THEORETICAL FOUNDATIONS OF PHYSICAL AND MATHEMATICAL MEDICINE

Comments and hypotheses on biophysical factors and mechanisms of action.

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CHAPTER 1

BASES OF THE ORGANIZATION OF LIVING SYSTEMS

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Hierarchical levels of the system organization of matter

At this present stage, as a result of the development of scientifical and practical medicine, clinical physiology, medical physics, physics and mathematics, cybernetics, electronics and other branches of knowledge, therapeutic opportunities of using physical factors in complex therapy, medical rehabilitation and disease prevention, as well as diagnostics have significantly increased. The impact of physical factors (electrical, magnetic, electromagnetic, ultrasonic, etc.) on biological systems and, in particular, on the human body is the subject of biophysics, physiology and other disciplines of theoretical and applied medical and physical research. Biophysics of complex systems studies the kinetics of bioprocesses, timewise behavior of various processes inherent to living matter and thermodynamics of biosystems in present time.

The human body is a complex biological system that functions by certain rules and principles, the knowledge of which gives an opportunity to evaluate its state and influence its inner processes. The complex system organization of the human body is represented by different hierarchical levels, such as atomic, molecular, supramolecular, cellular,

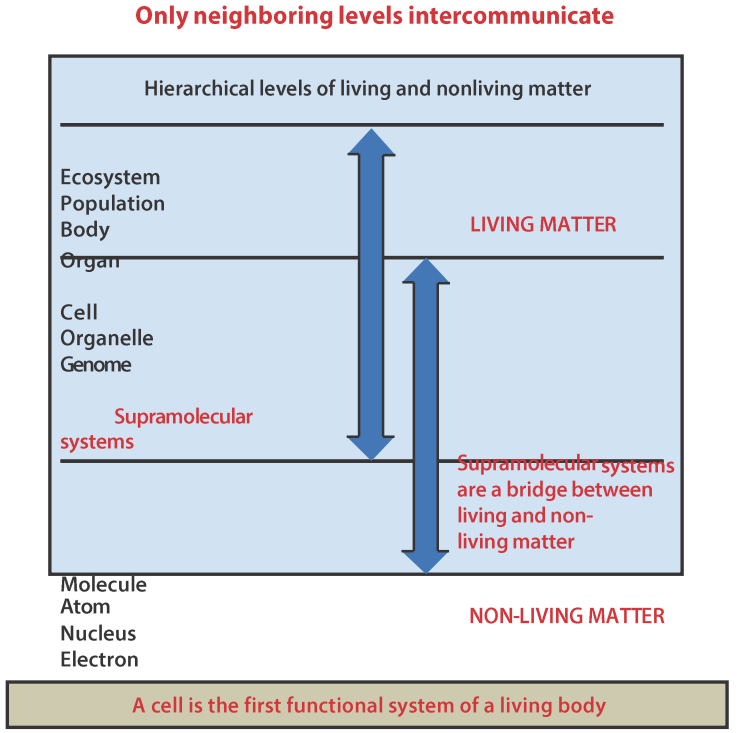


Fig. 1. Hierarchical levels of living and non-living matter

organ levels, etc.

There is certain functional relationship inside the body and between hierarchical levels. Simultaneously, every level of the system organization is related to a certain structural state of the elements it is comprised of, which in turn, to any extent, influences the functioning dynamics of the given system level and the human body in general.

The formation basis for the dimensional structure of matter of all hierarchical levels (atomic, molecular, cellular, etc.) is the "electric field". That allows us to know that an atom consists of a positively charged atomic nucleus and a negatively charged electron. Dimensional organization of molecules is also based on the unification of the different charge elements, - atoms, ions, molecular parts. Moreover, general dimensional molecular structure is very sensible both to the presence and location of every single one of its elements. For example, a toxin complementarily combined with a molecule, i.e. cellular receptor, is able to change its conformation and function. Such complementary combination (cooperation) works against the charge relationship of a site (part) of the molecule and the toxin. Supramolecular systems are a bridge between living and non-living matter.

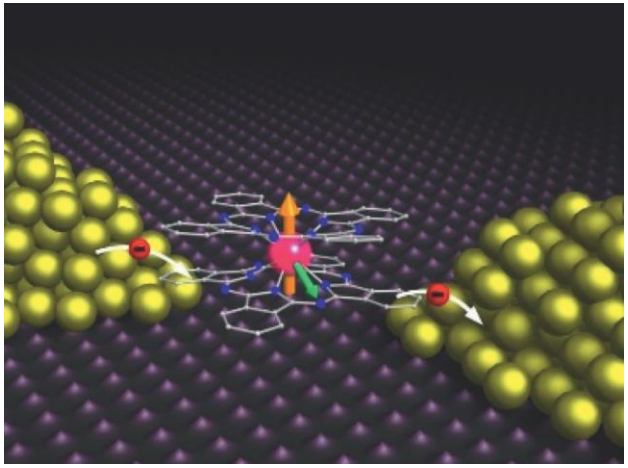


Fig. 2. An example of recognition and intercommunication of supramolecular systems.

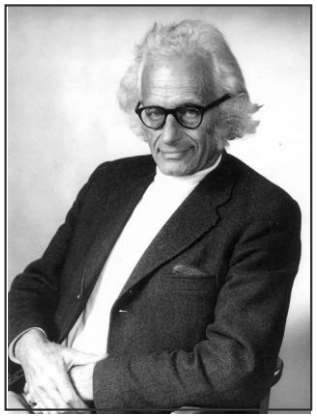
The ability of supramolecular systems to recognize each other is also built on the principle of complementary intercommunication between spatially distributed electric fields.

You can see in Fig. 2 the interaction of unipolar systems which recognises the analogizing principles of self-charge elements by taking into account the dynamics of spin connections, as well as the vector and polarization of such connections.

In 1987 scientists Donald James Cram, Jean-Marie Lehn and Charles J. Pederson were awarded the Nobel prize for research and discovery of supramolecular properties on the following wording: "For development and application of molecules with structurally specific interaction of high selectivity". Apparently from that moment chemistry started addressing not only the terms and properties of separate molecules, but the specific properties inherent to supramolecular systems, among which are recognition, transformation, relocation. These properties determined the mechanisms of self-assembly, self-organization and functionality of complex biological systems.

The life of biological systems takes course within space and time. A physical model of such a continuous medium is often called the space-time continuum. The electric field is the base for development and interaction of the space-time continuum.

Herbert Frohlich, an English physical scientist who established a theory of coherent oscillations in biological systems, noted back in his day that "all living cells possess a certain electrostatic charge that rhythmically changes under the influence of inner metabolic processes." It appears from this that the structure of matter and its dynamic patterns are reflected in certain structure and dynamics of an object's electric field intensity.



Herbert Frohlich
(1905 – 1991)

Not only do cells possess the dynamic ("rhythmic" according to Frohlich) electric charge, but also, as we already understood, most biological molecules, which form the very cells, their matrix, regulatory and control signals of intracellular and intercellular reactions and interactions. Electric charges in molecules and the related electric field intensity possess an individual space distribution, depending on its effect upon such a medium's molecules. Many physiological processes change depending on the functionality of biological tissues, thus leading to changes in the electric field intensity, which can be traced through the whole hierarchy of processes.

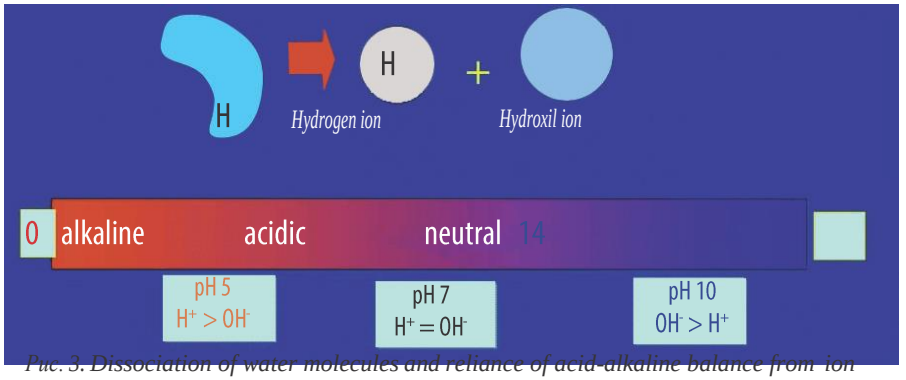
Let us consider the properties and effects of such an important factor as electric field intensity.

Electric field intensity and its impact on properties and functions of biological molecules: Isoelectric point.

The Electric field intensity is taken to be the main physical factor used in CME technology, which has collected different data on the state of the whole functional hierarchy of biological systems.

