxide increases a volume charge in the alveoli. It results in increase of coulomb forces which affect positively charged inner walls of the alveoli. (especially at the beginning of expanding) and this leads, alongside with increased partial pressure of carbon dioxide (Dalton's law) to increased pressure in the alveoli, thus making exhaling easier. This effect is particularly evident on breath-holding. It should be emphasized that the electric thrust of alveoli is not limited by mutual repulsion of likely charged walls of alveoli and gases within the volume surrounded by the walls. Alveolar electric thrust also means repulsion of the likely charged and probably partially stuck together (in spite of the residual alveolar volume) walls during exhale. Then, positively charged carbon dioxide when passing into the lumen of the alveolus, as well as evaporating liquid, intensify mutual repulsion, and the alveolus stretches, taking the form of a balloon, simultaneously with a movement of the diaphragm and intercostals muscles. When doing so, the lipids providing diffusion of gases may have either a positive or negative charge in contrast to lipids in other vessels of the body. So, the body gets rid of positive electricity and the electric thrust of the alveoli allows to supplement the already know mechanism of breathing process.

But why does the hypothesis suggests that the oxygen that passes into alveoli and transfers into blood is neutral if the inhaled air contains ions of different character? Here, we must explain. Since the time of Chizhevsky, light negative ions of oxygen, that give their charge to the blood inside the alveoli, have been considered healthy. But, as later research showed, negative aeroions do not go deep enough and are limited by the nasopharynx. For example, K.P.Semenov (1989) [16] reports the findings of the experiment with chickens and rabbits, placed in the medium saturated with powdered coal. For the experimental group the air was saturated with negatively charged ions, unlike the control group. After two months the animals were dissected and their respiratory organs examined, the mucous membranes being studied microscopically. It was found out that the lung tissue of chickens and rabbits who inhaled dust-laden but artificially ionized air contained much less dust than that of those chickens and rabbits, who breathed the air without being ionized. Thanks to additional negative ionization of the air dust accumulated in the upper part of the respiratory tract and could be eliminated by cough or swallowing. Without artificial ionization a large amount of dust penetrated into the lower parts of the respiratory system. So, it was determined that negative-

ly ionized air prevents "dustiness" of the lung tissue. But powdered carbon contains mostly heavy ions, and how about light ones? In other experiments the amount of ions in different parts of the respiratory tract was determined, and the findings showed that aeroions of both character settle on the mucous membrane of the upper respiratory tract [17]. A.M.Skorobogatova (1955) [18] thought that "a larger or a smaller part of light and heavy ions in ionized air give their charges to the walls of the auriferous tract". N.S.Finogenov [18] doubted "that the alveolar part of the respiratory tract participated in physiological aspects of aeroionization". Besides, turbulence of the inhaled air in the nasal cavity does not leave any doubt that any negative ion contacts the mucous membrane on breathing. In this case one may state that negative ions (not only of oxygen) give their charge to the nearest mucous membrane (due to moisturizing of the mucous membrane having small transient ohmic resistance) when they get with inhaled air into the upper respiratory tract. In doing so, heavy negative ions in the form of charged particles of dust settle here without passing deeper. The same may be said of positive ions. This confirms the assumption that it is oxygen with a neutral electric charge that passes into the lower respiratory tract and participates in gas exchange.

So, let us suppose that the negative electricity gets into the body via the upper respiratory tract on inhaling. Then, the negative ion in the inhaled gives its electron on contact with the mucous membrane of the upper tract. Having received the negative charge, the mucous membrane, in turn, gives the electrons to blood and lymph particles, thus decreasing its negative charge. This is the way the lymphatic system and lymph nodes along the right, left and thoracic lymphatic duct participate in redistribution of negative electricity and its transfer primarily to the blood in the thorax. One of the probable causes of complications in other organs (as after tonsillitis) is the effect inflammatory process in the pharynx exerts upon the normal transfer of electricity by the lymph and disturbed supply of other organs with negative electricity (disturbance in the already formed paths of negative electricity in lymphatic vessels). This effect may show not only during illness but also after it. Maybe we should decide on tonsillectomy more carefully?

General regulation and transfer of negative electricity based on the principle of the "pulse wave" is performed by the nervous system according to the rhythm set by the heart and lungs.

Positive electricity is discharged on exhalation. In doing so, positively charged carbon dioxide and water vapors are eliminated from the positively charged lungs and pass (due to the exhalation force) through the upper respiratory tract, which may be either negatively charged (or neutral depending on the body's need in negative electricity). Electrical charges may be partially neutralized. If exhalation rate increases (as many breathing exercises advise) neutralization decreases. Besides, this process has its own regulatory principles. For example, on tachypnoe, when one automatically starts exhaling through the mouth, the negative charge in the nasal cavity does not decrease.

Measuring changes of the exhaled charge on exertion by varying its degree it will be possible to define an electrical adaptation of the body and thus make conclusions about health, mobilization resources and even about resistance to stress. Later we will discuss this case and some other cases in detail.

It turns out that electric exchange has evolutionally formed as intake of negative electricity with particles of air and discharge of positive electricity with carbon dioxide and water vapor. And this is really the most convenient way that the nature provided. Breathing through the nose and exhalation through the mouth is the most favorable mode of breathing even under the threat of infection via contaminated air or presence of allergic factors, as an increased negative charge is one of the protective factors of the body and thus cleans the nasal cavity. The process of sanitation presents suppression of pathogenic flora with the electric field [19] and its precipitation with other particles including various allergens onto the ciliated epithelium of the mucous membrane, preventing them from getting into the body.

The situation considered above is peculiar for air with a large amount of negative ions. But a modern person spends most of time indoors and on streets of towns in unfavorable conditions for negative ions. But when does the body take ions from the air? Presumably, prevailing of positive ions in the air gives the nasopharynx a positive volume charge, which will not get into the body as there will be no need for it. Negative electricity the body needs will be produced by the body itself or taken from the "reserve" (below we will discuss the storage reserves of negative charges in the body). After some time, the volume charge in the nasopharynx will create an electrostatic obstacle to intake of positive ions of the air. The person will find it difficult to breathe. Let us try to analyze difficult breathing in a stuffy room taking into account the hypothesis suggested. As a rule, in such cases we say that there

is too little oxygen in the room. Of course, there is less oxygen, but still within the life supporting norms of (19-24%). Still, there is no oxygen choking (less than 19%), and, as a rule, under other conditions drop of oxygen concentration is hardly felt, for example, low content of oxygen may be present in other premises or even in the open air. There are some more factors in a stuffy room: a higher temperature, a higher concentration of carbon dioxide and in addition there are some metabolites (anthropotoxins), but the most important disadvantage is a large amount of positive ions and complete lack (or a small amount) of negative ones. A stuffy room may be the result of a large number of people sitting in it. A disadvantage of negative ions decreases the rate of metabolism and electric exchange in the body and correspondingly the electric thrust of alveoli is disturbed. Besides, increase of positive volume charge in the environment creates an electrostatic obstacle to exhalation and inhalation of positively charged air. Here lies the main problem of a stuffy room. Switching on the air ionizer (generating negative ions, but not bipolar ones, or, what is worse, producing "mountain" air by its ozonization) we will not add oxygen to the stuffy room, but subjectively it will be easier to breathe only due to neutralization of positive ions and saturation of the air with negative ones.

Some more technical aspects

Quite separately we would like to discuss the phenomenon of "bipolar ionization". It occurs when the ionizer generates simultaneously or alternately positive and negative ions to a certain rate "determined by nature" (as an advertisement of bipolar ionizers says), or, at least is mentioned in СанПиН 2.2.4.1294-03 [20] (Sanitary Rules and Standards). Let us leave the definition of "natural rate" (concentration of ions seen in nature will be discussed later) at the discretion of those who manufactures bipolar ionizers, and as for the sanitary standards mentioned, they regulate the correlation of aeroions of different polarity in the room but not the principle of their generation. The principle of generation was determined by Method Instruction МУК 4.3.1517-03 [21], which contains some limitations for application of bipolar ionizers. Non-effectiveness of bipolar ionizers and in majority of cases their uselessness may be simply explained: positive ions are excreted by the body and negative ones are consumed by it. To give a person positive ions is the same as to give a laxative for diarrhea. And beside a person, positive ions are produced by plastic surfaces, electric device-

es and equipment. What happens if more positive ions are added by so-called "bipolar ionization" is unclear. The fact is that no one researcher confirmed the significance of positive ions for the body, vice versa, they note their suppressing effect. As for the presence of high voltage electric fields and electrodeposition of dust on the walls and ceiling, which are typical of unipolar (negative) ionizers, they are easily removed by means of various constructions, as in [6, 7, 8].

In one of advertising articles on "bipolar ionizers" there was an observation which proved, as the authors thought, the usefulness (!?) of positive ions. So, using statistical data concerning the average life expectancy (women in Russia live longer than men), it was reported that the cause of longevity among women was that housewives spend more time at the oven cooking, thus consuming more positive ions coming from fire. No comments, I think. Then why do steelmakers or men of other "hot" professions live relatively less?

By the way, a positive side effect of negative ionization is electrodeposition of dust, tobacco smoke and microorganisms from the ionized air and suppressed growth of opportunistic and pathogenic microorganisms [19] that means a partial restoration of the environment. It is the effect of restoration that led to appearance on the market of widely advertised home appliances cleaning the air and working "as an electric discharge generating aeroions" (citation from an advertisement). Devices of this type commonly use ozone, besides aeroions, to enhance the effect of air cleaning, and ozone is known to be a strong oxidizer, being limited for MPC ($0,1 \text{ mg/m}^3$). The symptoms of overdose are individual, but mainly they are tickling in the throat, allergic rhinitis or pain in the eyes. Some manufacturers of air cleaners do not conceal the fact that they use ozone, and justify its application saying that "the air is clean just as after the rain". But this is a wrong belief. It does not smell ozone after the rain! Concentrations of ozone which are higher than the threshold of olfaction in majority of people occur only after a thunderstorm. After the rain we smell the air which is usually polluted with smog and dust and which disappears for some time as the atmosphere gets cleaner. Besides, humidity of the air rises and its temperature drops, and this is an additional factor that affects our perception of fresh air. In the atmosphere, including the air in the room, some concentrations of ozone are always present, but the smell produced by any ionizer or an air cleaner is the evidence of exceeded MPC of ozone.

Required doses and concentrations of aeroions

The question arises: what is the required dose and concentration of aeroions? To answer the question it is important to realize that natural concentrations of aeroions differ greatly depending on weather and climate, season, time of the day, geographical position, etc. The concentration of aeroions may also be affected by natural water ionizers, particularly water sprinkling (tides, waterfalls, rain), some plants, particularly coniferous and acutifoliate (a cactus in front of the computer), natural radiation (the earth, parts of constructions made of sand, clay and gravel), etc. Besides, negative ions abound if they can not be destroyed by positive ions and the air is relatively clean (without smog and dust), as in the country or in the mountains. It certainly does not mean that people living in the country or at the seaside do not suffer from cardiac, pulmonary or any other diseases. People in seaside towns spend most of time in poorly ventilated rooms, and these are mainly flats with concentration of negative ions is less than 100 per ccm, just as in cities. The reason is that furniture in our flats is made of wood chipboard; construction and decoration elements are made of artificial materials, TV sets and computers are on, and open windows are protected with mosquito screens that do not allow negative ions into the room. But people living in the mountains and spending a lot of time in the open air far from "the wealth of civilization" are marked with good health and longevity. Of course, to make the experiment valid, it is important to consider certain features, such as heredity, lifestyle, availability of health care, etc.

A modern person finds himself sometimes in the environment with a wide range of negative aeroion concentrations: from 0-100 (in the room) to 1000-5000 (outside the room) and to 300 000 (seaside, waterfall) ions per ccm. If a person leaves the room with concentration of ions of 100 per ccm and less and goes out into the street, he may not feel the difference. How does the body adapt to such difference? It is very simple, here works the principle of a car battery – the charge does not take more than it needs. As it was said above, aeroions are consumed from the environment passing through the mucous membrane of the upper respiratory tract. Though the surface of the skin is larger but its transient resistance is higher, besides, the skin is covered with clothes mainly made of artificial fibers and marked electrostatic effect. The excess of negative electric charge passes from the mucous membrane inside the body till the body needs it. That is, after each inhalation the charge is taken

from the mucous membrane. The required saturation achieved, selection of a negative charge stops, and the remaining negative electric charge stays on the mucous membrane, gradually increasing with each breath. The accumulated charge creates the electric field which prevents negative ions from entering the nasopharynx from the air. That is, in the nasal or mouth cavity may appear so strong charge that the field created by it will not allow to inhale negative aeroions at a certain depth of breath. It is natural that to "forbid" negative aeroions to enter the nose which cavity is smaller than the mouth, the electric field should have the lesser intensity. This is one of the factors of reflex transition to mouth breathing when there is lack of negative "electricity".

The principle of a storage battery is easy to observe. Entering a stuffy room after a walk in the open air, the person will not feel difficult breathing at once, but coming out again, he or she will feel how pleasant the gulp of fresh air is.

There are two peculiarities to be taken into account – deeper breathing up to hyperventilation and a high concentration of aeroions in the environment, over 1 million per cubic cm. On hyperventilation, the inhaled ionized air flow overcomes the locking action of the charge in the nasopharynx, which results in nonuniform oversaturation of the body with negative aeroions (details will be discussed below). The first peculiarity is quite subjective and, as a rule, the symptoms of hyperventilation subside in no time. The second peculiarity needs additional research, though Chizhevsky and many others, as the author of this paper, did not feel any discomfort or symptoms while staying in the room, where the concentration of aeroions reached 1 million per cubic cm and more.

The principle of a storage battery may be applied to a dosage. An engine generator continuously supports line voltage in the car, and the storage battery is recharged from the main, when necessary. Duration and the current of recharge depend on the battery quality and the input current; the higher the input current and lower the quality of the battery, the more frequently it must be recharged and shorter the time the charge is stored. The same happens to the body: how long one should stay in the open air or have the ionizer on, depends on many subjective factors, such as age, state of health, etc.