Let us first consider well-known medicine performance measures of physiological conditions and the criteria used to evaluate the display a chosen physical factor in the functioning biological systems. Among others you might be familiar with the concept of pH – the acid-alkaline balance. Unfortunately, this factor is not always given due consideration as a very important functional parameter. Nonetheless, the acid-alkaline balance is an important factor that significantly influences the regulation of physiological processes in a human body. Our breath, blood circulation, digestion, excretory system, immune system, hormone system, etc. depend on it.

Let us recall what this factor means and what physical impact it has on the state and functioning of molecules and cells, starting with a very simple example – a water molecule. Water is a very weak electrolyte, its molecules insignificantly break down to hydrogen ions H^+ and hydroxyl ions OH^-, i. e. dissociate:



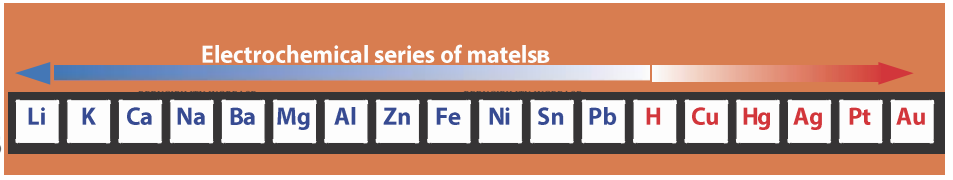
Puc. 3. Dissociation of water molecules and reliance of acid-alkaline balance from ion concentration ratio $(H^+) + (OH^-)$.

$$H_2O \leftrightarrow (H^+) + (OH^-)$$

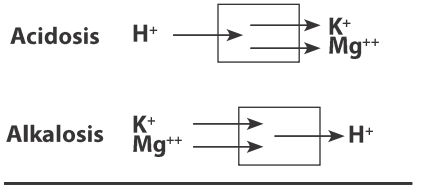
The more (H^+) ions water or any other liquid medium contain, the more acidic it will be. In contrast, if water has more ions (OH^-), the more alkaline it is. These ions can be free or be a part of other molecules, determining their acidic or alkaline properties. Ions of different micro- and macro-elements which have individual electrochemical potential will also be characterized by inherent acidic or alkaline (reducing) properties, influencing the acid-alkaline balance of a human body. Acidogenic reactions in a human body mainly increase its energy level, while acidifying reactions, on the contrary, reduce it. Due to the fact that both reactions are part of natural metabolic processes within a living organism, their dynamic balance becomes a very important factor. Such balance reflects normal physiological state of various biological media, functional systems, and organs.

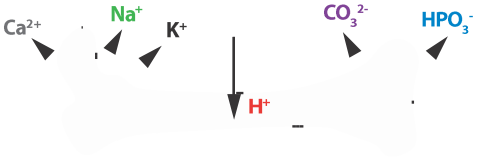
Electrochemical series of metals

Li	Cs	K	Ba	Ca	Na	Mg	Al	Zn	Fe	Co	Ni	Sn	Pb	H_2	Cu	Ag	Hg	Pt	Au
-3.04	-3.01	-2.92	-2.90	-2.87	-2.71	-2.36	-1.66	-0.76	-0.44	-0.28	-0.25	-0.14	-0.13	0	+0.34	+0.80	+0.85	-1.28	-1.50
Li^+	Cs^+	K^+	Ba^{2+}	Ca^{2+}	Na^+	Mg^{2+}	Al^{3+}	Zn^{2+}	Fe^{2+}	Co^{2+}	Ni^{2+}	Sn^{2+}	Pb^{2+}	$2H^+$	Cu^{2+}	Ag^+	Hg^+	Pt^{2+}	Au^{3+}



Transcellular shifts at:





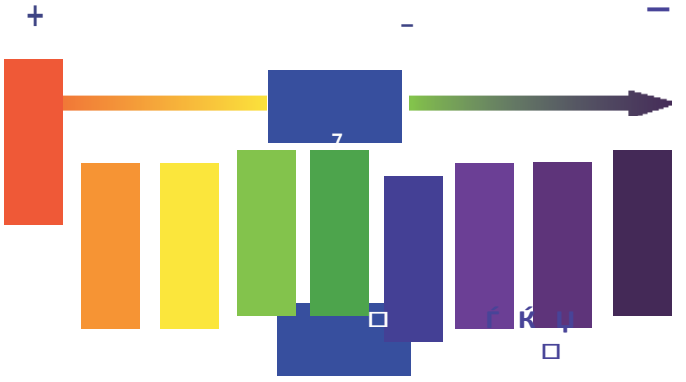
The Hydrogen-ion exponent is the level of pH which measures the activity of hydrogen ions (H^+) in fluid, quantitatively identifying its acidity. This measurement is equal in value and opposite in sign to decimal logarithm of hydrogen ions, expressed in литр:

$$pH = -lg\ [H+]$$

Because of this logarithmic correlation acidic properties of two media with, for example pp=7 и PH=8 will differ 10 times.

Let us consider the main physical mechanism that leads to the disturbance in metabolic processes and subsequently to disease development, in this case the aberration in the dynamic acid-alkaline balance within different systems of body.

Main biological molecules, such as amino acids, peptides, proteins and others, are electrolytes which contain both acidic and basic groups, and because of that dissociate into aqueous liquids, both as acids with hydrogen ions abstraction (H^+) and as bases with hydroxyl ions abstraction (OH^-). Substances with such properties are called ampholytes.



The charge of every such molecule is separated and depends on the quantity of ions in acidic and basic lateral radical groups.

Such molecules with individually distributed charges will move at different speeds inside a medium causing different acid-alkaline balances. Moreover, the acid-alkaline properties of a medium will not only influence molecules movements, but will change their electric charge. A molecule's essential characteristic is the "isoelectric point." When the value of pH within both a medium and molecule's charge are compensated, the molecule becomes electro neutral. An isoelectric point protein is featured to have the least solvability, it easily cipitates and its solutions are less viscous. This can be explained with the absence of an electrostatic repulsion between protein molecules. Uncharged elements of protein can agglomerate with each other and, as we already noted, cipitate. The Isoelectric point value can vary for the same protein in different conformations.

If the pH level of a medium is less than the isoelectric point value of a protein molecule, then the molecule is positively charged. If the pH level of a medium is higher than the isoelectric point value of a protein molecule, then the molecule is negatively charged.

This property of biological molecules in combination with different biological media of human body is widely used in the method of "isoelectric focusing", which is applied to identify molecules outside the medium's substance and determine the concentration of that substance during tests. Different proteins possess individual space charge and different isoelectric points. Acidic proteins predominate in living bodies.

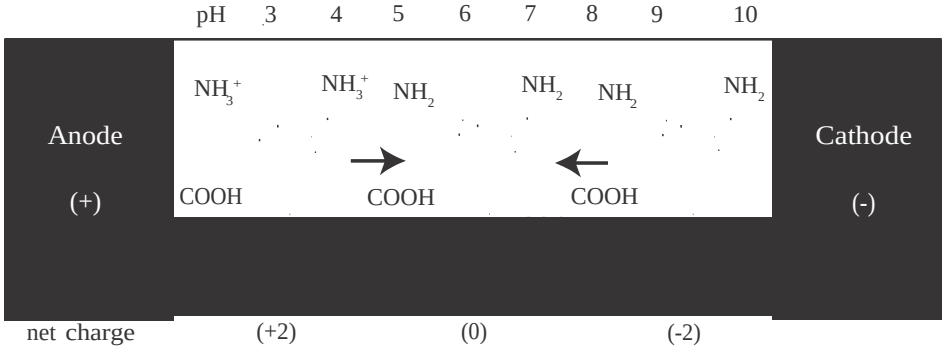


Fig. 4. The arrows show the direction of maximum protein concentration (focusing) to isoelectric point.

The gradient of the pH of a medium, consisting of differently charged molecules, forms its own electric field intensity. External field can also influence the formation of the medium's pH. Molecules-ampholytes under the influence of an external electric field migrate into a medium, creating pH gradient.

Due to the fact that every biological molecule in a living body has a particular function, deviation in the acid-alkaline balance from physiologically normal state, in which the molecule functions, can result in the change of a whole chain of connections and interactions we call "metabolism."