A reasonable explanation for a required amount of negative ions was suggested by A.L.Chizhevsky [12] in 1939, and it was so-called a biological unit of aeroionization, which makes for a human being 8.000.000.000 of negative ions a day. This is the amount of aero-

ions inhaled by a person daily (with average indicators for the volume and rate of breath) providing he/she is in natural environment in the open air with the concentration of negative aeroions of 1.000 per ccm.

So, the suggested mechanism of negative electricity consumption from the air and the well-known facts do not allow to conclude that aeroions with concentration up to 1.0.000 per ccm are able to do any harm to a person even if they affect continuously. The body on its own will decrease consumption of negative aeroions to the required level using the internal mechanism of electrostatic self-regulation.

Aeroions sizes and the notion of aeroions "lifespan"

Favorable effect of negative ionization for the body was noticed long ago, but researches did not stop. As the transmitter of negative electricity is oxygen which goes down to the lower respiratory tract on breathing, it was assumed that it is light negative ions (an atom of oxygen with an electron) that are good for health. As for heavy (complex) negative ions, their consumption is not quite good and even harmful, particularly with a certain chemical composition of a heavy ion.

Though the hypothesis suggested and the findings obtained [16, 17] show that the size of an aeroion does not coincide with its usefulness. On normal breathing negative aeroions do not reach alveoli, and an electric charge is transmitted by the aeroion to the mucous membrane of the respiratory tract.

When positive and negative ions collide in the air, they recombine. Besides recombination, ions settle on the air particles and form heavy ions. Recombination speed and ion enlargement depend on some factors, as temperature, purity of the air, presence of air flows, and, of course, on the amount of ions of either character. Lifespan of an aeroion as a particle carrying an electric charge is limited and may be determined by means of an aeroions counter of a common aspiration type. During aspiration the device allows to count not all aeroions, but only those which give their charge to the contact surface. It means that heavy ions (with the charge distributed over its volume) and ions with a charge multiple of 1, will not be fully counted while passing through the aspirating chamber. Getting onto the mucous membrane this aeroion will give all its charge to the body. Prolonged time and humid air will facilitate the process. Thus, one-compartment aspiration counters results in faulty regis-

tration of aeroions and increases an error (inaccuracy of up-to-date counters reaches 40%). The best variant of the counter [22] even for mass consumption may be the model with electrostatic differentiation of aeroions by their character and weight with simultaneous counting of negative and positive aeroions.

On the basis of the lifespan of negative ions, being 10-30 sec [5], we can confirm that ideally a human being should always live in the environment with prevailing negative ions.

Electropotential mechanism of "borderline" breathing patterns

We can approach the answer to the question concerning the highest concentration of negative ions from a different point. Let us consider in details "borderline" patterns of breathing, such as delayed and deep breathing.

As we know, an average person can delay breath for about a minute, not more. After this time start irreversible processes in the brain. The main reason is lack of oxygen which is important for glucose decomposition with formation of 38 but not of 2 molecules of ATP, which are formed by glycolysis without oxygen. It means, that a minute or more is enough for the brain to utilize both the oxygen contained in a breath (before a breath delay) and the oxygen stored in hemoglobin, and then to anaerobically synthesize ATP due to glycolysis activation, and still, to flake out (unconsciousness) and die. Besides, there is evidence that the brain in need of nutrients switches to lactic acid [23]. Naturally, raising concentrations of ATP, AMP and phosphocreatine should be taken into consideration, but they do not cause fulminant hypoxia and death. Then, what's the matter? A different explanation is possible. The cause of death of asphyxiation lies in severe electric disbalance in the work of cardiovascular and respiratory systems. Breath delay causes disturbed gas exchange in the alveoli and accumulation of positively charged carbon dioxide and water vapor, besides, the inflow of positively charged blood from the heart enhances its positive charge. Accumulation of a positive charge in the parenchyma of the lungs slows down the positively charged blood flowing from the heart. As mentioned above, electrostatic interference with blood flow may cause complete arrest in blood supply of alveolar capillaries and subsequent arrest of blood flow through the lung artery. Electrostatic deceleration creates a hydraulic obstacle close to

the heart and decreases blood flow that results in a damage and rupture of the cardiac muscle and vessels often seen on autopsy of those who died of asphyxia.

Besides changes in the blood flow, electrostatic deceleration increases a positive electric charge of the parenchyma of the lungs resulting in increased positive charge of the cardiac muscle. This affects regularity of rhythm maintained by positive ions of potassium and magnesium. Electrostatic deceleration in the weak heart leads to arrhythmia before the hydraulic obstacle occurs, and in combination with hypoxia of the brain, that happens within a minute or more – to death. That is, the cause of death in this case is in local increase of a positive charge, which forms a cardiac-pulmonary "electric clot" disturbing the normal rhythm of electric exchange between the heart and lungs and leading to cardiac arrest.

We can compare, for example, the symptoms of "sudden" heart diseases leading to abrupt death which is commonly called a cardiac rupture. Such cases are quite common in the work of pathologists. We may assume that electric cause of the disease, for example, myocardial infarction and even headache, is the same – it is the deficit of negative "electricity" in the body at the moment of stress (below we will discuss the electric nature of stress).

An electrical component of tissue hypoxia may occur in poisoning, for example, cyanides, barbiturates, sulfides and poisons of biological origin. Discovery of tetrodotoxin when studying passage of ions of potassium through the axon membrane may serve as an example [13], and it is well known that tetrodotoxin is a component of a potion used in Voodoo cult (one may believe it or not, but it should be taken into account).

By regular exercises it is possible to achieve longer breath delay and even get used to some poisons (it was often practiced in the Middle Ages). Even fatal effect of an "electric clot" may be avoided by decreasing physical exertion (decrease of the heart rate) of applying external devices [15], restoring electrical balance of the heart and lungs. And this is a step to enhancing physical resources of man.

In this respect data presented by the expedition that studied extreme situation in lack of oxygen at high altitude may seem interesting [24]. Unfortunately, there was no study conducted of possible electric component of breath in the experiment offered.

In other words, it is possible that breath delay interferes with a common electric exchange of the body with the environment, and it is the path from the point negative energy enters the body through the upper respiratory tract (on inhale) and then through the system

of lymph- and blood flow via internal electric exchange in the cells, again through blood flow and exits via lower and upper parts of the respiratory system. It is internal electric exchange that is more important for the body comparing to the external one. Without external electric exchange the body experiences the deficit of negative electricity – it is harmful for health but does not lead to sudden death. Here we see the natural foresight inherent to the body. So, if conditions for external electric exchange are disturbed, a person just feels some discomfort (lack of negative ions), and he/she tries to get rid of it by going for a walk, for example. Disturbance of internal electric exchange is more hazardous for health, as may cause an "electric clot" and death.

In Chizhevsky's experiments laboratory mice being in deionized environment lost appetite by the 8-10th day and they became sluggish. Gradually the symptoms progressed: the animals were lying motionless, did not eat and died on the 13-18th day. Histological examination of the dead animals showed marked dystrophic and destructive changes in many internal organs: degeneration of the myocardium, hypertrophy and anemia of the lungs, fatty degeneration of the liver and kidneys, anomaly of the vessels (excessive blood supply in many organs). All morphological changes were typical of hypoxia [25]. This is a typical manifestation of a chronic tissue hypoxia due to the effect of an "electric clot" in the conditions of the deficit of negative atmospheric "electricity".

Thus, the electrostatic thrust of alveoli and easy exhalation require that the lungs have a positive charge and the trachea (composed of cartilaginous rings as an additional mechanic thrust on insufficient or absence of the electric thrust) and the upper respiratory tract have a positive or neutral charge. The negative charge of the mucous membrane of the nasopharynx should get into the body. Just as the person inhaling the air with negative ions "charges his storage battery" (the body receives the ultimate negative charge), selection of a negative charge from the nasopharynx stops or decreases. With high concentrations of negative aeroions in the environment the body is saturated quickly and increase in aeroions concentration will interfere with inhalation due to electric repulsion. If there is a necessity to increase the rate and depth of breath, then deep breath will surmount the limiting negative charge in the nasopharynx and "breakthrough" of a negative charge to the alveoli. Negative ions recombine in the alveoli with excreted carbon dioxide which is positively charged. Then the positive charge in the alveoli which (as was shown above) provided their electric thrust decreas-

es and gas exchange and breath impedes. It happens either if the concentration of negative ions exceeds the permissible rate (taking into account physical condition of a person) or on deep breath.

Maximum permissible doses of negative ions were discussed above, and deep breath from the viewpoint of the suggested hypothesis must be separated into forced deep breath without exertion and deep breath as a necessity on physical exertion.

As physical exertion increases and the breath gets deeper, the problem of ions penetrating into alveoli does not commonly arise. Negative ions are absorbed earlier, in the upper respiratory tract. Increased physical exertion (regular is better) activates metabolic processes in the body, upon which depends consumption of external electricity and discharge of internal positive electricity. After a while breathing becomes irregular and the body should adapt to a new level of exertion (of course if it is reasonable enough, but that depends on fitness). The new rhythm of the respiratory and cardiovascular system on a higher level of exertion may be thought as acceptable which improves wellness and makes feel comfortable while performing new tasks. In sport it is called "the second wind".

As for forced deep breath without physical exertion, it is characterized by a slow gas exchange, and consequently, slow discharge of carbon dioxide. On this type of breath negative ions may get into the lungs and recombine with positively charged carbon dioxide in the alveoli. It results in decreased electric thrust in alveoli. The body overcomes this obstacle by increasing the volume of blood pumped through the lungs (increased heart rate), that is increasing the positive charge in the alveoli and then increasing the rate of breath (one should recover one's breath). In doing so there occurs a reflex delay of exhalation and this allows to increase the concentration of positively charged carbon dioxide in the alveoli and thus to create the electric thrust. In support of this statement there is an evidence that such symptom of hyperventilation as slight dizziness appear after one breathes in deeply after staying in a stuffy room. So, if the concentration of negative ions in the environment changes abruptly, deep breath allows negatively charged oxygen to enter the alveoli and for a short time upsets the breath rhythm taken in a stuffy room aimed at saving negative electricity by the body. The same happens when a person breathes upwind. Undoubtedly, the wind force decreases the residual air volume, but also helps negative ions enter deep into the respiratory tract which upsets a usual (and discussed above) electric exchange in the lungs.

If we return to the definition of maximum permissible concentration of aeroions for a person, we can assume the following: the concentration of negative ions in the air is maximum permissible for an individual if a negatively charged aeroion can reach alveoli.

Thus, on prolonged breath delay resulted from saturation of the body with positive electricity, there appears an electric clot in the lungs upsetting the process of electric gas exchange in the lungs and cardiac function resulting in its arrest. On deep breathing without physical exertion the body gets oversaturated with negative electricity, which also disturbs and complicates the process of gas exchange in the lungs, but the electric clot does not form in this case and consequently, this process affects cardiac function less.

Breathing exercises

While considering borderline breathing patterns we cannot but stop at various well known breathing exercises. As a rule, all breathing exercises are reduced to forced breath retention in the lungs. Why? One of a few explanations is to increase the level of carbon dioxide in blood or stable decrease of breath rate. Herewith one can observe increased blood supply, drop of blood pressure and changed heart beat. We will not discuss the value of a high concentration of carbon dioxide in blood up to the level of eucapnia, but offer our own explanation of the efficacy of breath retention.

So, let us discuss an electric component of breath retention as an element of all breathing exercises. As well known, one of the functions of the exhaled carbon dioxide is discharge of positive “electricity” from the body, though carbon dioxide should have this very positive charge. On normal or deep breathing a part of exhaled carbon dioxide may lack a positive electric charge. Then we can view elimination of carbon dioxide from the body in terms of efficiency factor of elimination. Then it turns out that keeping breath we have some time to let positively charged carbon dioxide into the alveoli and due to extended exhalation we completely discharge it. Of course, we should take into account physical exertion, heart rate, elevation of blood pressure over normal values, etc. So, the breath retention after physical exercises, e.g. a run, is such a breathing pattern which is considered rapid at rest. All know, how to recover one's breath after a run, but it occurs to nobody to hold breath for long. The level of electric exchange processes in the body is so high that even drop of breathing rate to the increased level, but lower than on running, also means breath retention.

For the state of rest breath retention means either delayed exhalation or a long exhalation (inhalation). Besides, after a run it is reasonable not to stop, but walk for some time, and still better to do some breathing exercises (hands up while inhaling and down while exhaling). Somebody may think that straining our chest muscles we facilitate breathing. May be, but probably a better effect is gained because if we make use of the muscles which are less active on running, we stimulate blood supply at the points of electric clots formation, as in sharp pain in the chest or side (the details will be discussed below).

The suggested variants of breathing exercises are numerous enough, and some of them are quite special, but the general sense of them may be reduced to decrease of the breathing rate. Most efficient are breathing exercises in the forest, at the seaside or in the open air with high content of negative aeroions. Then, besides complete elimination of positive “electricity”, the body will be filled with negative one; there is a kind of “electrical airing” of the body and restoration of its electric balance. Moreover, breath retention disturbs usual electric exchange and correspondingly numerous "electric stress" in various organs that also facilitates improvement of health.

For example, breathing exercises practiced in yoga (prolonged breath retention) allows, alongside with other exercises, to be absorbed in meditation by using a system of successive electric stresses of the organs. Though an inexperienced person (and not uncommon a person weakened by a disease, but for whom the breathing exercises are meant), unlike a yogi, who expects such an effect, may feel dizzy or even lose consciousness; and such conditions limiting the application of the exercises should be stipulated by the instructions.

Supporters and sometimes opponents of each system of breathing exercises are many and it makes no sense to develop one more "correct" set of exercises. It is sufficient to have a notion of the mechanism of the effect and listen to one's body. When doing breathing exercises in order to get a desired effect it is more reasonable to control not the level of carbon dioxide in blood but the level of electric charge in tissues or the concentration of exhaled positive ions.

If most of up-to-date breathing exercises were deprived of unnecessary ritualism and sometimes sophisticated equipment, one could achieve a well known principle – deep regular breathing in the open air (saturated with negative ions). Herewith load on all groups of muscles following the rhythm of breathing is desirable. These are known to everybody

morning exercises, walking, jogging, swimming, etc. Many types of breathing and other types of exercises with one or other cultural bias (Tibetan, Chinese, Indian) known to us, at careful consideration present certain physical exercises (for all groups of muscles) with some elements of breathing control and naturally done in the open air. Cultural, class, historical limitations brought something peculiar to each of these systems of exercises. For example, in Tibet, in conditions of low oxygen content, swimming is not popular and one can not afford jogging in the mountains; for that reason in a well known Tibetan gymnastics only special exercises provide necessary load upon all groups of muscles. The can be said of ancient China – overcrowding of towns and monasteries, as well as class stratification of the society helped develop wu-shu exercise. Unlike China and Tibet such old cultures as Egypt, Mesopotamia or Greece did not leave us any special breathing exercises. In most cases, they did not need it. Lifestyle of people, who live in these areas supposed staying and free moving in the open air saturated with negative aeroions, particularly near water basins. Ancient Greece, which gave Olympic movement to the world, is a good example; there the electric balance of the body restored in games and sports competitions in the maritime air.

Let us apply our hypothesis to the well-known and simplest breathing exercise - yawning (long deep inhalation – breath holding – long or short forced exhalation) and try to understand its causes. Yawning may be caused by necessity of the body to additionally get rid of positive electricity. As a rule, yawning is a sight of tiredness, depression, boredom or just because one feels sleepy. How is it possible to overcome sleepiness without drinking coffee? That's right, it's better to breath in some fresh air by opening a window, or which is better by going for a walk and thus make supplies of negative electricity. Or, maybe one should get rid of excessive positive electricity by means of yawning. Contagiousness of yawning for the people staying in the same room is associated with deficiency of negative “electricity” for all (besides reflex imitation).

Besides, frequent yawning, as a sign of disseminated sclerosis, forerunner of migraine of epileptic seizure, indicate to a possibility to treat these diseases applying negative electricity.

Weight lifters or sprinters also yawn sometimes during active training or competitions, and sometimes they may even have attacks of nausea. But this is yawning not because of boredom, but evidently (and in this case yawning is not "contagious" for the spectators)

an attempt of the body to restore the required electric balance after intense physical stress caused by physical exertion (the issue of electric nature of stress and the role of GIT in supporting electric balance will be discussed later). So, the suggested mechanism of yawning does not exclude a well-known principle of activation of sympathetic and parasympathetic nervous systems, correlation of carbon dioxide and oxygen on blood, but suggests considering its electric aspect.

Thus, by means of breath holding the body gets rid of internal positive “electricity” and decrease of breath rate helps rational utilization of negative electricity which enters the body. The benefit of breathing exercises, as regulators of internal electric balance is evident, but the technique of their application must have limitations of dosage. And still it is better, when there is a possibility to pay more attention to walks and work in the open air instead of tiresome breathing exercise, which combine body purification from positive electricity and its saturation with negative one with reasonable physical exercise stress. Besides, it is advisable to air the room and, if necessary, to use an air ionizer.

For example, there are records for decreasing oxygen in blood of penguin [26]. Oxygen may fall in their bodies down by 100% and researchers suggest that penguins "... have more ideal type of hemoglobin", but the main cause may be in the particular mechanism of storing a negative charge of the body and their possibility to eliminate a positive charge. Undoubtedly, investigating into this and many other unusual facts (including the phenomenon of endogenous breathing), one can obtain findings, which may help a person in extreme situations.

Concluding our discussion of breathing exercises and borderline breathing patterns it is necessary to touch upon one detail. This is xenon anesthesia which has become widely spread and anesthesia in general. The suggested electrostatic mechanism is the following: the inert gas, xenon, by taking a certain volume in the breathing system, affects the electric charge of blood resulting in change of the electric balance of the brain in general (see below). Changes in the electric balance of the brain (decrease of the negative electric charge which is necessary for its function) disables some functions by reflex. In this case all processes are slowed down and sensitivity of the body decreases.

Borderline conditions due to the changed electric balance of the brain are coma, clinical death, anabiosis and death (electric death will be discussed below).

The same way decrease of the pain threshold manifests itself in other type of electric charge decrease of blood, because of severe loss of blood or intravenous administration of large amounts of liquid; sometimes after hemodialysis or in absence of local blood supply, as due to a tight bandage. On the basis of the above let us assume that a similar (anesthetic) effect may be achieved applying inhalation of ionized air with various concentrations of positive and negative electric charges or administer intravenously a solution containing certain electric charges, for example, physiological solution that passed through a membrane regulating the concentration of Na and Cl ions. This idea is supported by the well known fact which later helped N.V.Lazarev discover xenon anesthesia. He observed the state of euphoria and decrease of pain threshold in divers who dived to great depths. But in this case besides the effect of inert gases it is important to take into account the change of partial pressure of carbon dioxide and deionised air for breathing.

The electric mechanisms of borderline breathing patterns presented above may probably serve as a foundation for development of special techniques for submariners, pilots, astronauts (breathing and blood circulation in the state of zero gravity), or athletes, and without doubt should be taken into account in resuscitation and rehabilitation.

Electric lubrication of the body

There are friction surfaces in the body where the friction ratio is provided by various substances, being natural lubricants. On the assumption that prevailing of the like electric charges on the contacting surfaces or tissues, one can suppose that there is also an electric lubrication and namely, separation of friction surfaces on mutual repulsion of the like electric charges. The repelling force of charges is in proportion to their product and inversely proportional to the squared distance between them. That is, the large is the charge of contacting surfaces and the smaller the distance between them, the stronger is the repelling force and the more efficient is “electric” lubrication.

Though the mechanism of “electric” lubrication may seem very simple, there is a great number of variants of its application in the body. According to well-known theories and the suggested hypothesis in the body may coexist the organs and tissues with prevailing negative or positive charge son their surfaces. This charge may also have different surface-volumetric distribution. The role of insulator separating “electric” fluxes in the

body, as well as the organs with different character of charges or the like charges of different size is mainly played by serous membranes.

If the load on the pericardium by the heart is uniform, then the role of electric lubrication is less important, but as for heavy or abrupt load on the synovial joint one probably can not do without an electric component. In this case we discuss only a probable electric component of separating friction surfaces without denying or lessening the role of other known factors, e.g. synovial fluid, dielectric properties that may change with age, temperature fluctuations, disease or injury.

Let us discuss the said in details. On abrupt sharp or heavy load (except already known mechanisms) the electrostatic repulsion of surfaces of adjacent cartilages will not probably allow to damage the joint. Why does it happen? With maximum approaching of surfaces due to the increased load coulomb repelling forces come into action. On sharp load electric effect may be decisive (due to the inertia of hydraulic effect of synovial fluid). But for that the electric charge on the joint surface has to increase instantly, comparing to the time of load increase. Blood transmits electric charges in the body but even blood is unable to instantly carry and transmit a required amount of charge. There is only one way out: a charge should accumulate and be stored somewhere near, and immediately be transmitted to the joint on demand. From electrical engineering it is known that it is possible to accumulate charges with a capacitor. Bone cavities and tubular substance are excellent natural capacitors allowing to store and quickly transmit the electric charge to the joint surface under load, the cartilage and the external wall of the bone (compact substance and periosteum) being insulators and providing reliable storage of the charges.

Age changes and some diseases (as osteoporosis), when the bone loses its strength, result in disturbed dielectric strength of bones and cartilages. In this case inability to store and accumulate electric charges by the joint (alongside with other factors) results in pathologic manifestations not only on increased exertion, but on usual walking.

In support of the above said and as a special case of the hypothesis we can remind of a property of bone crystals (crystalline matrix), which is able to form a weak electric field on load, and it attracts osteoblasts producing a bone [27]. In medicine this property is used to stimulate growth of a bone electric current in case of complicated fractures.

The role of electric charges in the spine may be even wider. As it is already known,

elasticity of the cartilaginous disc depends on the state of the pulpous nucleus and content of fluid in it. Besides, the presence of a certain electric charge in capillaries and tissues of intervertebral discs facilitates electric thrust, which helps retain their form and volume. Decreased blood flow due to the daytime compression lowers the required electric charge and correspondingly decreases the electric thrust. At night, during sleep, an emotional stress of the day is relieved (electric nature of stress will be discussed below), besides, relaxed muscles and lying position of a person allows to increase blood supply of the organs and tissues which were compressed in the daytime. Then a healthy person (a relatively healthy person) is able in a relaxed state to restore the electric charge (enhance the electric thrust) and wake up refreshed, particularly if there are negative ions in the air during sleep (I would like to say again that mosquito screens hold negative aeroions of the air outside as an electrostatic screen). In injuries, salts deposit, "electric microclots" or age changes efficiency of the electric thrust decreases. Besides, in such cases a person does not commonly stay in the open air and so does not consume negative ions, and then it is necessary to switch on an air ionizer, particularly at night. If they are indicated, various types of orthopedic girdles and body belts are used. In this case efficiency is higher if there are enough negative ions in the air.

“Electric” ear

Having discussed in the previous chapter an electrostatic regulator of a friction ratio in the joint, let us extrapolate this mechanism upon the known process of obtaining and transforming an audio signal in the middle and internal ear. Let me ask, why for oscillations transmitting from the eardrum to internal ear membrane three ossicles are needed? One is sufficient to transmit a signal without a loss. To protect the internal ear against an acoustic shock or for an additional mechanism (besides an affect upon the eardrum) of "volume control" by changing the spacing, two ossicles are enough. Exactly so, though we know that the articular cartilages of the ossicles are elastic on rotation and distention. If we take an electric capacitor microphone as an example (acoustic oscillations, by changing the membrane position, also change capacity between it and the other plate and turn into the electric oscillations) even slight oscillations are transformed into the electric signal, which, if necessary, can be amplified to the level desired. Then, is it possible to hear without the internal ear? For

that it is sufficient to fix the slightest change of electric capacity in the connection of only two ossicles – the principle of the most common joint (discussed above), in which the bones composing it are capacitor coatings and have different electric charges. Here it is important to take into account changes in dielectric properties of the synovial fluid. These sounds, of course, can not have such a variety that is obtained because of the sound separation with hair cells and then integrated by the auditory nerve, but it is not the oscillation perceived by the deaf. Does it mean that there is another possibility to hear certain sounds without the internal ear and osseous and air ducts? Acoustic pressure is transformed immediately into the acoustic signal received by the brain. But this is a mere suggestion which may be either proved or disproved.

But why are there three ossicles, but not four or more? There is a medical explanation of it, but we will try to give an explanation in terms of our hypothesis. Let us take volume of sound as a principle. The force of acoustic signal reaches the membrane of the internal ear through the two "electric gaps" (the junction of three ossicles) – malleus-incus and incus-stirrup. Above we discussed the variant of receiving the electric signal under the influence of the external acoustic signal, i.e the variant of receiving information. Now we can offer another variant, that is, when the outer electric affect (by CNS) upon the ossicles conjunction will be used. Transmitting a certain electric charge to the ossicles conjunction allows to adjust an electrostatic gap between them (by changing the tone of the joint tendons), and thus change the force of the transmitted acoustic signal within a wide range. So, the external electric effect may participate in the process of changing the contact area of the articular surface. Then, why are there three ossicles or two articulations? Just to have the possibility to electrically "tune up" each of the articulations. Then one articulation allows to better recognize a hardly perceptible noise, but without differentiating between the tones and halftones, and the other one – a loud sound. So, each of the two conjunctions between three ossicles may have different functions: perception of loud or low sounds received from two "capacitor microphones". Such a present of nature possibly allows a person unlike many other species to hear effortless sounds of various volumes – 5-110 dB, and make out a wide spectral range – 16 – 22,000 Hz. Then, which of the two variants work in man the first, the second or both? And what is the purpose of them, if there is a well-known mechanism of sound transformation? We can suppose that this is the body's reserve that may explain many cases of "mira-

ulous" restoration of hearing and ability of some unique people to hear certain infra- and ultrasonic waves.

Very interesting are the findings reported by the Center of Neuro- and Cognitive science of the University of Montreal (CERNEC) in collaboration with colleagues from McGill University and the University of Glasgow, who studied hearing capacities of the blind [42]. It turned out that blind people actively start using visual cortex, being initially useless, to process audio impulses.

Contradictions of the suggested hypothesis

The hypothesis suggested in this paper does not contradict the hypotheses and theories already known to science, which deals with the effect of negative ionization on the body. But there is a deep difference concerning the entry of negative electricity into the body. The statement about negative ions missing the alveoli on normal breathing, which was accepted and proved in the hypothesis, contradicts Chizhevsky's concept of electric exchange in the alveoli. I repeat – simultaneous presence of positive and negative ions in the alveoli results in difficult breathing. Condition, in which negative ions break through into the alveoli, should be considered as abnormal and experiments prove this [16, 17]. In Chizhevsky's time no facilities existed to conduct such experiments: gauges were far from being perfect. Still, the statement about negative ions getting into the alveoli was doubted by many researchers even in the middle of the 20th century [18].

It also refers to the notion of light negative aeroions, whose usefulness (for their entry into the alveoli) is valued higher than heavy ones. On transmitting its charge to the mucous membrane of the upper respiratory tract, the mass of a charged ion does not matter. What matters is the amount of charges that the ion possesses and how easy it may be transmitted to the mucous membrane. Of course, for such a complicated "construction" as a heavy complex aeroion, e.g. an aerosol particle, to transmit an electron or electrons on their contact with the surface of the mucous membrane is more difficult than for an atom or a molecule. Certain aggregation of negatively charged ions settled on the mucous membrane of the upper respiratory tract may affect the mechanism of exit of positive aeroions from the lower respiratory tract. This may be the main cause of "non-usefulness" of heavy negative aeroions, that may be easily eliminated with internal processes of electric exchange in the body.