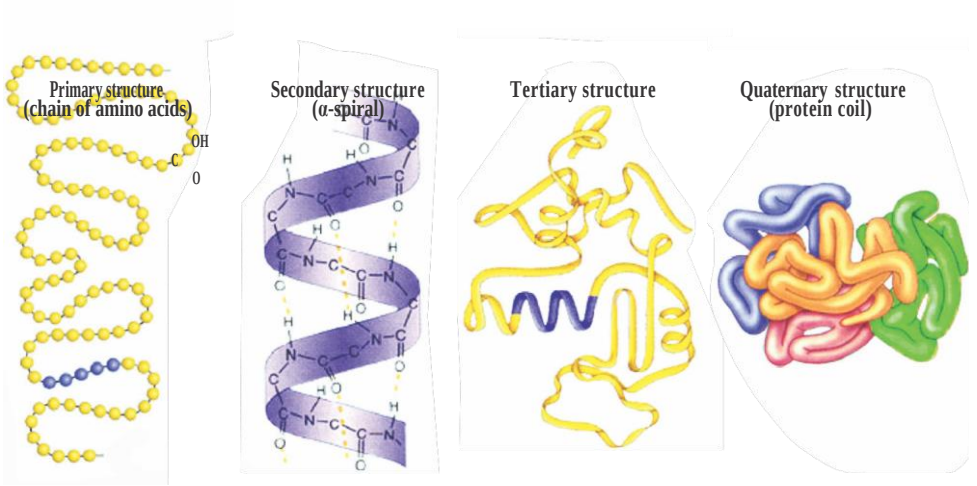


Fig. 5. Biological function of proteins is mainly determined by their dimensional structure.

Nowadays over 95% of all medicines in the market are aimed to influence proteins, changing their synthesis, structure, and activities.

Almost all diseases can be traced back to the changes on a protein level.

Suffice to say proteins act as ferments, hormones, and antibodies on cellular level. They ensure cell structure formation; they are engaged in signal functions of cells and the functions of cellular communication.

If the primary structure of a protein doesn't contain enough information, it defies its
The biological function of proteins in the first instance is identified by their dimensformation.

At the same time, the native form of proteins is related to its maximum functionality, which is connected with their functioning media.

In that light, the importance of using methods to correct the acid-alkaline balance within media becomes obvious.

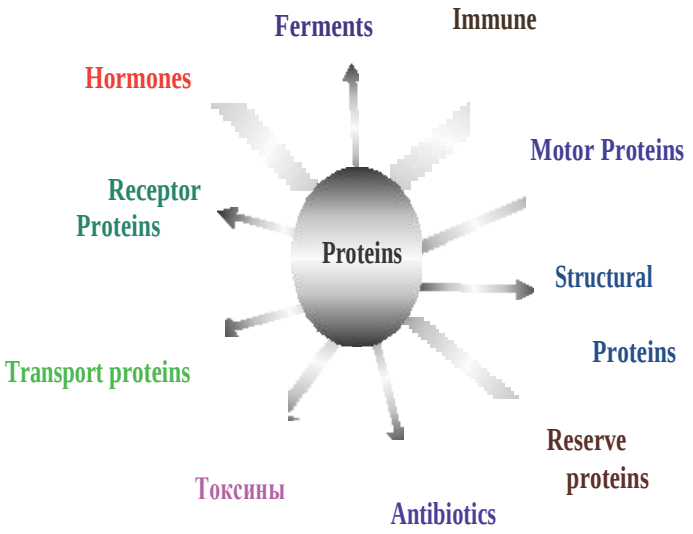
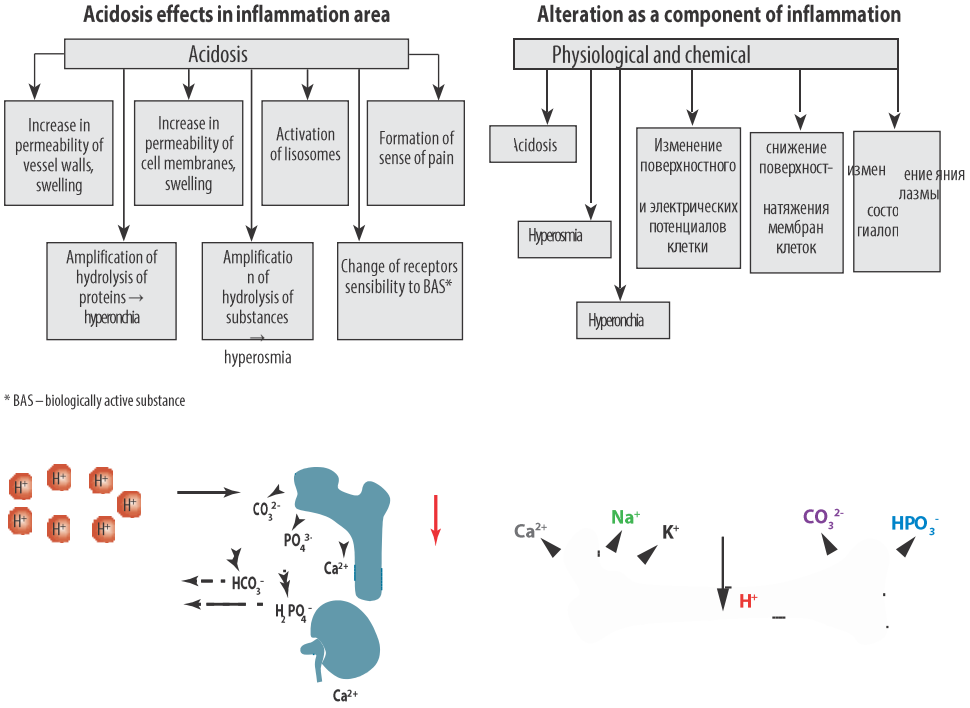


Fig. 6. Biological functions of proteins

Here arises a reasonable question: what kind of chain of interrelated mechanisms and impact principles used in CME allow us to regain the acid-alkaline balance and other metabolic processes on a molecular-cellular level?

The Answer: The dynamic gradient of the space-time distribution of an electric field intensity is formed during compensatory correction on an electrode (with the use of a correction marker) within the actual state of the biological system. When the intensity is release down to zero the activity of the 'vector potential' is preserved, which in quantum systems synchronizes their structural elements, restores information density of the system and thereby redistributes inherent electrical charges of molecules in ampholytic (biological) media, recuperating the functionality of both media and molecules. These changes are bound with the alteration of the isoelectric point in functional molecules (mainly those that are being targeted by a compensatory signal marker) to the level of its native state, i. e. maximum functional activity. In this regard, the molecular interaction of kinetic and metabolic processes is restored.

Recuperation of the molecular-cellular synchronization of biological tissue, under the influence, if what is noted above, restores its informational density (reducing the level of entropy process, chaos) and increases the level of contact and non-cognate interactions based on the principle of non-local connection.



Acid-alkaline balance, Acidosis-alkalosis And Catabolism–Anabolism

The concepts of "acid-alkaline balance", "acidosis-alkalosis", "catabolism-anabolism" are not always viewed as mutually conditioned. We will try to connect how these concepts can't exist without each other. Segmentary use of these terms to some degree obstruct the comprehension about the consolidated mechanisms of their actions and doesn't always let us evaluate to the full extent the properties and effects of their development in a unified manner. Let us unite these concepts within the same context and essence of the inherent processes.

The term "acid-alkaline balance" means that the inner medium of the body should be balanced in a certain way. Shifting of these values away from a physiologically normal state indicates alkalosis or acidosis of body, which then leads to vital functions impairment. Both alkalosis and acidosis are undesirable for body. Their existence is in a constant fight between oxidants (free radicals) and antioxidants. The increase in acidity level leads to the increase of the quantity of (H^+), provoking acidosis development.

This condition accompanies any inflammatory process. Along with this, acidification will lead to an inflammatory process and conversely the inflammatory process results in an acidic media. Whatever the chosen therapy, it should recuperate the acid-alkaline balance and remove inflammatory process.

Any inflammatory processes are related to acidosis development. Inflammation disarranges tissue structure and even leads to its disintegration, promoting metabolism ("fire metabolism"). The more acute the inflammation is, the worse the case of acidosis becomes. Normally the concentration of hydrogen ions in tissue is 0.5.10-7, i.e. pH equals to 7.34, but during inflammation it can be, respectively, 25.10-7 where the pH equals 5.6 and lower. Thus, at acute, suppurative inflammation the pH equals to 6.5-5.39 and at chronic inflammation equals to 7.1-6.6.

Acidosis can be determined in all cases of blood circulation failure, diarrhea, nephatony, convulsions, collapse, tissue hypoxia. Acidosis can lead to osteoporosis, usually with a case of polyuria (frequent urination), when increased amount of calcium is removed from the body.

Venostasis and venous insufficiency is also related to acidosis. Acidosis results in acid crystals tophus in vessels, muscles, joints, connective tissue, adipose tissue. Due to excessive acidification, arterial pressure and cholesterol level increases in the body.

Dysmetabolism can trigger both physical and psychic disorders. A weak alkaline level is ideal for the functioning of nervous system cells.

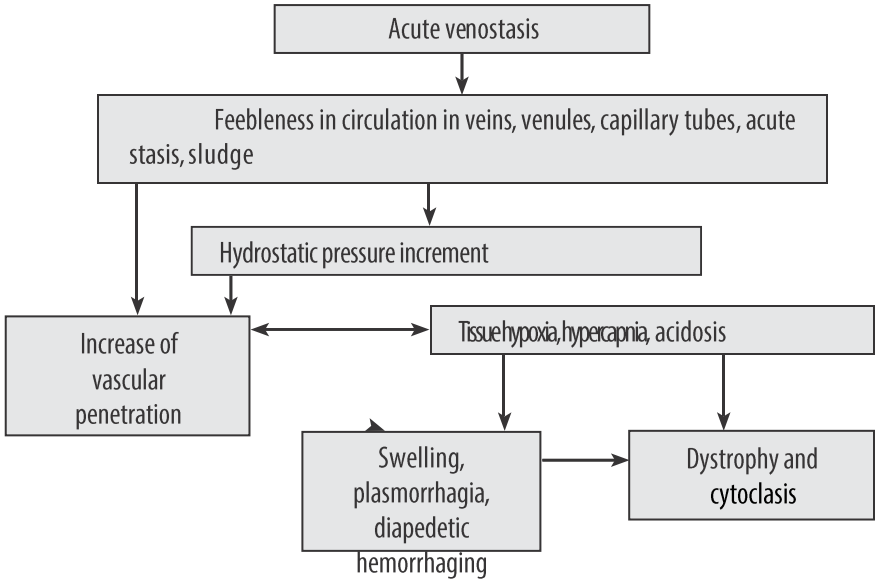
Based on experimental data, it has been established that the intelligence level of children with a weak alkaline medium level is twice the level of intelligence of children with an acid level. The same dependence can be traced among adults. Depression can be a result of imbalance towards acidification. In this case the brain is in a condition of chronic poisoning and suffers as much as any other organ. Sometimes it's simply enough to restore the acid-alkaline balance as a cure for depression.

Blood is the most vital medium. Its physiologically normal state within a healthy person accords with a weak alkaline reaction of a pH level of 7.35.

Blood is a very conservative medium, it has relative uniformity, because its pH aberrations are permitted within a very narrow corridor of values, from 7.35 to 7.45. Values beyond the limits of this corridor can bring dangerous consequences towards fatality. Hemoglobin is just about the only protein containing 80% of histidine, (a potent intercellular buffer in erythrocytes), keeping the blood pH at a constant level.

The limits for arterial and venous blood pH are particularly strict – 7.37-7.45 for arterial blood and 7.32-7.42 for venous blood. Venous blood is more acidic, because it is carbonated. A human being can live only within these limits. Blood pH values lower than 7.3 and higher than 7.5 leads to drastic consequences within a human body. A blood pH at 6.95 leads to loss of consciousness and death. If concentration of ions (H^+) decreases and the blood pH equals 7.7, it leads to harsh convulsions (tetanus), which can result in death.

Pathogenesis of Acute Venostasis



At normally functioning metabolic processes there takes place an accumulation of large quantities of carbonic acid (H_2CO_3) and other (non-volatile) acids.

Invading body fluids should neutralized by means of buffer systems and removed.

A level of pH 7.3 – 8 is characterized for the biological medium known as saliva. The highest rate of acid-alkaline balance oscillations are inherent in urine, its pH is 4 – 8. Such wide range of values is related to rhythmical dynamics of body metabolism, when admissions of acid and alkaline rotate every 3 hours.

The pH level of epidermis of a healthy person equals to 5.5. Deep layers of skin are more alkaline with pH equaling 7.35. Core layers of skin are alkaline. The human body tries in every imaginable way to get rid of acids and toxins and that is why there is constant acidification of derma. Most eczemas, urticaria, pruritus and erythema are the result of sweat acidosis. Acid medium gives rise to cutaneous fungi on finger and toe nails, epidermis and mucous coating.

Let us assume that eczema or psoriasis develop at an anabolic (alkaline) state of skin usually accompanied by the alkalization (putrid disbacteriosis) in the large intestine. Treatment of these diseases should be carried out simultaneously, both with skin acidification and

Li	Cs	K	Ba	Ca	Na	Mg	Al	Zn	Fe	Co	Ni	Sn	Pb	H_2	Cu	Ag	Hg	Pt	Au
-3.04	-3.01	-2.92	-2.90	-2.87	-2.71	-2.36	-1.66	-0.76	-0.44	-0.28	-0.25	-0.14	-0.13	0	+0.34	+0.80	+0.85	-1.28	-1.50
Li^+	Cs^+	K^+	Ba^{2+}	Ca^{2+}	Na^+	Mg^{2+}	Al^{3+}	Zn^{2+}	Fe^{2+}	Co^{2+}	Ni^{2+}	Sn^{2+}	Pb^{2+}	$2H^+$	Cu^{2+}	Ag^+	Hg^{2+}	Pt^{2+}	Au^{3+}

Reducing series of metals (donating electrons) decreases, while oxidative activity of their cations (joining electrons) increases in the specified row from left to right

Normalization of the large intestine pH level. Successful tactics of such treatment is obvious and proven with numerous case studies. The whole variety of diseases provoked by acidification has 3 main reasons:

1. Insufficient ferment activity
   Ferment can properly work only at certain pH level.
2. Aggression of acidic medium.
   Aggressive acids in tissues provoke excitation resulting in inflammatory processes. Most eczemas, urticaria, pruritus and erythema are the result of skin acidosis. Surplus acid in urine can provoke enuresis, scalding, impulsive inflammation (urethritis) and ingress of infection (cystitis). Surplus acid in joints provokes arthritis, neuritis, intestinal upset (enteritis, colitis, burning sensation in anus). Altogether such acid activity effects the status of immune system.
3. Demineralization.
   Demineralization is related to bone and teeth diseases. Bones depleted in calcium lose their hardness and flexibility, can easily break (spontaneous cervical hip fracture), lose their density (osteoporosis), get inflamed in joints (rheumatic disease) and grind intervertebral cartilage (sciatica). Acid neutralization actively engages micro elements that lead to their loss and demineralization. (6).

It's an obvious fact that normal functioning of a human body is in positive correlation with acid-alkaline balance. Apparently this is the reason why the great French scientist Henri Bequerel declared that life is the victory of ion (OH^-) over ion (H^+), while death is the revenge of ion (H^+) over ion (OH^-).

Reasons of body acidification: Acidosis.

Different reasons lead to acidification. First of all, it can be due to an imbalanced diet or varying diseases. It can also be due to staying indoors in a poorly ventilated room without moving for a long term, slowly accumulating carbon that leads to acidosis and lungs failure. If the lungs work properly, then carbon dioxide is produced throughout the day and will not do any detectable harm to body.

Acidification can also be a result if mycelial fungus metabolites activity, as well as onset of the following parasites living in many bodies such as helminths, trichomonas, etc. Parasitology establishes that an increased pH level enable helminthes and aerobic bacteria to grow, while a decreased pH level enables fungi, viruses and anaerobic bacteria to develop.

Reportedly most people tend to shift towards an acidification conditions with age.

Diseases and relatable inflammatory processes provoke more active acidification, resulting in acidosis.

Many people are familiar with the symptoms of acidosis, but its influence on their health is often underestimated. The symptoms of acidosis can be emotionally expressed as excessive criticism, cynicism, inability to succeed, hesitancy, inability to distinguish right from wrong. Physically acidosis proves itself through heightened asthenia, irritation, neck and shoulders muscular rigidity, arthritis, stomach ache, nausea, gastritis, ulceration, coprostasis, fast physical and mental fatigue, bitterness in mouth, tongue debris, flush, black rims around the eyes.

The body itself tends to normalize its acid-alkaline balance, because it affects all physiological processes within body. Many organs and systems take part in such regulation. The lungs, liver, stomach, intestinal tract, and the nephron are the first to maintain the balance. Surplus acid secretion in the stomach leads to carbon dioxide retention in the blood. It increases the alkaline level in blood. Decreased level of acids in the stomach decreases the alkaline level in blood. An alkaline medium is preferable for productive liver functionality. In response to an increased acid level the liver produces more ammonium and in case of alkalization it increases the urea level. Some acids are neutralized by alkaline luminal fluids, produced in intestinal tract, the rest of the acids are balanced out by the so-called buffer systems (blood plasma and tissues), which reversibly binds hydrogen ions (H^+), preventing undesirable changes in the pH level.

Kidneys are the key-note link for biological balance, because they finish the neutralization of acids and alkalines.

The body uses its alkaline reserves to neutralize acids such as minerals (calcium, sodium, potassium, ferrum, magnesium, etc). A person feels weary in the case where hemoglobin is used to neutralize acids, it also provokes insomnia and irritation. A reduction in alkaline reserves leads to derangement.

Catabolism or Anabolism.

Anabolism is the biological synthesis of growth, development, regeneration and energy accumulation. Anabolism primarily sits within an alkaline medium of pH > 7.