To contradictions, though curious ones, refer some conclusions made by Academician A.A.Mikulin and reported in his paper "Active Longevity" [2]. The thought of necessity to "shake the body" by doing "volition exercises" and massage of all groups of muscles is nothing more than external and internal forces which help restore the internal balance. Unfortunately, there are some inadmissible simplifications and generalizations in the work. For example, from the graph of changes in the electric potential on the surface of the biceps, measured by electrocardiography, Mikulin concludes that "the work of the muscle is followed by inversely proportional drop of a free negative charge in it". Though, potential measurements on the surface of the skin can only indirectly mark the electric processes in different tissues under its surface. We can not but compare this technique to taking temperature in a patient by applying the thermometer to the external wall of the patient's ward. And further he writes about the capillary blood flow: "... hydrodynamic forces can not provide the flow of fluid in such thin vessels due to friction. Here electricity helps again. Coulomb forces make each forefront erythrocyte repulse from the one behind. I think, these great electric forces alongside with vibration forces of the medium surrounding the capillaries and provide movement of blood through capillaries". [2]. The above said is a well-known mechanism of electric repulsion together with the principle of electrotaxis (discussed above), but it can not be directed in a certain way and can not in such interpretation help hydraulic forces move blood. One can not doubt in Mikulin's advocacy of negative aeroions. For that reason his success in keeping fit is explained by being constantly and doing exercises in the ionized environment.

We must dwell on the problem of endogenous breathing. I do not see any contradictions here but on further development of hypotheses and concepts concerning endogenous breathing, oxidation stress, etc., we must take into account not only a biochemical but also a biophysical aspect of interactions, particularly the one discussed in this paper.

Electric circuit of the body and principle notions

The hypothesis of electric processes is based mainly on stationary fields and charges. But in the body, as outside it, there are alternating and magnetic fields, and complexity of their interactions evidently needs a detailed consideration and special research. As a rule, though, electromagnetic fields and currents affect more single organs, particularly on reso-

nant coincidence of frequency.

Joint “electric” work of various organs and systems may be presented as a multilayer electric frame of the body, where the electropotential diagram of the cardiovascular system is the same as an electric power part, work of the brain and the nervous system is similar to the control system, and individual organs are consumers of electric energy; respiratory and excretory systems are responsible for the electric exchange with the environment and endocrine and immune systems are responsible for the internal and intracellular electric exchange, regulation and control of biochemical processes. The functions of the endocrine and immune systems in the electric regulation of the body are more complicated and require a detailed consideration, just as the role of the liver in general electric balance of the body.

One should emphasize the role of the gastrointestinal tract in maintaining the electric balance of the body. As the respiratory system, the GIT is able to get negative ions and utilize positive ones. The settled residues of deionized and non-deionized heavy air ions in the upper respiratory tract are covered with mucus and eliminated with cough or (to a larger extent) inactivated in the GIT. The process of electrolysis occurs along the whole gastrointestinal tract and results in redistribution of electric charges depending on work of other organs and systems of the body. These processes are complicated and an additional research is needed to describe them. But one can assume that many of GIT mechanisms possess an external (in respect to GIT) regulating component and its nature is electric. Unlike electric exchange in blood with prevalence of "electronic" transmittance of the charge (without changing the chemical content of the particles bearing the charge), in the GIT prevail splitting and synthesis processes based on chemical changes and formation of complex molecules (ions).

Possible external (from other systems of the body) abrupt "throw" of positive “electricity” in the GIT disturbs digestion and a following reaction depends on individual peculiarities of the person and his/her condition

For example, sudden nausea of athletes (or even vomiting) may serve an attempt of freeing the body of a large amount of positive electricity due to stress (about electric nature of stress see below) or a well-known manifestation of stress as diarrhea, etc. We are used to the fact that the nervous system participates in such manifestations (certainly, excluding chronic conditions and poisoning). But how and, what is more important, why

dies the body need such a reaction? Sudden hiccup, vomiting, gastric spasm, flatulence in stress are hard to explain in terms of appropriateness for a person. But if we assume that the body tries to help itself and eliminates excessive positive electricity in large amounts, everything becomes clear. It turns out, that the GIT has a unique ability to consume, store and eliminate electric charges, and if necessary, it can render "first aid" to the body. The excess of positive electricity of the body may accumulate in the GIT, and probably provoke different diseases (gastritis, ulcer of the stomach, etc.)

On the basis of the above we will lay down the notion of electric balance of the body: Electric (electromagnetic) balance of the body is a spatial collection of electric charges (fields) of cells, tissues, organs and systems of the body, corresponding to its particular physiological condition. Electric balance between various physiological conditions (rest, exertion, stress, disease) is regulated by internal and external electric exchange. Inability of the body to restore by itself the electric balance results in electric pathology.

A general electromagnetic and electric image of an individual, observed or registered by indirect signs, e.g. Kirlian effect (GDV, instrumental electromagnetic diagnosis) is a result of a general manifestation of electromagnetic processes in the body (diagnosis by acupuncture points and MRT are the exceptions).

Advocates of gas-discharge visualization (GDV) or bioelectrography when taking pictures of "auras" or information structures of individuals had rather compare the findings obtained with actual pictures of electric potentials distribution on the skin surface and adjacent tissues, and take into consideration the level and ionization character of the air medium of the examined object. And, of course, it should be taken into account that each examination with high-frequency corona discharge temporarily changes conductivity of adjacent tissues. Duration depends among others on the capacity of the body to restore its electric balance. Electric processes in the living organisms, in larger part at the cellular level, can not stop straightaway, even if other evidences allow to diagnose death, and it is these subsiding processes that allow to see residual images in gas-discharge photos, e.g. to grade seeds to their germination ability.

A total electromagnetic or electropotential field lacks certain information and external effect upon it is not the best way of treatment, particularly in physiotherapy. Besides, the external electromagnetic and electric effects show better only on the superficial tissues. It is

more difficult to affect internal organs, as electromagnetic field in the superficial tissues should be overcome before internal organs are affected. The intensity of the external effect is weakened and dispersed, and its increase is not always possible or acceptable.

The principle of electric balance may lie in the foundation of "electric immunity" as one of the principles of the immune system.

Of course, every person responds in his own way to different radiation frequencies but common electromagnetic smog of our personal living space, our homes and towns is quite unfavorable. Weakened "electric immunity" allows external electromagnetic effects, e.g in the atmosphere, to influence stable processes in the body that may manifest as susceptibility to weather change or weakened immunity.

It is quite possible that one of the factors of electric balance maintenance is constancy of body temperature and its fluctuations in certain conditions, as there is a direct dependence of electric resistance of tissues on their temperature. So, internal changes of temperature, for example, during a systemic or a local disease, is the evidence of the body's attempts to change electric balance and thus settle the problem. In this case a thermal taxis is the mechanism optimizing electric potentials of the organs or the body in general. Besides, when body temperature elevates, mucus in the alveoli starts evaporating and this results in additional increase of exhaled positive electricity. The mechanism of maintaining the internal temperature of the body is the evidence of a higher level of "electric" organization of warm-blooded animals.

One should be more careful with constancy of temperature, as in order to maintain normal metabolism in the body (or in an organ) it is sufficient to maintain the temperature in the body in a wider range. Then a person will feel more comfortable and his expenditure of energy decreases. But what happens in fact? Is it the nature's shortsightedness in creating man or in evolutionally process of natural selection? Maybe such a narrow range is important to prevent possible occurrence of thermoelectric potential in temperature gradient due to significant influence of different temperature zones upon electric balance of internal organs? These questions have not been answered yet.

The elements of the suggested electric circuit of the body have been widely known for quite a long time. Though, the work of this circuit is possible to study only in a live tissue (anatomy is a poor assistant in the case): the sample of tissue under the microscope is

deprived of all electric charges, and furthermore, it can not interact with charges in other tissues. At present, many electric studies are only approximate as they do not take into account all peculiarities of electric processes. Even ECG determines only an external picture of the heart's work, which is far from being complete.

What we know of ECG

Somebody may think he knows everything. In every manual you may read something like "... the heart is a powerful muscle. In it a lot of fibers are excited at the same time, and in the medium around it there is a strong electric current, which even on the surface of the body produces potential difference of about 1 mV". I suggest your pondering over the following: how does "...a strong electric current in the medium around the heart" produce local areas (points) with an electric potential on the surface of the body (the version with induced potential is beneath criticism)? To obtain electric potential on the surface of the body from the cardiac muscle to the surface of the body electric current should not only overcome numerous tissues with various electric resistance (some of them are dielectrics under certain circumstances), but also numerous local areas with their own electric microvoltages and multi-directional microcurrents. Besides, the process of current flow is associated with tissues depolarization, which requires either time or increased depolarizing potential. It certainly is possible, but the simplest electrical calculation shows that in this case cardiac potentials should be significantly high. Again it happens so that cardiac electric potentials initiate these processes in the body that eventually produce electric potentials registered by ECG. There is nothing surprising in it, except the fact that the phase and time of changes in the potentials coincide with contractions of the heart. Let us try to consider a two-dimensional counterpart of this process – propagation of surface water waves. For example, producing a surface distortion on one side of a water canal, it is impossible to obtain its mirror reflection, leaving aside an in-phase one, on the other side, taking into account reflections from its tortuous walls and other kinds of disturbances. The claim that the electric signal passes from the heart through the tissues to the skin surface through certain channels (blood vessels, nerves, etc.) is convincing enough but only with a glance at the hypothesis suggested.

The path of electric signals of the brain neurons registered by the electroencephalograph on the surface of the skull is still more intricate. Cancellation of these signals is higher

than in ECG, as the nerve cells act nonsimultaneously (i.e. at the time when one cells produce a positive potential on the skin surface, the others produce a negative potential). Besides, the skull bone on the way of electric signals to the surface makes an ideal insulator.

The question arises: What in reality do we register, and how do electric potentials, being registered, appear on the skin surface? To answer this question we need a research, and start it with collecting and analyzing distribution of electric potentials not only on the skin surface but over the whole body capacity. It is important to compile a kind of an atlas of electric anatomy of the human body, where individual organs and tissues would present electropotential static and dynamic pictures in various physiologic conditions, including pathologic ones. It may well be so that so-called biologically active points and even area may become fixed points in this atlas. Such atlas would be evidently more important for studying the live body than the anatomical one.

The notion of “electric” life and death

From what was said above, one can determine the "electric death" of the body accompanying physiological death or resulting in it. The "electric death" is inability of the body to maintain the electric balance of vital organs at a required level. Variants of the "electric death" are coma, lethargy and clinical death. The "electric death" of non-vital organ is an important and a sufficient condition for its decreased function with subsequent death.

Having mentioned "electric" death we can not but mention "electric" life, or rather try to answer the question where life "comes from". Religion and science give different answers. I will try to make my contribution from the standpoint of the hypothesis suggested. What if the moment of independent control over electric processes in his/her body should be considered as the "starting point" of independent life of an individual? It is highly probable that the border would lie between conception and birth, and it is this period that should be taken for germination of a new human being. Confirmation of this concept and research into it may help settle numerous moral and social problems, including the problem of abortions. By independent control over electric processes we mean the function of any organ (or a system of organs) of an embryo, receiving (with mother's blood) or giving (into mother's blood), as well as conscious redistribution and application of electric charges.

Electric mechanism of stress and electric pathologies

After we have discussed electric mechanisms of blood circulation and breathing, as well as having introduced the notion of the "electric clot", we can move on another mechanism of disturbance in the electric balance of the body – "electric stress". The symptoms of the effect of physiological stress are well known, and these are fatigue, vascular hypertension, heart- and headache, dysfunction of the GIT, apathy, etc. Similar clinical manifestations may occur due to disturbance in electric state of the body. So, we may assume that any stress triggers a mechanism resulting in impaired electric balance of the body and occurrence of multiple "electric microclots" and "electric spasms".

Electric spasm may be due to the electric blockade of a certain area by the progressing "electric clot", and this makes impossible for external forces to restore electric balance in this area. Any spasm evidently contains an electric component, and in treatment of such a spasm it is important to consider not only chemical but also electro physical effect.

Naturally all clinical manifestations are very individual and depend on the existing electric balance in the body at a time of stress. It may be the existing electric balance that is responsible for our stress resistance (adaptation power), taking into account a general state of health. The reserve of adaptation power has an impact on the effect of stress, that is, amount and quality of the occurring "electric microclots". Unlike a cardiac-pulmonary "electric clot" which makes the heart stop, an "electric microclot" is a local disturbance of electric balance within a single organ or a system of organs and expresses itself in disturbed electric currents and fields. A sharp "shock" (stress) may change this condition by means of various factors depending on the type of stress. In majority of cases these factors result in decreased electric negativity of the blood flow which is the main instrument of electric power transmittance in the body. The work of an organ or a system of organs without a necessary supply of negative energy and taking of negative energy (in some cases it is a vice versa process) becomes difficult and this leads to a change of electric charge of the organ and formation of an "electric microclot" or "electric pathology" of an organ.

Summarizing what we said, we can specify the mechanism of the "electric microclot" formation as changes in tissues polarization which prevent blood supply or lymph flow, and the mechanism of "electropathology" as tissues polarization, when stable changes in electric

intracellular processes are observed.

The energy supply of the body is spent to "resolve" the "electric microclot". In most cases stress affects negatively, but its positive effect is also known. Stress may remove the electric pathology of the organ which has already formed and restores its normal function. Such facts are well known in medicine and life, though some of them are perceived as "mysterious" cure of incurable diseases including oncology, and others are quite common and used for ailments, as cold rubdowns or contrast showers. Or, we can take massage as an example; it helps not only decrease local concentration of lactic acid and increase pH of sarcoplasm, but it exerts mechanic pressure resulting in changes in electric conductivity of tissues. In fact, massage, as any other movement, is a physical opportunity given to electrostatic forces to improve capillary blood supply. That is, mechanic action upon tissues does not improve blood circulation in them but gives an opportunity to improve it. For this reason an important prerequisite of its efficacy is the possibility to consume negative ions from outside, and this is either fresh air or an air ionizer.

Quire effective is ribbing and stroking the skin with the least force, done either with a hand or any objects. But in fact, this is nothing more than an external electromagnetic action of a human hand (in self-massage) or an object (with certain electromagnetic properties" on a diseased organ. The efficacy of such an action increases manifold if it is done by a person who possesses a certain energetics (here a strong electromagnetic field of a person is meant) or just a healthy person (without any diseases, that is, having normal electric balance).

As an example of a positive effect of stress in life we can take a common viral disease, when the body reacts with elevated temperature, changed metabolism, etc. Of course, elevated temperature can be explained by well-known reasons, but changes in electric balance of the body, its organs and systems is not taken into account (see below). Nevertheless, taking sample of tissues for a test has an electric component. For example, erythrocytes sedimentation rate (ESR) is one of the objective criteria in making the diagnosis of acute respiratory viral infection (ARVI). But how is it possible to obtain the rate and time of sedimentation of electrically charges particles (a well-known fact, by the way) and compare the data obtained without considering possible external electromagnetic effect? How is it possible to estimate the influence of protein shift and mucopolysaccharides concentration without considering an electrostatic charge of the vial or a glass tube for col-

lecting blood or an electric device working nearby? What about particles of blood that affect the electric charge while passing through the steel needle? To confirm our statement it will be enough to compare the results of ESR test with different types of blood collection from different parts of the body.

“Electric stress” causing changes in the electric balance is sure to be present in any breathing exercises, swimming, running, thermal loads (a bath, cold rubdown, contrast shower, or other means of thermotactic effect), massage, acupuncture (particularly with heating of needle or connecting to needles under voltage). In this case stress is opposite to physiological stress, e.g. mental stress. Resolution of "electric microclots" occurs due to increased blood circulation in muscles and metabolism, accelerated heart beat, resulting in growth of the number of charged particles in the organs and the body as a whole, as well as speeds up their movement. Naturally, external supply of the body with negative “electricity” and removal of positive “electricity” is desirable. Then a rapid movement of a large number of charged particles of blood will allow to decrease a stable "electric pathology" (en "electric microclot") and later even eliminate it. Mere stretching or simple exercises is no more than increasing a tone, including distribution of electricity in the body and destruction of local "electric microclots". Particularly effective is a well-balanced complex of exercises, and probably it is the electric component of these exercises that allows to achieve the state of physical tone. Historically development and improvement of exercises did not take into account the electric component. But by means of successive adjustment of various exercises it became possible to achieve a certain progress and it automatically included an electric component.

The mechanism of the suggested electric balance of the body makes it possible to analyze well-known systems of exercises for the succession of movements, force of action and other factors taking into account individual features, health condition, or readiness to train.

For the electric component direction and order of warm-up and training of certain groups of muscles is important, as well as fresh air and quiet for doing exercises.

The known systems such as Wu-shu or Quigong suppose that a person doing these exercises achieves a certain degree of conciliation, liberation or estrangement, which allows the body to do exercises "independently" under the influence of inner feeling. In

other words, any exercises or systems (marked in advance or done at will of the body itself) provide various flows of internal electricity by means of successive movements directed at relaxation or contraction of muscles that results in restoration of a general electric balance of the body.

On the basis of the above, evidently it is necessary to make corrections to therapy of diseases, including those that were caused by stress. In doing so, it is important to take into account the electric balance of a person, as well as effect of external ionization and various devices able to change electric balance of the body.

Psychiatrists, particularly forensic psychiatrists know what the state of affect is (lat. affectus – a strong emotion, passion), when a short but strong emotion (anger, horror) arising in response to a strong irritating stimulus may serve as extenuating circumstances. What really happens in the body besides hormonal and other biochemical changes? We can assume that affect is the manifestation of extreme stress which creates multiple electric clots in all parts of the body. The signs of a strong stress are known; these are black-out, confusion, feeble arms and legs, lack of coordination or automatic movements, etc. All these signs may be explained in terms of the hypothesis presented. The rate of electric microclots resolution in each particular area is different and should be taken into account at the judicial sitting. So, how is possible to prove extenuating circumstances in courts if considerable period of time has passed? Can affect be provoked again by mere reminding a person of an experienced mental emotion? To answer the question conventional psychological tests should be supported by the test for electric stress resistance.

On the other hand we all know about healing properties of sleep in stress. Why? It is also clear, as in sleep metabolic processes slow down and the general state of rest helps the body cope with minor electric pathologies which are accumulated in the daytime. May be a quiet environment of sleep naturally necessitates it? It is good, if a person sleeps in an aired room and the body can get negative aeroions.

"Therapeutic" effect is produced by sleep in acute attacks of a disease. What happens in this case from the standpoint of our hypothesis? When a person takes a horizontal position, his muscles are as much as possible relaxed. This makes restoration of electric balance the easiest, as the absence of external compression of the muscles facilitates transmission of electric charges with blood or by means of intercellular membrane con-

tacts.

We should separately note all possible consequences of electric clots in the brain. We all know well many facts of extrasensory abilities or a gift of foresight after severe injuries, on the border of life and death or after electric injuries, e.g. during a thunderstorm, though these phenomena are not well researched.

External electric effect on the body

The body as an electric system gets into contact with external electromotive forces. Sometimes though, this contact goes up to the level when we may define it as an electric injury. Biophysics of an electric injury is unable until now to answer the question, what is the real cause of death (in many cases, when there are no injuries to the internal organs) – cardiac or breathing arrest or injury to the nervous system. In terms of the suggested hypothesis we may assume that in all cases when there is no evidence of physical damage to the internal organs due to direct exposure to electric current, the cause of death is a cardiac-pulmonary electric clot which results in cardiac arrest, rupture of the myocardium or vessels or respiratory arrest.

There are cases when death of electric shock occurred after some time. I offer the following explanation. In any case on electric injury electric balance of the body is disturbed, there arises one or several “electric microclots” or even broader electric pathology. It means that some parts of tissues of one or several organs, which are depolarized by the external influence of electric current, are unable to separate electric charges and participate in a common system of the body's electric balance and thus, prevents electric charges in the body from flowing in the body.

Clinical manifestations of this electric pathology are sluggishness or excessive activity is classified as a shock. So, electric pathology affecting, for example the brain or the CNS, may manifest not only in the arrest of electric exchange process but also in its growth.

The established mechanism of electric balance of the body is disturbed, which foresees a certain a certain flow of electric charges from internal organs carried by blood and their consumption. If health condition changes, the electric balance is disturbed, but it restores by using cellular reserves and flow of negative charges from outside. Restoration oc-

curs either at rest or due to the effect of biochemical changes or after taking a medicine.

Inability to carry out its electric function by an organ for a long time (time perception is individual) depends on how vital this organ is, its electric functions in the general electric balance or stronger changes in the health condition (subjectively perceived) results in the electric microclot in this organ, and, what is more important, it affects the blood flow. Then, if the body is unable to cope with the electric microclot (taking into account external aid or the aid may be unskillful) electric charges redistribute and accumulate on other more vital organs that results in their impaired function. These changes accumulate and result in cardiac-pulmonary electric clot, i.e. sudden and "unexplainable" death after quite a long time. The examples of sudden deaths (after a few hours or even days) after an insignificant electric injury are numerous.

In electric balance the same mechanism at the cellular level is known as action potential. It "...arises, when due to some affect the membrane of a nerve or a muscular tissue is depolarized up to a certain level, e.g. potential of 50 mV" [13]. When an "electric microclot" is formed, its depolarization balance is high and affects a large amount of tissues.

The mechanism of an electric microclot of a single organ growth to a cardiac-pulmonary electric clot is typical. It must be considered while managing many diseases caused by emergencies, such as injury, infection or some drugs, narcotics, alcohol, etc.

As an example we can take the statement by a founder of electrical safety, an Austrian scientist S.Jellinek: "The factor of being attentive plays an extremely important, and may be decisive role... and commonly nothing happens to those who is in a state of concentrated attention...". Significance of this factor was proved by S.Jellinek both experimentally and statistically. For example, cats in a quiet state died under voltage of 220 V, and cats, being vexed with a stick, took the same voltage as a strike with a stick and attacked the experimenter. Attention mobilizes host defenses. A stick presents danger for a cat; it sees a stick and its past experience and reflexes gives it cues for further behavior. What has electric resistance to do with it? From the standpoint of the hypothesis we may suggest that mobilization of the body in danger includes a significant electric component. Electric "reserves" (increases intracellular generation and aeroion air exchange) in certain parts of the body and their instant discharge in a required area is a kind of protection which neutralizes the depolarizing effect of an external source of electricity and prevents electric pathology and electric

clots. There may be objections concerning the hormonal background and other biochemical changes, which take place in case of danger. Certainly, they do take place and moreover, they play a crucial role but only at a certain stage. Otherwise, then it becomes possible to chemically avoid physical exposure of tissues to the electric current. A tablet should be made and given to all electricians. But it is nonsense! Then, biochemistry has nothing to do with it? Most likely, biochemical and electric (better to say electrobiological) processes are simultaneous, alternating and interfering. In other words, they follow a certain instruction. If the state is normal, they follow one instruction, if there is a danger – the instruction is different, etc. As for a counteraction rate, it is only the internal electrobiological effect that is able to oppose the external electric effect.

It is important to understand that electric injury to the tissues is caused by the current flowing through them, and it depends on voltage and tissue resistance. The voltage, being applied to the body, initiates intricate and versatile processes in the body and on its surface, e.g. depolarization of individual cells. In general these processes result in decreased electric resistance of tissues up to the moment when new conditions allow electric current to flow freely and its value grows snowballing. Then comes what is called electrochemical breakdown which results in various tissue damages and dysfunction of the organs through which the current passes into the body.

To increase electric stability of the body is possible only at the stage of cell depolarization, and namely by interfering with external polarization. To be able to do this, the body should possess certain electric reserve and the "instruction" required. The level of electrochemical breakdown depends on voltage, frequency of the electric current and the state of the body (alcohol intoxication, anxiety, disease, etc.). These conditions decrease the "attention factor" (S.Jellinek) and electric stability of the body. Works by N.Tesla are of great interest in this field.

Thus, it is possible to reduce the consequences of electric current effect on the body or even increase electric stability of the body. The main mechanism in both cases is purposeful movement of electric charges.

Work of the brain as a 3D processor

Comparison of the brain and the CNS to a computer (a biocomputer) is well known:

there is peripheral equipment, the principles of its interaction with the brain are determined, the types of impulses are studied, the brain itself is divided into the areas of responsibility, the clock speed of the processor is determined, etc. But what do we know about logical thinking and what is its mechanism? Let us transfer our hypothesis to the facts known from anatomy and physiology of the brain.

The work of the transistor as a control agent of any processor is based on changes in the current passing through it on application of a low control voltage applied to one of its three outputs to control and manage the current at the two other outlets. This is the way the wanted analog signal is formed according to the initial form of control voltage. For digital devices to which a computer refers to provide all types of logical operations, the work of transistors in the mode "on-off" (0 or 1) is characteristic.

On the basis of their research British neurobiologists say that a synapse – the point of contact between two neurons or between a neuron and a cell, is not just a conductor for impulses, but it regulates the amplitude and frequency of the transmitted signal. This "device" may be called a small biological transistor [28]. Earlier, this neuron property was described by the Russian scientist Yu.V.Lebedev [40].

So, when we have a large number of small biological transistors. Now one more well-known fact: hematoencephalic barrier formed by endoplasmic processes of astrocytes is peculiar to capillaries of the brain and the CNS. A complex lamelliform coating of the capillary with endoplasmic processes (biological transistors) surrounds the blood flowing through the capillary, the blood containing a great number of electrically charged particles. Each astrocyte, as a rule, has contacts with several capillaries. Let us imagine that each lamella has its own electric potential different from the others. Each of blood particles moving through the capillary and possessing its own electric charge will interact with the charge of lamellas. Unlike a common capillary, each lamella may take an electric charge via an astrocyte. But then the external control of charges of endoplasmic processes with different electric potentials can regulate speed and direction of blood flow and even move electrically charged blood particles within the capillary, make them rotate or even move in the opposite direction, or make the flow of particles give their electric charge to certain endoplasmic processes of the capillary. Why? To transmit the electric charge to another capillary or a group of capillaries via astrocytes, and this is the part of the "processor" function. As in this case we al-

so deal with a small biological transistor, which synaptic counterpart (more powerful) was presented above. How many transistors are there in the brain? Just guess. For a prompt the number of lamelliform capillary coatings should be divided by three. And then this figure may be increased by adding a few zeros to it, because each transistor (at least 3 lamellas) after some time is able to work with other scales or groups of scales. Is it a self-adjusting processor?! Modern computers are very far from such organization of work. Though of course, it is not a quantum processor yet (in its modern sense) but not a digital one. It is quite a different principle of performing logical operations created by nature itself and proved by thousands of years of faultless work. Such a processor does not need low temperature and it does not have the problem of coherence. Maybe these lines will be attentively read by designers of microcircuit chips? Though this point needs more attentive explanation and investigation.

Besides, it is possible to regulate the blood flow pressure on a part of the inner surface of the capillary, transcapillary exchange through its various parts and the amount of blood flowing through each of the capillaries. This is the principle of regulation (amplification and attenuation) in blood supply of the brain. To complete the picture of the brain as a processor we need such elements as capacitors, resistors, delay lines, etc. It is known that non-myelinated and myelin areas of axons, the number of Schwann's cells and neurofibril constrictions deal with all these functions. In capillaries these functions are carried out by a number of electric charges of the blood flow, its rate and direction and even the slightest change of the capillary's size. Besides, there are data [13], that ion canals (sodium, potassium, calcium) apply not a binary condition of closed or open levels (a binary code of data transfer), but several levels, condition of which was called stochastic [13].