Catabolism ("breakdown, dissimilation") is a process of metabolic breaking of molecules into simpler ones with the oxygenation of a substance leading to energy release in the form of heat and formation of ATP. The body uses this energy for its vital functions. Catabolic reactions form the basis for dissimilation – the loss of specific properties by complex substances within a given organism as a result of dissimilation to elements. Catabolism sits within an acidic medium of pH < 7.

Anabolism and catabolism in a healthy organism will be in dynamic balance. Keeping track of anabolism and catabolism dynamics is a serious criterion in order to evaluate the development and status of physiological and pathological processes. Unfortunately, modern medicine does not operate on these concepts. All herbal medical products and chemical drugs have either a catabolic, or anabolic effect on body.

The intensity of catabolic and anabolic processes and predominance of these processes in cells is regulated by hormones. For example, glucocorticoids increase the intensity of proteins and amino acids catabolism, and at the same time inhibiting glucose catabolism (more specifically increasing glucose anabolism, inducing glucose accumulation in the form of glycogen in the liver and muscles, thus reducing glucose concentration in the blood and plasma).

In contrast, insulin boosts glucose catabolism and inhibits protein anabolism. For example, morphine, diphenyhydramine, and codeine are the substances with anabolic properties. This is the reason these anesthetics are less effective in reducing pain for cancer patients with metabolic disorders and anabolic increases. Surgeries provoke increase in catabolism, and so the anesthetics mentioned above are prescribed to reduce pain after operations.

The impact of pH medium on the properties of ferments

The impact of the pH medium on the properties of ferments should be reported separately. Ferments (enzymes) are specific protein catalysts occurring in the body and determining the intensity of its metabolism.

. By directing and regulating metabolism, ferments play a very important role in all vital processes of the body. Ferments catalyze all biochemical reactions in the body, using both metallic ions and organic compounds (many of which are vitamin derivatives) as co-factors. Many ferments (around 2/3 of them) are metalloenzymes: for ferment activation of hematopoiesis it takes Ca^{2+}; oxidoreductases use as their co-factors Fe^{2+}, Cu^{2+}, Mn^{2+}; kinases uses Mg^{2+}; glutathione peroxidase (an important ferment in the system of ROI de-activation) needs Se. Enzymosis, unlike inorganic catalysts, is strictly specific and depends on the structure of substrate, which is influenced by enzymes.

Enzymosis depends on a variety of factors, such as temperature and pH reaction. The optimum temperature for the highest activity level of ferments is at 40-50°C. Lower temperatures usually slow down the enzymatic reaction rate. At temperatures close to 0°C the reaction stops almost completely. The increase in temperature over the optimum level also inhibits the rate of enzymatic reactions and then ultimately stops altogether. The reduction in the intensity of enzymosis but an increase over the optimum temperature is mainly explained by the beginning of ferment destruction (denaturation).

Key factor of enzymosis, as it was first established by S. Sorensen, is the active reaction of mediumактивная реакция среды – pH. Separate ferments are distinguished by its pH level, which is optimum for their impact. For example, pepsin, contained in gastric acid, is most active in strongly acidic fluid (pH 1-2); trypsin – a proteolytic enzyme produced by the pancreas, has optimum action in a weak alkaline medium (pH 8-9); the optimum action of papain, a plant proteolytic enzyme, lays within a weak acid medium (pH 5-6).

Table

Optimum pH for some ferments

Ferment	pH	Ferment	pH
Pepsin	1.5-2,5	Catalase	6.8-7,0
Cathepsin	4.5-5,0	Urease	7.0-7,2
Malt amylase	4.9-5,2	Lipase панкреатическая	7.0-8,5
Intestinal sucrase	5.8-6,2	Trypsin	7.5-8,5
Salivary amylase	6.8-7,0	Arginase	9.5-10,0

All ferments are related to globular proteins and every ferment has a specific function associated with its exclusive globular structure. Activity of many ferments depends on non-proteus compounds, called 'co-factors'. Metallic ions (Zn^{2+}, Mg^{2+}, Mn^{2+}, Fe^{2+}, Cu^{2+}, K^{+}, Na^{+}) or complex organic compounds can act as co-factors. For example, peroxidase and catalase contain ferrum; ascorbate oxidase, (which catalyzes oxidation of ascorbic acid), contains copper; alcohol dehydrogenase, (which oxidizes alcohols in correlated aldehydes), contains zinc.

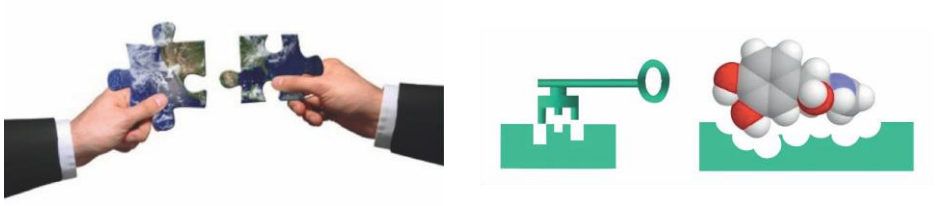


Fig. 7. Complementary principle – "key-lock principle".

Due to the fact that maximum ferment activity is dictated by optimum conformation of a ferment's molecule in general and its active centre in particular, even small changes in the medium, related to substrate binding or conformation of tertiary structure of its proteins will affect the rate of ferment activity. For example, a change of pH leads to the change of ionization in the ionogenic groups of ferments and consequently the redistribution of intracardiac connections within its tertiary structure. An optimum pH level within a medium is the best complementary for a ferment to activate a molecule ('key-lock principle').

Every molecular form of a ferment (isoferment) exhibits catalytic activity in a narrow corridor of the pH of its medium, because the concentration of hydrogen ions depends on the state of the ionization of the substrate molecule and active groups in the centre of a protein ferment, which enables catalytic enzymosis. Moreover, the concentration of hydrogen ions influences the conformation of the active centre. That is why even a small shift in a medium's reaction from its optimum changes the charge of acidic and basic groups of ferments and substrates and the active centre's conformation. As a result, it drastically decreases the catalytic activity of the ferment molecule.

There are several ways to regulate enzymosis. At a constant level of ferment concentration its activity can increase, known as ferment activation, or decrease, which is called inhibition. The curative effect of most medical drugs is based on the fact that they are inhibitors (blocking agents) of certain ferments. The therapeutic action of an aspirin as a febrifuge and anti-inflammatory drug results from the fact that aspirins inhibit one of the ferments, which then catalyzes the synthesis of prostaglandins (the substances which takes part in inflammation development).

Another way of changing enzymosis is related to the change of ferment concentration usually as a result of induction or repression of ferment synthesis.

Excessive acidity of a medium:

1) Prevents proper functioning of ferments;

2) Irritates and significantly reduces minerals in body;

3) Provokes diseases.

A normal pH liver and pancreatic secretion is 7.1. A salivary pH is between 6.0-7.9. Oxidation in the body firstly changes the pH of saliva and urine. Connective tissues have a pH level from 7.08 to 7.29, pH of muscles is 6.9. Muscle pH can vary in a wider range that blood pH. Muscle tissue needs constant removal of acid. For example, if the pH level in cardiac muscle is lower than 6.2, it fails and the heart stops working.

Kidneys are the most important body organs, clearing or neutralizing excessive acids. Urinal acidity together with salivary acidity is the main indicator of acid-alkaline balance. The pH level of urine is from 4.5 to 7.7. IT's very important to have pH of night urine being different from the morning and daytime pH.

Urinal reaction determines the possibility of stone formation. Uric stones often form at pH lower than 5.5, oxalate stones – at pH it equals at 5.5–6.0, phosphate stones equals at a pH of 7.0–7.8.

Gastric fluid is characterized by the most acidic pH in body – from 1.6 to 1.8. It affects the activity of pepsin – the ferment, which catalyzes albuminolysis and enables proteopepsis of meat, milk, cheese and other protein products in stomach. That's why it's necessary for gastric fluid to be at this level of pH for regular eupepsy. When the level of pH changes diseases arise. For example, the level of pH at gastric ulcer decreases to 1.48.

From the forego, it is apparent that the evaluation of the state of biological systems and possibility to influence them is to a large extent connected with the possibility to evaluate and influence the charge component of molecular-cellular systems and consequently the related to it intensity of electric field. This is the reason why the intensity of electric field as a systemic physical factor is used as a basis of the evaluation and correction of biological systems in CME technology.

Electric field intensity, Vector potential and The Aharonov-Bohm effect

One may reasonably ask: if the electric field intensity forms on the surface of skin, then what kind of corrective external field intensity should be applied? The CME equipment generates an electric field with an intensity of no more than 5 microwatt/cm^2 with a decaying gradient at sensor output for compensatory correction. The main principle here is not "the more, the better", rather it's based on the impact on the internal organs systems of other mechanisms that have a direct connection with the electric field intensity. The electric field intensity is correlated with a physical factor called the 'electrodynamic vector potential'.