So, we can imagine a general electric principle of the "brain" processor function. Control impulses of neurons (small control impulses of transistors) influence the blood flow in the brain capillaries, and electric charges of blood in the matter of the brain and CNS obtain a supplementary function, that is, of the "working medium" of the processor. The purpose of the working medium is power supply, transfer and amplification of the wanted signal. Even modern knowledge of electronics is not enough just to evaluate capacity and processing power of such a processor. Besides, this processor applies several clock frequencies, better known as the brain biorhythms (delta-, theta-, alpha-beta- and gamma-rhythms). There are other rhythms with higher frequency, though they are irregular. Nevertheless, the

main clock frequency is the pulse rhythm, which determines a general mobilization of the body and the necessity of the brain to participate in it. Comparing to clock frequencies of modern processors the frequency of 0.5 to 55 Hz is small, but evidently this range is not complete and the role of frequency in the brain processor is not clear yet. Compare the mechanism, cited above, and efforts in developing a "quantum processor" described, for example, here [29] – there are a lot of features in common.

Some hold the opinion that sound vibrations lower than 20 Hz (infrasound) are either harmful or have unusual effect (mainly of psychotropic character) on an individual. Infrasound vibrations in their pure form are not so harmful and the brain is protected enough. And to get information of a true harmful affect of infrasound and other sound and electromagnetic vibrations on the body, we must consider the point expressed in our hypothesis, as well the sum-total of additional effects, as a closed room, the crown effect, etc. The knowledge of this mechanism may help protect a person against modern types of psychotropic weapon and explain the mechanism of transcranial magnetic stimulation (TMS).

Organization of human consciousness is still being discussed in the world of science. One of the assumptions is that the brain is a neuron net and its particular areas are responsible for a particular process. Probably it is so, but if the brain a self-adjusting processor, could an idle area be substituted by working areas? Sometimes it happens so. In this case division of the brain matter into certain areas is rather conventional? Enhancement of activity of each of them is judged by indirect evidence (tomogram, encephalogram). Both ways are not quite accurate as they do not make possible to fix individual electric impulses and may produce only the picture of activity of executive mechanisms of the brain. For comparison we can take a computer. The user not familiar with architecture and purpose of computer parts may think, looking at its interior arrangement, that the main intellectual part is a working CD drive (on performing the order to record something on the CD). Consumption of oxygen by the brain is only an indirect index, as it shows only increased power consumption which may not be always the principle of thinking process, though this is the subject of another discussion. The most accurate may be the EEG but a small amount of electrodes and their remoteness from the brain matter allow to be inaccurate in the evaluation of the processes.

The theory of evolution of intellectual abilities of living beings associates con-

sciousness and thinking with the volume of the brain, the amount and quality of the neuron net components. This is of course important but the hypothesis suggests applying one more criterion, that is accessibility of external aeroions and ability to use them by the neuron network components. It presupposes a certain structure of capillaries, synapses, non-myelinated and myelinated axon areas, Schwann cells, neurofibril strangulations, etc. We may consider the following as an assumption: rapid development of intellect among animals is observed mainly in vertebrates who evolutionally moved either to amphibious or terrestrial mode of life. It is this step that permitted us to quickly eliminate positive ions and get an additional amount of negative ions from the atmosphere. Sea water and especially fresh water have fewer possibilities. That is why higher intellect is noted in fish which is able to get in contact with atmospheric air, as dolphins or whales. And if it is so, then application of gas masks and other breathing devices with forced feed of deionized air may decrease some parameters of thinking process. Correspondingly, those people who have to breathe deionized air at work find themselves in a group of certain risk

As was noted above, the main energy for organizing blood circulation in the capillaries is electric energy, obtained from the internal energy of cells, making the vascular wall. The brain tissues are characterized by a large number of capillaries. Correspondingly, cellular power inputs should be comparable with general power inputs of the brain. Till recent time it was considered that almost all energy consumed by the brain is spent to transmit nerve impulses, that is, thinking. But as a group of researchers from the Medical School of Minnesota University learnt [30], only 2/3 of the consumed energy is spent for transmitting impulses, and the rest is spent to support vital activity of the brain itself. Certainly, most of this energy is important for the brain blood circulation and the suggested process of thinking.

The title of the chapter compares the brain function with a 3D processor. What is meant by it? Local computing networks are characterized by physical connection of network nodes (basic are: a bus, a loop and a star) called a topology. All these figures are on the plane. And what do the same connections of neurons in the brain present? All things listed above in various combinations and besides connected in different planes. Then, in electronics besides ordinary transistors, sometimes transistors with homogenous outputs are used, e.g. emitters. These complications are required to be used in certain circuits. Existing processors in our computers use, as a rule, only ordinary three-output transistors and work with

one current or, in other words, they work in one plane. But each endoplasmic process may transmit a control impulse and simultaneously regulate a charge, speed and direction of several charged blood particles in the blood flow and besides, change the direction and rate of blood flow in the capillary itself (this feature was named as a self-adjusting processor). This is the work of processor transistors with several independent currents and/or the work in several planes, i.e. work in dimension. Underlined "may transmit" means that for some reasons a part of the "brain processor" might not work and it is observed after some diseases, injuries, on sharp elevation of BP, after taking narcotics, or just be stored. Besides, the storage may be used in emergency, as solving difficult problems, urgent mobilization or necessity to transfer some functions from one area of the brain to another. Well-known facts may supply with information to think over, when the problems solved change the blood flow in various parts of the brain. For example, when a person tries to solve a virtual problem for orienteering, the MRT notes changes in the blood flow through certain parts of the hippocampus. Sometimes the blood flow affects neurons activity [31].

Let us come back to a computer. Each computer has several types of memory. Let us discuss one of them called RAM and which stores the data only when the computer is on. So, the elements of the electric circuit or a part of a processor maintain only a certain level of the electric impulse at the expense of external power supply, and this impulse alongside with other levels comprise the bulk of stored information. The same way may be designed and stored short-term memory in the brain. Current activity of the brain, as well as organization and control over the systems of the body is associated mainly with short-term memory, just as in the computer (procedural memory). Long-term memory of the body just as PAM memory is based upon electric principles but unlike RAM, it is rather complicated.

The mechanism of memory organization suggested above is of crucial significance for storage of information in semantic and random memory. We can not exclude the leading and executive role of the mechanism offered alongside with neuromediators and hormones (dopamine and norepinephrine) on filtration of the data and storing them. But where are the data stored? This point needs additional research.

The facts of partial and complete amnesia are known and occur because of impaired cerebral blood circulation. Elevation of blood pressure impairs blood flow, the lumen of the vessels changes and this affects the pattern of impulses transmittance and re-

sults in a temporary disturbance. The same mechanism occurs on stress. A slight nervousness does not sometimes allow a person to concentrate and recollect the simplest things.

The brain is protected against mechanic injuries by well known means including thick bones of the skull. Besides, the bones of the skull protect the brain against external vibrations of electromagnetic fields. It is not only thickness of the bones that protects the brain but also the spongy structure of the bones surrounding the brain (frontal, occipital and parietal bones). Porosity allows to dissipate and more effectively weaken the external electromagnetic radiation. Besides, we can not exclude the role of sinuses in possible storage and redistribution of negative “electricity” entering the body.

“Superstress” state of the body

Having outlined the mechanism of electric stress development, its strongest manifestation in the form of affect and having discussed the principles of the brain “computer”, we can state that “superstress” state of the body may also exist. This state is provided by “electric microclots” in the brain.

Coming to superstress (naturally subjectively) allows to do things which seem impossible under usual conditions. In this case a person's reaction becomes much quicker, his muscles get stronger, a person can jump, lift weight, moves things, tears, holds, breaks, etc., that is, he/she does things impossible in a real situation. Mental manifestations are also possible, for example, sharp increase of intellectual capacities, or on the contrary, complete absence of it even in the most ordinary situations (intuition has evidently a different mechanism).

If we put aside the mystic part of this phenomenon, then it becomes clear that such actions need additional energy (even to recall something quickly because short-term memory and moreover, a long-term memory do not work "free of charge"). Where can we take this energy from and how is it possible to redistribute an additional volume of energy, what kind of energy is it? The answer seem evident: it is only electric energy that can be quickly redistributed and used (hormones do not flow at such rate), and take it from the stored electric charges in the body. Besides, it can be taken from other organs which do not participate in the process and redistributed over the conductive media of the body (large lymphatic and

blood vessels, nerves). Any superstress process accelerates the brain function. It is not without reason that people describe this state as if "time slows down". The evidence of the "natural storage battery" exhaustion after stress is a deferred state up to coma. A person needs help in this state but of course with taking into account the hypothesis of electric balance of the body and mechanisms of restoring it.

Superstress that occurs in racing drivers, test pilots or members of the armed forces must be studied by researching into "electric microclots" that occur in the body during superstress and after it is over. So, superstress differs from a common stress and affects by mobilization of all electric resources of the body, not uncommon at the expense of other organs to achieve a certain vital goal. Undoubtedly, control over superstress will allow representatives of the professions mentioned to increase their capacity to carry out the task without any harm to their health.

How is it possible to develop the ability to switch the body to the state of superstress without much harm? This state can become very beneficial for a person. There are several ways and many of them are well-known. For example, coaching hard and making all movements automatic. In this case not only groups of muscles but also a part of the brain get trained getting used to a kind of doses of "electric microclots". Besides coaching a psychological aspect is necessary which may be inborn or developed by various methods, for example, cabbala meditation, kundalini, dao, yoga or philosophy of eastern martial arts, etc. For example, Gopi Krishna's description of his bodily feelings and the body state in Kundalini [32] can be logically explained in terms of the hypothesis suggested. Undoubtedly, the key to the control over different mystic and semi-mystic "energies" of the body is a psychological state of the person. The energy itself is electric in many cases and its manifestations and achieved conditions may be explained by the hypothesis suggested.

A few more words about electric pathology of the body

Electric pathology of the organ also means impairment in blood supply of tissues caused by compression, e.g. tourniquet, tight clothes or changes in the spine or joint because of ageing, etc.

Normal blood flow in a compressed extremity occurs alongside with gradual restoration of sensitivity and is accompanied by prickling (from pleasant up to painful), which re-

mind of current prickling. This is actually the affect of electric charges on tissues on restoration of electric balance of the body.

For example, the symptoms of disseminating sclerosis include sudden numbness of hands and feet, but these are only the first symptoms, what comes next? Physical overloads or exposure to heat may provoke the onset of the disease. In disseminating sclerosis impaired contractions of arms and legs are observed, there is also impediment of speech. Probably changes in electric balance also contribute to it.

Even the time of tourniquet application on wounds may be prolonged taking into consideration the electric component of artificial decrease of blood supply. This factor can be used in hostilities, in disaster medicine and in long surgical operations.

Knowledge of electric processes in the body may help solve the problem of quick arrest of a pain shock in emergencies.

We can not but mention the problem of smoking, which also has its electric component free from nicotine intake. The process of tobacco burning is followed by additional discharge of ions which a smoker inhales, and that leads to chronic electric pathologies of the respiratory and cardio-vascular systems.

«Cavitation in the body»

The chapter offered is devoted to the article of A.I.Goncharenko [9], who offers a cavitation mechanism to explain a changing blood volume in the body. Cavitation in fluids occurs under certain conditions (pressure, rate, etc.) Let us assume that all these prerequisites are present in the body. Evidently, some manifestations of cavitation can explain the facts cited by Goncharenko, but the principles of cavitation can not explain decrease of total blood volume after 1.5- 2 l of donor blood have been transfused or drop of blood pressure down to zero with normal pressure in the carotid artery in patients with collapse. These and other facts are possible to explain with the theory of the electric thrust of blood [1] and the hypothesis of electric balance in the body suggested by our hypothesis. Negative electric charge is increased because of increase of negatively charged ions and/or because neutral or positively charged particles of blood (not all of them, of course) change to negatively charged ones. In this case increase of the negative charge may sharply raise the electric thrust between blood particles or decrease it. Besides, the value of negative potential of the particles

which already have a negative charge increases and it may affect its size compressing or expanding due to coulomb forces between the centre and the surface of the particle. All this may happen quite rapidly all over the body including the internal cellular energy.

Outwardly, this process looks as "increase" or "decrease" of blood volume. Just as on transfusion of donor's blood or other solutions, or on application of pump oxygenation, the electric charge of the patient's blood decreases; this results in decrease of the electric thrust and "decreases" blood volume. As for massage, stress and emotions, they increase the electric charge of blood and thus "increase" blood volume. Sharp increase of the electric charge is one of the causes of blood pressure elevation on stress. This fact is explained by mobilization of the body's reserves and discharge the "supply" of intracellular negative "electricity" into blood to "rescue" the body or even to create a superstress.

Typical examples: a defibrillator "increases" blood volume at the point of the electric discharge by 60% [9] or donor blood being stored in air-proof containers diminishes in volume with the lapse of time.

As for the above mentioned drop of general blood pressure almost to zero with normal pressure in the carotid artery is nothing more than electropathologic condition of peripheral vessels associated with electrostatic "forbidding" of electropathology for blood supply in shock.

In the article were given the examples of selection "... of isolated blood cells from one vessel and their purposeful movement to a certain branch. For example, large old erythrocytes of 16 to 20 microns from the aorta turn only to the spleen, and small young erythrocytes with a large content of oxygen and glucose, and besides warmer, move to the brain. The plasma flowing to the impregnated uterus contains much more protein mycelium than the neighboring arteries at the same time" [9] in terms of the hypothesis of electric balance is based on a simple principle of electrostatic interaction of tissues surrounding the vessel with blood particles which have different level and character of the electric charge, and namely, "old large erythrocytes" and "young small ones with a large content of oxygen" (having a larger charge), which is similar to the above description of 3D self-adjusting brain processor.

The principle suggested by Goncharenko saying that "...control over blood flows, their selection and direction to certain organs and parts of the body is performed by the heart itself" [9] by means of trabecular recess is quite interesting but needs additional research

considering the hypothesis suggested.

Maintenance of electric balance of the body

"Eliminate the cause – the disease will go away" is one of Hippocrates's rules. On the basis of the hypothesis suggested and the well-known facts of favorable effect of negative ionization on the body, one can say for sure that negative aeroions are not a panacea, but their effect can not be denied, the more so because at present there are no other reliable ways to maintain electric balance of the body because there are no other "proven" methods of electric balance maintenance at present. Deprivation of modern people of fresh air and application of dielectric (accumulating electrostatic charges) materials for homes, clothes and footwear disturbs supply of the body with natural negative "electricity". To increase electric negativity of the body it is necessary, in the first line, to use natural ionizers (a walk in the open air), and if it is unaffordable, to use artificial ionizers. A criterion of ionizer applicability is its ability to maintain the level of negative ions in the room according to СанПиН 2.2.4.1294-03 standard [20]. For facilities with forced ventilation: offices and civic buildings, transport (train carriages, cars in which continuous inflow of deionized air decreases safety of traffic), submarines and spaceships aeroionizing appliances combined with forced ventilation are absolutely necessary. Application of artificial aeroionization is obligatory in homes, in children's, educational and health facilities to improve indoor air quality. The appliance viewed above and the way to deliver aeroions without loss through the air ducts [6, 7, 8] provides a required aeroion background of the room and protection against electric fields and high voltage equipment. Locally it is possible to use home air conditioners generating negative ions.

At present the choice of home air ionizers is wide including those that are built in air conditioners, vacuum cleaners and even irons. But unfortunately, many manufacturers of home ionizers and other combination appliances (often bearing Chizevsky's name) pursue only one aim – gaining profit, and forget a more important thing – consumer's health.

So, for better supply of the room with aeroions it is necessary to use only a unipolar ionizer and spread ions in the room mechanically, blowing air through the ionizer. For large rooms it is better to use air ducts together with the appliance [6, 7, 8]. This appliance pro-

vides integrity of aeroions inside the air duct, protects the internal ventilation or air conditioning system against pathogenic flora (e.g. legionella) and excludes the problem of spreading infectious diseases through the ventilation system. In this case the electric field is localized by the ionizer volume and parts of the unit under high voltage are out of the man's reach.

Closed metal conductors affect "electric current" of the body, an individual wearing them in large quantities, e.g. chains, bracelets (especially with magnet inserts) and some clothing details. Thought from electric engineering we know that any short-circuited turn of the conductor around an energized wire affects the current in the conductor, that is why it is difficult to predict the effect of its wearing.

Manipulations of various healers and biotherapists refer to unproven and dubious ways to increase electric balance of the body. The attitude towards them in the society is very different – from recognition to complete disclaimer. This remote diagnostics is probably based on non-instrumental perception of the electric field by an individual. Each person has his/her own set of electric fields which are stipulated by electric currents flowing in his body and interaction of electric fields is a well-known fact. So, that one person influences the other is without doubt. It is natural that each person has his/her sensitivity threshold and what is more important, "realizing" this sense (the effect of external electromagnetic field may manifest in meteosensitivity). There is only one limitation: to correct a foreign electric field it is important to know what should one do and how the affect is accepted, in other words, constant control is needed. It is the principle of control on treatment lies in the foundation of the device for diagnosis and treatment of the patient [15]. Besides, this device realizes the principle of resonant effect which is much more efficient than existing methods of treatment. Sometimes it helps decrease the level of surgical intervention.

Besides, the external local affect upon internal electric fields and currents of the body combined with local heating, cooling and audiovisual support allowed to make a device [33] which provides physical implementation of virtual reality created by a computer or other person, as well as complete relaxation of the body. Unlike the above mentioned device [15] the necessity physically feel the virtual reality allows to make educational, game and training complexes with unlimited number of participants located in various places, being connected via the Internet.

Placebo effect

The hypothesis allows to discuss in details a possible electric component of the mysterious, though widely known phenomenon called placebo.

As we know, placebo is a tablet or medication which does not contain any active substances, but still affects a person. Its mechanism is unknown. The only thing that is known is that the other tablet with active substances affects biochemical processes in the body with the same effect. So, placebo achieves a desirable effect without active substances. Naturally, it is the result of psychological self-suggestion which mechanism is far from pharmacology.

Let us try to assume that the placebo mechanism is based on restoration of the electric balance of the organ or system that was to be treated with the tablet. Then, what is the mechanism of recovery, if the tablet is "correct"? Well, it is quite simple. For each medication the mechanism is known and details can be learnt from various sources – from a leaflet applied to the medicine or from a reference book. But this is only a biochemical principle and it can not be different, because a tablet is a chemical substance. All but one point is correct: at some stage of interaction of the medicine taken or its derivative with the body the "right" for its further effect upon the body, as the treatments requires, goes to electrostatic and electrodynamic forces. These forces influence directly both organic and inorganic substances in the body or act as catalysts of the required processes. These forces are known to the body (as it is a therapeutic effect of the help from outside including an element of the immune system) and the body reproduces them at the psychological level. The process has, of course, its peculiarities, but generally it works this way. It is also natural that not all medications may have a placebo effect, because of absence or little participation of electric forces in their effect on the body.

Placebo, though, is not only a psychological effect, but also the presence of elementary participants of the treatment process (without a tablet) in the body in the form of various ions. So, in the main, the effect of mineral water is based on a long-term consumption of a definite amount of salts dissolved in water, that is, delivery of a certain amount of anions and cations to the body. Participating in different chemical reactions, they change the electric balance of the body (naturally these processes are affected by the gastro-intestinal tract by changing pH ; for this reason there are different methods of drinking it, depending on time

of the day, water temperature, etc.). Intake of ions of mineral salts (mineral water) is the same as the body's getting ready for placebo effect. This is what the person drinks mineral water for - he/she improves his/her health. Saturation with ions occurs when mineral water is also used in baths, inhalations, instillations, compresses, wrapping, etc.

How is it possible to overcome the first chemical stage of the pharmaceutical substance effect and move on to the effect of electric forces? The effect will be the same but without unnecessary chemical substances. The answer may be given only after careful studying and observing electric processes after taking a medicine in real-time mode. The electric balance should be monitored at the level of individual organs and their parts, for example by means of the device [15].

In general, first comes chemistry, then, of course, physics. What does mind have to do with it, and how and when is it involved in treatment? Let us consider the placebo variant. There is no "external chemical substances" (a dummy tablet), only internal ones, i.e. only those substances, that are inherent in the body, what it is composed of or can synthesize. "Electricity" in the body is present in two forms: free electricity (electric charges) and a certain potential possibility to obtain it (produced by cells) in required areas, in required amounts and corresponding to the principles of electric balance. Now, somebody must show how everything should work, and the rest is the matter of organizational skills of the brain and the nervous system. Is it difficult? Yes, it is. And highly probable that it is not true. Though, there is a certain set of standard instructions either inborn or gained in course of life, for example, after some disease, i.e. being immunized. At the same time the algorithm of actions leading to recovery is remembered as a kind of instruction for actions for the immune and other systems of the body. Besides, complete information about the normal electric balance of the organ or system is contained in the brain, and it also works as a peculiar instruction following the principle "do as it done before". These "instructions" can be reproduced by the body either independently or via an external stimulus. What can serve as a stimulus? They may be expectations of the effect produced by the "correct", but in fact, the wrong tablet, going to a bathhouse, drinking alcohol, a strong wish to recover, euphoria, exposure to aromatherapy, herbal therapy; autogenic training, hypnosis and even spells of a healer. In the foundation of all this lies stress or catalytic changes in the electric balance of the organ or the whole body performed by the nervous system due to its effect upon the cel-

lular energy either locally or totally. For example, temperature is elevated in infections. Of course, if the temperature elevates by one or two degrees, many bacteria but not all and not everywhere) will be destroyed by overheating, immune protection will activate; metabolism and the heart rate will increase, etc. The main thing is that electric conductivity of tissues will change as well as increased thermal and electrotaxis will result in electric exchange in the cells and between the organs. And nobody knows what is more important for the body at the moment. In other words, without specific research it is impossible to determine the sequence of chemical and physical (electric) processes leading to recovery and, moreover, to give them a universal definition. Undoubtedly in most cases in the course of recovery electric interactions take place and not only at the known ion level of chemical reactions.

It is probable that in homeopathy the mechanism of action is the same, when small doses of a substance trigger the "instructions" for the immune and other systems of the body.

The nature of stress forming the "electric microclot" is different – from exposure to heat to a nervous breakdown. In this case there is no guarantee of recovery, besides the final effect depends on a number of factors: necessary instruction stored in the memory, a sufficient level of stress, and resources of the body to produce enough amount of electricity, etc. A typical example is urinothrapy (also a placebo of its kind), unnecessary and even harmful way of treatment. But it helps somebody, and we can not call liars everybody (the author does not belong to supporters) who applies this method. Sure, there are some positive results. What is its mechanism? The same – it is stress. We can fancy the psychological state of the person who made up his mind to start such a "treatment" and did it cost to make the first step. Unfortunately, our medicine is to blame in this case. It is necessary to understand and study the whole algorithm of the treatment, put away the first barbarian step and move on to the second step.

Sudden strong stressful effect on the body is applied on purpose in order to obtain a required response of the body. So, a borderline superstress condition of a patient is used by psychotherapists, for example, sudden falling on one's back is used by A.Kashpirovsky to help the patient break psychological defense and this way increase suggestibility or healers who achieve the required state of the patient by decreasing their sensitivity (cautery without any traces left, fire walking, unusual and shocking piercing, etc.).

I would like to repeat that not every medicine has a clearly marked electric component in the chain of biochemical effects. But it sure is present and must be found, and the patient should have the possibility to try it, maybe with lesser doses of his usual medicine before he starts chemotherapy. The population being adequately informed it will eliminate the problem of delayed official treatment by oncologic patients because of the fear of side effects of potent medicines.

As the latest findings show, acupuncture has also a placebo effect. For example, scientists of the Nordic Cochrane Centre in Copenhagen "... did not reveal any "clinically significant" difference between the true and "false" acupuncture. Though, they found out that the patients who underwent the course of "false" acupuncture experienced relief unlike those who did not undergo acupuncture. The authors of the report assume that this maybe the result of psychological effect known in medicine as "placebo". As the scientists say, their research makes the true effect of acupuncture doubtful, both of "true" and "false" acupuncture. The experts claim to carry out more research to find out whether the whole theory of acupuncture is built around placebo effect. [34].

What happens in reality? Inserting the needle into the skin allows several conducting planes of tissues, which are on its way and have different electric charge (separated by tissues with insulating properties, e.g. serous membranes, fat, etc.) connect by means of a good conductor – a metal needle. Electric energy flowing through the channel of the needle to the surrounding tissues decreases electric voltage in the tissues and this allows to relieve pain or have some other therapeutic effect. Presence of a certain channel around the needle which appears on turning the needle while inserting it (sometimes the needle is rotated longer, in this case more fluid gets to the site of the needle). As for conducting fluid, it helps obtain a certain effect even if dielectric needles are used. To make a kind of short circuits between conducting planes of tissues in individual areas it is not necessary to get into the acupuncture point. In this case it may go about "areas" of electrostatic acupuncture, excluding the possibility to get into a blood vessel or a nerve.

The same process is observed in massage. Strong pressure increases conductivity of the "layers" of tissues with higher specific resistance (particularly in fat areas). It decreases the charge of a kind of a condenser (where the plates are represented by conducting tissues with different electric potential that surround the tissue with low conductivity, e.g. a serous

membrane), increases blood circulation and, as a consequence, relieves pain, particularly if leakage current arising from condenser failure touches and stimulates the neighboring nerve endings which increase and transmit the received impulse. The response of the nervous system that follows the impulse may serve as a source of trigger and biochemical changes in the body, for example contraction or relaxation of a group of muscles.

In addition to the above said may serve the example of the effect that gives the so-called "iodine net" drawn on the skin. Besides irritating and warming effect of the iodine tincture, it gives an electrostatic effect by producing areas with different concentrations of ions on the skin surface. This facilitates appearance of ion microcurrents on the surface of the skin and in the adjacent tissues improving electric exchange and removing an electric microclot. Not accidentally the effect of mineralized solutions on the surface of the skin, taking baths with mineral water and various salts have been popular for a long time. When mineral water gets into contact with a human body, an electric exchange occurs. This process is regulated by the body at the expense of positive charges discharged through the sweat glands and receipt of negative charges from the anions of the solution.

Thus, it is possible that the placebo effect is an electric part of "multipass" processes in the body on treatment. Applying our knowledge of the process it is possible to decrease the chemical effect on the body.

Diagnosis and restoration of the electric potential of the body

In order to restore electric potentials of tissues it is necessary to accurately measure them in the most convenient for a person way. To measure a charge or potential difference between two points in the body is possible either by contact or noncontact method. Application of contact electrodes on the skin surface is not the best way to determine the internal electric potential, though it is the easiest way. If the value of the internal potential is accurate, one can say only after analyzing several measurements on the surface of the skin in different directions from the required point. Contact electrodes for internal measurement of tissues, shaped as needles for acupuncture with a lot of contact rings lengthwise or of other types, are more informative but their application is limited. It is desirable to compare the data obtained from contact rings with the findings of tests, EEG, ECG and other methods of examination for evaluation and analysis. Only this information allows to estimate the known

processes in the body in a different way.

Electric balance of the body is a prerequisite of its normal functioning and study of errors allows to prevent diseases and possibly influence the process of ageing. It is highly probable that electric processes affecting the mechanism of telomere shortening have not been properly examined yet.

Lately there have been many investigations to determine various auras and biological fields. For example, devices to study Kirlian's effect, skin resistance (polygraph, electro-puncture diagnosis), Bekhterev's biometer and some others obtain only the total effect of electric or magnet processes in the entire body or at least a few organs. To obtain information about a particular organ, and what is more, about a part of it, is rather difficult, and sometimes impossible. This obstacle, without doubt, holds back research but to have the entire picture of the electric balance of the body this information is important. Drawing and monitoring of 3D maps of the electric potential of the body maybe the shortest way to prevent diseases. This requires non-contact method, for example [15]. Mass production of this device is preferable on the basis of nanotechnologies but its features allow to measure electric potentials in the entire body volume, and make a surface and volume maps of static and dynamic electric potentials including drawing a 3D image and 3D picture of an organ potential. This method is more informative than tomography and besides diagnosis also treatment is possible, which progress will be seen on-line, besides the device is much cheaper and what is most important, it can be placed on the body and used for a long time, including a portable variant.