According to the ''Aharonov-Bohm effect'' the electrodynamic vector potential follows on from equivalent action of the electric field intensity, when its value equals to zero. In practice, an external electric field is able to influence biological structures even at areas with zero intensity of potential. This effect reflects the mechanism of non-cognate interaction. (See Chapter "Non-locality"). The Aharonov-Bohm effect was predicted by these scientists as early as in 1959.

The Aharonov-Bohm effect is a quantum phenomenon, which illustrates that the electromagnetic field influences a particle with an electric charge or magnetic moment even in areas where both the electric field intensity E and magnetic field intensity M equal 0, but the scalar and/or vector potential of the electric field are not equal to 0 (i.e. if the electromagnetic potential is not equal to 0). This effect applies both to magnetic and electric fields.

The nature of the Aharonov-Bohm effect can be explained as so regular (according to the concept of classical electrodynamics), the local exposure on the state of a charged particle never stops in case the field intensity (whether it's magnetic, electric, or electromagnetic) equals to zero, and its quantum actively works through the vector potential of the field. In this case, there arises an interference effect (i.e. the fact of exposure) even without direct power exposure of the field on the particle. Performed experiments strongly indicate that the vector potential of an electric field is not shielded by a conductive shield and retains its electrodynamic transmissivity. Potential different thab zero exists everywhere (5). In recent years, scientists have repeatedly proven the direct exposure upon biological objects with this electrodynamical factor. Formerly this value was taken into account only in classical equations of electrodynamics (Maxwell's equations) and was considered as a convenient mathematical function to simplify theoretical computations until the end of 1950's. This relation is proven by the essential works of Russian scientists in the context of the role of the vector potential in the field of biological and medical research [3-8]. It was established that the vector potential of a "zero field" changes the chemical, biochemical and cellular processes (bacterial chemoluminescence, erythrocyte sedimentation rate, glycolysis in yeast cells, oxidative burst and other effects), as well as protozoa physical activity.

Thus, the electrodynamic vector potential following from an electric field intensity allows it to influence the dynamics (rate, density, and direction) of biophysical and biochemical processes; producing high informative value that allows us (thanks to a special mathematical treatment, which will be told about further on) to evaluate the state of such processes at different hierarchical levels of biological systems, including the molecular-cellular level.

Optical density of biological tissues: The Kerr Effect.

Biological tissues have inhomogeneous optical density. The properties of tissue and its optical density varies in normal and pathological conditions. The degree of tissue variation can be seen in morphological research. Molecular-cellular regulatory processes and interactions depend on the state of the optical density of tissues. Any biological tissue in a given physiological state possesses individual optical density and anisotropy correlated with particular space-time distributed electric field intensity. The exposure of the external electric field intensity on biological tissues changes its optical density and anisotropy. This phenomenon is called the 'electro-optical Kerr Effect'. The change in optical density within biological tissue due to the exposure of an electric field will lead to the change of metabolic, kinetic, regulatory processes and reactions within such tissue. These changes will impact the dimensional structure of molecules (proteins, lipid, etc.) and Isoelectric point of such molecules.

The Kerr Effect became widely used in optical devices (for example, in lasers), fiber optic technology performing electrical modulation and the synchronization of processes and signals at a very fast rate.

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CHAPTER 2

ОСНОВЫ ФИЗИКО-МАТЕМАТИЧЕСКОЙ МЕДИЦИНЫ В ТЕХНОЛОГИИ КМЭ

Оглавление

Chaos and order: Dissipative systems.

In the previous chapter, we reviewed the intensity of the electric field as the main analytical and compensatory factor used in CME technology.

Our next goal is to determine the degree of information produced by this physical factor by evaluating the functional conditions in different levels in the body. We shall understand which physical and mathematical laws and models serve as basis for this physical factor to be a key in description of the states and processes of biological systems. We also shall determine the degree of credibility and objectivity of this evaluation upon such states and processes.

In this regard, let us consider in no particular order the physical and mathematical phenomena, laws and processes used in CME technology for evaluation of dynamic states in different hierarchical levels and processes in the body.

The dynamics of connections and functional processes within the structural state of a biological system changes constantly, reflecting a state of some "order" and "chaos". First we shall define what "order" and "chaos" mean. By "order" we understand the state of a system in which it is possible to detect the accurate location and/or movement of processes and objects within such system. By "chaos" we understand to be a totally disorganized state of system. In reality we deal with an intermediate situation, characterized by some degree of order of system. Maintaining in a dynamic non-equilibrium system with some rate of chaos will enable it organize itself-, as we will see further on, as well as maintaining health in the human body. Such self-organization during the treatment process will indicate the process of "self-recovery". Life is impossible both in total chaos and total control. A normal body needs some degree of both.

The systems with dynamic non-equilibrium chaos are called "dissipative systems". This term was established by Ilya Prigogine.

Dissipative systems (or dissipative structures, lat. *dissipatio* – "dissipate, destroy") is an open system functioning outside the state of a thermodynamic equilibrium. In other words, its relatively stable dynamic state sits within a dissipative environment under the condition of energy dissipation coming from an outside medium.

The main characteristic feature of open systems is the ability to exchange energy and information with an external medium. A closed (sealed) systems are isolated from the outside environment.

It shall be noted that dissipation plays a constructive role in structure formation. At first thought it seems astonishing, because dissipation is primarily associated with the decay of different moves, energy dispersion, loss of information. Nonetheless, dissipation is necessary for structure formation in open systems (and this is very significant). This is the reason why processes of self-organization, along with degradation processes, occur in open (dissipative) systems.

It's a paradox: fluctuation creates order in dissipative conditions, traditionally associated with system disintegration.

Biological systems are dissipative systems. The environment is the tool that helps a human body to maintain itself at a relatively high level of stability (or low level of entropy which will be covered further on); it's the external medium from which the dissipative system continuously creates order.

We need to use a mathematical function to describe and define some information about the state and behavior of this dynamic system. Due to the fact that these processes are chaotic this mathematical function shall account for the probabilistic states in the system. Among different macroscopic functions only entropy S possesses properties allowing it to be used as a measure for the statistic description of chaos acting within the processes of macroscopic systems.

Entropy

The term "entropy" was first coined in 1865 by outstanding German physicist Rudolf Clausius, one of the creators of thermodynamics and molecular-kinetic caloric theory. In thermodynamics entropy defines the measure of irreversible dissipation of energy. The word "entropy" comes from the Greek word "entropia", which means "turn, transformation". The phenomenon is related to a change or transformation of something. Entropy is a measure of the disorganization (chaos) of systems of any nature, in other words entropy reflects the degree of order within the structure of the substance and/or processes in a system.

The degree of disorganization of a system contains information, as any inhomogeneity does, which in its turn correlates with entropy. Any deviation from chaos to relative structuring and order in the system increases the system's informational value. Information decreases in dissipative systems with entropy growth, and conversely increment of information leads to the loss of entropy. The phenomenon of informational entropy along with the entropy of physical processes measures uncertainty of messages.

The concept of statistic measure concerning the amount of (entropy) information was first coined by Claude Shannon while developing the foundations of theoretical exchange of information. However, this information theory by Shannon has limited applicability due to the fact that this function is considered by Shannon as a mathematical abstraction without connection to fundamental physical functions, describing the state of matter and energy

Developing the information theory further, American professor and quantum physicist Theodore van Hoven, (the Nobel prize winner for physics), considered this informational function as a physical category (informational entropy), which reflects upon one or another particular hierarchical level of an object's internal structural organization, and which has a connection with fundamental characteristics such as an object's energy and mass.

Such an approach to natural science allows one to construct real processes in connection to fundamental characteristics such as matter, information, and energy. Consequently, the "three-component energy conservation law" was created, on the basis of which both matter and information can transform into energy. In this way, this informational function is already determined as a physical category, which reflects the level of an internal structural organization of an object and its relation to the energy and mass of that object. (4,5)

Informational entropy, as well as thermodynamic entropy, possesses the property of additivity, when synergetic effect equals the sum of effects of each action. Entropy of several messages equals to the amount of entropy of separate messages.

Ternary energy conservation law.
Both matter and information can transform into energy.

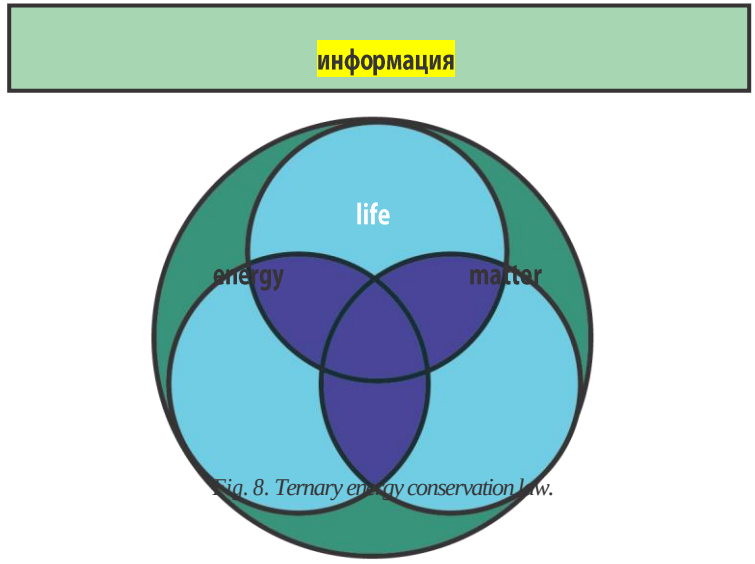


Fig. 8. Ternary energy conservation law.