The counterparts representing some special cases of application of the device [15] start appearing, for example, to stop internal bleeding on the battlefield by means of ultrasound [35], the system of telepathic communication in the US army [36], clothes able to register biological current [37], a T-shirt registering a cardiac rhythm [38] or a digital patch [39].

To non-contact methods of measuring internal potential refers monitoring of "positive exhalation" charge (taking into account ionization of the environment during examination and after it), which allows to generally estimate the internal electric balance.

Application of the hypothesis

The interest of scientists to the "vitamins of the air", as Chizhevsky called negative aeroions, reached its climax to the beginning and the middle of the 20th century and is closely associated with his name. Unfortunately, the up-to-date medicine often neglects human nature because of the efforts made by the pharmaceutical industry. Still, electrostatic changes in the human body after a tablet of aspirin have not been studied yet. The hypothesis presented in this paper will probably help correct some methods of therapeutic and surgical treatment, thus doing less harm to the body.

The external correction of the electric balance of the body increases immunity and a general tone and serves a kind of "electric dope". Replacement of harmful chemical dope by the "electric" one will lessen the harm and enhance resources of the body.

Being in the environment with negative ions is an obligatory condition for electric pathologies prevention as it is possible that progressive arthritis or osteoporosis may result from accumulated electric pathology in the joint.

Radioactive emission exceeding a natural level and its influence upon the body deserves separate consideration. We can only state for sure that radiation changes the charge of equipotent surfaces of organs. Registration of these changes may help reveal radiation disease at early stages and restoration of the charge will relieve its course and even treat radiation disease. It is known that small doses of radiation comparable with a natural level, stimulates immunity and cell division and triggers other mechanisms of cell defense. The mechanism of this process is internal ionization of tissues and enhancement of the body negativity. It is necessary to control changes in the electric balance of the body in general or in a certain organ on radiation and learn to resist these changes in order to build an active protection against radiation.

Modern ways of treatment of such a wide spread disease as chronic obstructive pulmonary disease (COPD) do not take into account electric features of breathing, and the work of ciliated epithelium is nothing more than mechanic movement of the charged bodies in the electric field. Disturbances in the electric field or the charge of epithelium also disturb mechanic work of epithelium to discharge mucus and sputum. The parameters of the electric field of the bronchi are affected not only by the influx of positively charged blood but also a general positive charge of the bronchi that may change for various reasons. The chain of

adequate treatment of COPD might have lost an important "electric" link, which becomes more important if the ways of electric exchange in the lungs and bronchi underwent pathologic changes, for example, induration of tissues, commissures, complications of inflammatory process, etc. successful treatment of COPD is possible but it should be conducted in complex. It is known, though, that influence only upon the "electrostatic" link may result in a positive treatment dynamics. In this case the mechanism works that was described in the chapter about placebo effect. For example, favorable effect in asthma is noted not only after spa, but also on artificial negative ionization of the air (works by Chizhevsky and his followers). A well-known Frolov's device helps treat many diseases by means of difficult breathing through water that boils up and spatters. This is the instance of breathing exercise supplemented by balloelectric effect, that is, occurrence of electric charges on dispersing water. Small droplets of water receive a negative charge and are inhaled, and larger droplets get positively charged and remain inside the device. The same effect may be observed at the seaside or while doing inhalation, for example, mist spray made by a nebulizer.

One of the therapeutic factors in speleotherapy is a certain aeroion composition of the air in karst caves and underground openings. Artificial speleoclimatic chambers with walls made of sylvinite or halite (natural mineral of sodium chloride) and equipped with aerosol sprayers can to some extent serve counterparts of natural caves but aeroion background is an obligatory condition which, as a rule, does not correspond to natural conditions.

Electric potential 3D map of each person is a natural instrument in a physician's hands that allows not only to diagnose a disease but also coordinate the process of treatment. Dynamic changes of the electric potential map helps follow not only local disturbances in the electric exchange but also reveal an electric pathology in early stages and analyze the mechanism of their occurrence. Electric potential maps of individual organs in different people do not differ much and this makes possible to apply a 3D electric potent method to treat in-born diseases. Here we mean a real electric potential map and not that made on the computer by several points of real measurement, as, for example, the well-known CARTO system (design of 3D electromagnetic map of the heart).

Surgical interventions especially transplantations take into account only physiology and anatomy of corrections and neglect electrophysiological integrity of the organ and the

body in general. In some cases on transplantation "electric rejection" of the transplant is possible and actually takes place; the phenomenon which can not be explained in medicine. Long-term storage of transplants is impossible without artificial generation of a 3D electric balance which is so important for this organ. The organ must be stored in a container providing electric fields inside the organ and 3D electric potentials typical of this type of the organ. After engraftment it is important to create habitual conditions of the electric balance even if it is done artificially.

There is a mechanism in the body which is able to restore the disturbed electric balance. Knowledge of this mechanism and its taking account of in medicine makes possible to look upon such notions as damage of tissues, healing of wounds and engraftment. One of the elements of the mechanism is without doubt the fact of restoration of capillary circulation when a part of vessels are damaged in a certain body area. In any case independent formation of new capillaries or new paths of blood flow means not only restoration of blood supply but also restoration of "electric supply" in this part of the body. It means that some processes, as healing of wounds, may be accelerated, as Chizhevsky could observe on artificial air ionization.

To accelerate the process of healing of wounds and giving first aid in electric pathologies, it is necessary to increase internal electric negativity of the body and restoration of the local or general electric balance. It can be achieved either by purposeful intravenous administration of ion containing solutions close to the site of injury. To stop bleeding, particularly internal ones, positive ions are to be administered. For this purpose injections or intravenous infusions must be made downstream of the corresponding organ. The ions can be obtained by different ways: solutions of salts passing through ion separating membranes, application of various technical devices saturating the administered solutions with ions, or administration of aeroion solutions. In any case it is important to provide stability of ion concentration in the liquid in connecting tubes according to the already mentioned principle [6, 7, 8].

Besides, ionization of the administered solutions of elements of blood in situations when it is impossible to give a qualified medical aid, will allow to develop different blood substitutes and decrease harm of some medications. The effect is based on "electric" compatibility of the particles of the administered solution and the patient's blood, as on administra-

tion of some drugs (naturally, de-ionized) the "electric microclot" is formed preventing further administration, provoking pain and eventually decreasing efficacy of treatment.

Substituting a conventional way by which oxygen enters the body for another way, for example, the stomach (oxygen cocktail), intravenous injections of solutions containing oxygen or apparatus of artificial air exchange is technically realizable, but it becomes impossible without taking into account the electric component of breathing on prolonged application to support vital activity. These additional measures are necessary in case of emergency, though in some cases they may be primary measures; for example, to prevent cardiac-pulmonary "electric clot" in the absence of spontaneous breathing on resuscitation. This method is applicable if a person is unable to breath for some time as in the army or on the work of special service.

As it was said above, the change of the charge in the capillary wall is an additional factor regulating metabolism through the layer of endothelial cells. Then, effecting electric potentials of individual cells or groups of cells it is possible to control their development and growth. For example, by changing the membrane potential one can regulate the material balance of the cell. It turns out that this method must be used in treatment of various malignant tumors. Certainly, it is impossible to connect a group of cells or moreover, one cell to a wire, and the potential should be changed locally in a certain point of the body. To reach the aim one can use different means including the device suggested [15].

We know how a spermatozoid moves towards the ovocyte (especially its chemotactic stages), but it is important to take into account electrostatic aspect of a spermatozoid movement (also being charged) on its way, starting with its formation and maturation, and maybe it will help solve some problems of infertility. The amount of electric charges in a spermatozoid and their distribution of the surface may serve the basis of their grouping depending on their type [41].

Disproportional intrauterine development of the embryo, just as disproportional growth in childhood and adolescence (acceleration problems) may lead to abnormal development of the system of internal electric balance, and may be the cause of many diseases, which are considered to be inborn and incurable at present (e.g. cerebral palsy).

Study of electric process in the body after taking a narcotic will possibly help destroy the "electric link" of drug dependence and thus decrease it.

We can assume that disturbed electric balance of the brain results in disorders in the physiological mechanism of the hematoencephalic barrier which alongside with other factors lead to hardly treatable diseases, such as Alzheimer's, Parkinson disease, disseminating sclerosis, etc.

A number of already known manipulations and therapeutic procedures should be given an additional explanation. For example, mechanic pressure in massage particularly pressing acupuncture points or acupuncture itself change electric properties of tissues, conductivity in the first line, and it causes a local electric "burst". A mustard plaster or a compress not only have a local warming effect but also change electric negativity of the adjacent tissues and organs and stimulates electric impulses in the nerve endings.

On application of electric-physiotherapeutic procedures it is important to take into account the effect of the currents, laser and microwave radiation upon the electric balance of the body. It means that one should be very careful with administration of such procedures. For example, one of the factors of laser efficiency is blood ionization and it may be both a benefit and the source of "electric microclots".

The presence of controllable electric balance of the body is maybe one of the physiologic conditions of vital activity of the body. So, local necrosis (as a consequence of burns, frostbite, injuries or infections, etc.) occurs as a result of the failure to maintain the electric balance in this part of the body. In different concentrations of positive and negative ions in the environment, all other factors being equal, increase of the temperature corroder of vital activity of a human being was noted. For example, cold is easier to survive if the air contains ions. This is the reserve of the human body which may be used in emergency.

So, the popular statement "...the cause of all diseases are the nerves" may be easily explained. This is how the nervous system provides control and regulation of the electric balance of the body and its organs including the discussed above placebo effect. Electric monitoring of the body [15], is an additional factor in prevention and treatment of many diseases associated with partial necrosis of the internal organs tissues (kidneys, heart, liver, etc.). The other side of disturbed electric balance is "receiving permission" for a chaotic growth of cells and formation of tumors. Chaotic spread of metastases aggravates the electric imbalance of an organ or the body in general, and it maybe the cause of severe pain, necrosis of tissue and death. To add an electric component during diagnosis and treatment of

oncologic diseases is particularly efficient at early stages. Nevertheless, artificial maintenance of the damaged organ can possibly relieve pain, help prolong therapy and increase efficiency of the surgical intervention.

The main questions of the hypothesis

Let me formulate, probably the most important question which arises on the first acquaintance with the suggested hypothesis. What are the facts proving the correctness of the statements? I will answer at once, they are absent (if there were any, the hypothesis would be called a theory). But there are no facts proving that these suggestions or a part of them, are false. You must agree that the suggestions expressed in the hypothesis are rather convincing and the modern medicine either does not explain these phenomena, or explains them unsatisfactorily. The, what do we have today? Researches into the living organism are based on anatomy that gives only an outline of the dead body organization. Unlike biochemistry the electric processes finish immediately after the person dies. But to confirm the points of the hypothesis on the live body is problematic.

An ideal variant would be the presence of electric contacts of nano-sizes and possibility to place them on the inner surface of the arteriole or capillary, but such instruments do not exist.

Electric interactions discussed in the hypothesis are not quite strong to be registered by the existing methods. It goes about ultrashort distances and insignificant forces, which are sufficient to roll an individual erythrocyte in a tube. Besides, the abundance of multidirectional electric interactions in each cell, mentioned in the hypothesis, is suppressed by stronger electric processes in the body, such as electric potential pulse wave, registered by ECG, or electric impulses of the brain, registered by EEG, etc. For that reason electric interactions are only a weak electromagnetic background or white noise, which is weakened by the nearest cells and do not leave the surface of the body. What can be done? - To use indirect methods and wait for an appropriate level of nanotechnologies.

Conclusion

The hypothesis concerning interaction of electric currents and fields in the body is based both on assumption and on factual findings of various researches. The hypothesis in

no way suggests substituting the crucial role of biochemical processes in regulating the functions of the living body by electric interactions. The goal is to try to unite and systemize the well-known facts and theoretical prerequisites (often fragmentary) into a whole picture, explain them, reconsider some of them, and offer a general picture of electric processes in the body. How I managed to cope with the task, the reader will judge. Probably, the suggestions expressed in the hypothesis are not real. But who knows? One thing is certain – charged ions are an important factor of maintenance and often provision of physiological processes in the body. The examples cited above show that the role of electric processes in the body known from electrophysiology is underestimated, and most probably should be supplemented and even revised. Some conclusions of the hypothesis, as they are offered, may serve a source of application in practice, and some need comprehensive study and confirmation. In spite of frequent mentioning the device for making a diagnosis and treatment of the patient, we believe that the principle of obtaining electric potential pictures in the body is the most acceptable and available to research into the electric balance of the body and implementation of the already known methods of treatment and diagnosis.

There is a well known saying by Leo Strauss that any author addressing only thinking readers should write in such a way that only an attentive reader would be able to understand the true meaning of the written lines. Speaking of the hypothesis we can say with certainty that in part it was written exactly so, for this reason "an attentive reader would better reread it and besides start with the end and finish with the beginning, paying special attention to the lines which seemed the least serious. It is re-reading that may help re-discover the hypothesis. And of course you may ask the author. I answer the question, why it was written so? Because the hypothesis is meant for a wide circle of readers, each of them being an expert in his own field. And reaction of my readers to the 1st edition of the book is a proof to it.

The first edition of the hypothesis received a lot of responses from the representatives of medical science, but most remarkable were two of them. The first said "...it can't be", and the second - "... it is well-known". I absolutely disagree with both of them. Or, rather, I will not argue, that is why on nearly every page I call to carry out experiments. It is collaboration of experts in different fields in studying natural forces and processes will allow to refuse from the stereotypes. Joint work of chemists, physicists, biologists and physicians at the junction of different sciences will help revise the already known mechanisms, have a broad-

er look at the processes in progress and eventually find the truth. That is why I hope the readers will find the suggested problem interesting, particularly among health care specialists and serve a stimulus for further research.

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