The additive effect is a kind of synergism, when synergistic actions (for example, лекарственных веществ) equals the amount of each separate effect.

This effect defines complex complementary action, amounting to optimum the methods to correct health, including both medicament and drug-free correction methods.

Later Theodore van Hoven introduced such concepts as the entropy field density, which changes depending on consumed or spent energy, which in turn reflects upon the structural organization of a system. By doing so van Hoven defined the connection between the destruction (chaos) of a system and the maximum amount of energy, which can be radiated or absorbed by the system. Further development of this concept of informational properties and relatable processes encouraged the creation of the "quantum entropic logics theory". This theoretical concept also demonstrates that informational exchange within elemental structures in a system's components is carried out remotely, associatively and selectively at the expense of a quanta of electrical (electromagnetic) radiation, in proportion to the amount of energy which destroys the connection (entropic potential) within the elemental structure of the system.

An aggregated electric field intensity can be presented as an additive result of the quanta of electrical radiation.

On one hand, the physical factor of the electric field intensity with its additional characteristics such as density and gradient allows us to define (based on the nature of quantum energy) the informational component of additive entropy, carried by the undulatory characteristic of a quantum of radiation. On the other hand, every quantum of electric radiation, possessing an energetic component, is able to influence in a certain way biological structures and processes

There also appears an additive effect upon the quantized part of the energetic component, correlated to a certain density of the electric field.

If static electric (electromagnetic, gravitational) fields lead the system to mechanical movement and polarization, i.e. change its structure, then dynamic electric (electromagnetic and gravitational) fields activate its entropic potential (vector potential), i.e. informational component, which also influences the structure of matter and its inner processes.

Limits of Entropy

The certain dynamic equilibrium state of a physical object or a functional process can be limited by entropy boundaries, in which the object or process remains in a relatively stable phase state. Moreover, the limits of entropy are positively correlated with the dynamic gradient of the electric field intensity within the human body.

Because of the fact that the density of electric field intensity (gradient) affects the degree of the structural modification of a system, entropy also possesses the field density and therefore possesses the gradient.

$$S=k\,logW$$

where S – entropy, k – Boltzmann's constant, W – state probability of system.

Biological systems are characterized by a great amount of gradients (osmotic, electric, concentrating, etc). A characteristic of a gradient is how it demonstrates the direction and increased speed of a variable when it changes from one space point to another. The gradient within some parameters of the system changes with distance. For instance, the gradient of the electric field intensity (dynamic field density) illustrates how the electric potential changes per unit of volume within a biological object. Having been changed, the gradient of the electric field intensity in a singular segment of such a field conditionally corresponds with the unitary vector of the given field segment.

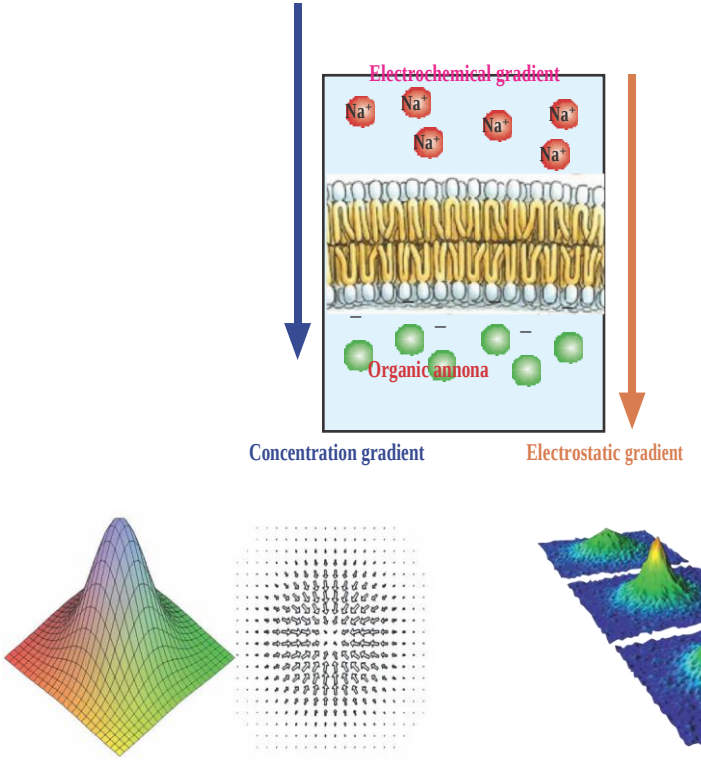


Fig. 9. Examples of gradients

The collection of the measured values of gradient vectors presents itself already as a three-dimensional matrix of co-efficiency, which is later used for mathematical data processing.

Changing the density distribution of the field (electric field intensity), with the superposition of the fields in similar objects, provides information about the volume, and the volume distribution density, within the structural elements of these similar objects (molecules, cells) that are involved in a particular process function. The rate of the field's change (or the co-efficient vector concerning the strength of the electric field) contains information about the activity of the running processes, while the co-efficiency of distribution density and gradient vectors gives a representation of the location and the severity of the process.

Even though the CME signal taken from dynamic biological objects can appear segmental, (for eg. in the terms of sound), it is in fact stochastic and highly informative, because it presents itself as a multi-dimensional hologram, having a high spectral density that provides information on the dynamic range of chemicals. (Properties and features of holograms of biological structures are described in the section "Holograms.Fractals").

Again, note that the entropy is a measure to streamline the structure of matter and/or data structures. The distribution density of entropy, that is the gradient of entropy, is a measure of concentration and can be distributed as both the entropy of the structural matter, and the entropy of information. The density gradient of an electric field has a direct correlation with the gradient of entropy of matter and with the entropy of information.

Limiting the growth of entropy density can lead the system to an unstable, critical state. If you choose to change the entropy from zero to one, the structural collapse of the system happens in two critical cases:

- when the entropy is zero, the system collapses into a point.
- when the entropy is close to one, the connection structure of the system disperses, leading to the destruction of the system

For biological systems, both cases are critical for their normal function and even existence.

On the other hand, for the normal functioning of the system, as was noted earlier, it must be in a non-equilibrium, dynamic entropy corridor. This position is determined by Bauer's principle. Bauer Erwin Simonovic, a Hungarian Soviet biological theorist, formulated the principle of stable non-equilibrium living systems:

"All (and only) living systems are never in equilibrium and perform due to their free energy constantly working against the equilibrium required by the laws of physics and chemistry in existing external conditions". (Bauer E. S. Theoretical Biology, 19350

E. S. Bauer proved that the law of conservation of information, and that the sum of information (I) and entropy (S) becomes a constant, which operates in an open and dynamic dissipative (see "dissipative systems") biological systems. Thus, this law refers to the reciprocal relationship between energy and information in a system and the possibility of regulating these relations. Once again it can be ascertained that energy and information are interrelated, correlated, adaptive functions. The CME technology has technically implemented this action of the law, with a notable compensatory adjustment.

Most processes in dissipative systems are implemented under the impact of many external and internal factors that cause, in a certain sense, their chaotic behavior. With this in mind, the majority of processes in biological systems cannot be discussed by linear functions, but only with the help of functions operating on probabilistic characteristics, those which were discussed above.

Since entropy is a probabilistic measure calculating the randomness of a system, we must consider the various forms of chaos this concept measures upon systems.

Deterministic Chaos

The concepts of determinism and chaos are directly opposite in meaning. The word deterministic means "conditioned, predefined". Determinism is associated with full predictability and reproducibility; with chaos, it's associate with unpredictability and non-reproducibility. This raises the question, what is meant by the term "deterministic chaos", which combines two opposites together in this concept? The answer to this question is not easy, but it is possible.

Deterministic chaos – an abstract mathematical concept, denoting a deterministic process in a deterministic non-linear system- is concerned with the property of a given system showing unstable, sensitive dependence of its dynamics through small perturbations.

The phenomenon of deterministic (dynamic) chaos has been actively studied through physics and mathematics in the 60s, – he dedicated his work to A.N. Kolmogrov, V.I. Arnold, J. Moser, V.K. Melnikova, B.V.Chirikova and others.

Deterministic chaos, i.e., a disorder in one way or another, **can be ordered with random, irregular processes and movements that are partially predefined and even logical. Determinism refers to the capability of explicit predictions in the status of a system at any given time, based on its initial conditions. The phenomenon of deterministic chaos is truly comprehensive, universal and is observed on all levels of matter organization.**

As has often been observed in most deterministic systems you can find elements of stochastic systems, i.e. systems that have evolved due to the influence of stochastic processes. Random effects can be applied to the system from outside, or arise from the inside (such as internal noises).

Completely unpredictable processes may be understood under stochastic processes. A random process is a probabilistic, stochastic process. Nevertheless, in stochastic systems, subjected to the effects of random processes, the dynamics of their development can be predicted to some degree. In this way, stochastic processes are probabilistic or can be anticipated with some probabilistic process (from the Greek, *stochastikos* – being able to be guessed). In the event that random data influences the data source, the present state of the system Is insufficient to predict the possible state at a later moment in time.

An important factor is that in dissipative systems, chaotic processes are developed within a certain structure, i.e. being a part of the dissipative system. This structure is difficult to study with an established conventional study of dynamics, such as retrieving dependencies from a response time or a frequency spectrum.

The evolution of chaotic (dynamic) systems in time proved to be convenient to analyze with the help of phase space. The coordinates in the structure of phase space has to be determined by the speed and/or acceleration of the process. Thus, in a structure's coordinate system, the speed and/or the acceleration becomes a changing process, unlike just the change in time in deterministic processes.

The "phase space" is the space of certain values within the parameters of a system. The set of all states of a system is represented in the phase space so that each possible state of that system corresponds to the point of the phase space.

The "phase trajectory" is the trajectory of a point's movement in correspondence to the state of a dynamic system within the phase space. The phase trajectory is identical to the concept of the vector potential.

The vector potential, (the concept of which we discussed earlier), contains the required information about the coordinates of physical factors (in this case, the versions of the intensity of the electric field) in conjunction with the speed and/or acceleration of their change, i.e. what actually corresponds to the concept of phase change.

Strange Attractor

The mathematical parameters of a system within a phase space, studied in some visual models, may be represented by a dynamic path called an "attractor".

In other words, the attractor is a phase state of a dynamic system, to which it is committed to the course of its movement (or development).

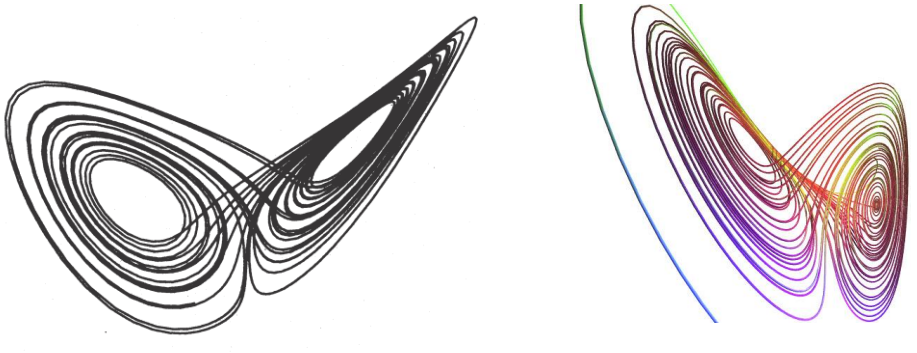


Fig. 10. Examples of strange attractors.

The phase space of deterministic chaos as a dynamic process, in most cases corresponds to a mathematical function (model), known as the "strange attractor". Difficult motions in non-linear dissipative dynamic systems mainly correspond to the behavior of this mathematical image. The word "strange" emphasizes two properties of the attractor.

Firstly, the strangeness of its geometric structure. The dimensions of the strange attractor appear as a fraction (consisting of approximately similar, homogenous trajectories) or, as they say, fractal.

Secondly, a strange attractor is an attracting area for trajectories from nearby areas. In this case, all trajectories inside a strange attractor are dynamically unstable.

Despite the fact that every single chaotic trajectory is extremely sensitive to the slightest disturbance, the strange attractor (the set of all possible paths) is a very stable structure. Dynamic chaos, on the one hand, manifests itself as a model of disorder, but on the other hand, as a model of stability and orderliness. Once again, we note that the attractors, as stable and active centers of potential pathways of the evolution of the system, are capable of attracting and organizing the surrounding environment.

Control of Chaos

At first glance, the nature of chaos eliminates the ability of managing it. In reality, the opposite is true: the instability of the chaotic system's trajectory makes them extremely sensitive to management. Systems with chaos demonstrate both good handling and a surprising plasticity; the system is very sensitive to external influences while retaining the type of movement. For example,

let us say that it permitted to transfer the system from one state to another (move the path from one point of the phase space to another). The desired result can be obtained for some time by one or a series of subtle, minor perturbations of the system's parameters. Each of them only slightly change the trajectory, but after a while, the accumulation of the small perturbations lead to a significant correction of movement. Meanwhile, the trajectory will remain on the same chaotic attractor. The combination of handling and plasticity, according to many researchers, is the reason that the chaotic dynamics is characteristic of the type of behavior for many vital subsystems of living organisms [8].

Example of Deterministic Chaos

Deterministic chaos, with elements of stochastic processes can be exemplified by the rhythm of the heart.

From a mathematical perspective, there are two types of attractors: the first is related to a non-equilibrium order and displayed in the phase space point ("focus") or a closed curve ("limit cycle"); the second attractor within the formation of deterministic chaos and a limited region of phase space, is continuously being evolved through time ("strange attractor").

For the first type of trajectory attractors, the process develops as follows: If the system is stable, the path begins from the start point and terminates at either the focus (stable focus), or at a limit cycle (unstable limit cycle). If the system is unstable, the path begins either at the focus (unstable focus), or at a limit cycle (unstable limit cycle) and gradually moves away from its attractor.

Deterministic chaos in the functioning of the body is normal, a sign of health and an orderly mode, providing pathological evidence. Contractions in a healthy human heart, devoid of strict periodicity, with its trajectory in the phase space, creates a chaotic form or a strange attractor. A study of the cardiograms in patients with heart disease found that in one case, it took a course of 8 days before a sudden stop of the heart's attractor occurred in the form of a limit cycle. In another severely ill patient with unsteady pulse for 13 hours, a point attractor of the heart's rhythm was detected before cardiac arrest. A certain randomness or confusion of the heart is observed in healthy young people with great potential adaptive responses to unpredictable changes to unpredictable changes in the environment. With aging and diseases of the heart, its contractions happen at more regular intervals and the flexibility and adaptive reactions decrease.

Chaos in the functioning of the body, to a certain extent, is a sign of heath, whereas a rigid periodicity indicates the opposite.

Pathologically, a high degree of chaotic contractions is required until atrial fibrillation and the termination of an acceptable working of the heart muscle, may make it necessary for external synchronization, such as a pacemaker or even a strong electrical

discharge.

Changing the degree of deterministic chaos in the structure of the heart rhythm indicates an increased risk of sudden heart failure and death of the organism. It is possible to predict the risk of developing myocardial infarction, hypertensive crises, and strokes in advance, at least 30-50 days.

It is proved that, among the huge number of factors that determine the heart rate regulation processes, it is also greatly influenced by the ratio of chaos and order which may be expressed as a relative measure of entropy. The aspiration is to normalize it to the "golden rhythm" indicated in the harmonization of the cardiac activity [2].

Fractal Biological Systems

One of the fundamental principles of biology is the principle of replication (doubling) of genetic information (principle of progressive matrices). The mechanism of matrix copying is based on the principle of complementarity and the minimization of the free energy between the interacting elements. In biological systems (as opposed to artificial) the process of multiplying is not just the increase in mass and ordering on the surface of the matrix, but the formation of "similar" types with the "repulsion" and individualization of the latter. Living matter creates self-similar matrix structures, that is, the same type of molecules, cells, etc. Each of these similar matrix structures is called a fractal. The structural and functional organization of biological systems is carried out on the basis of this matrix principle.

Perhaps not by accident, opening the Bible, on the very first page, the reader finds the words "...and God said, let us make man in our image and after our likeness…" (Genesis 1: 26).

Fractals are irregular, self-similar structures. The basic properties of fractals are self-similarity and the fractal fractional dimension.

Since the human body has self-similarity properties at different levels of the system's hierarchy, we will look at the most important manifestations of fractal structures. Let us ask ourselves: What gives a biological system a specific amount of self-similar structural elements? In the historical sense, this gives identity to a tissue of one organ or another, or a humoral fluid, which reflects the degree of homogeneity, optical density, and anisotropy. But what gives this fractal organ tissue, cells, and molecules their functioning?

This is due to the cooperation (concentration) of similar cells and molecules, which are also called "enantiomers", provided that the relative timing of the oscillations of the structures and processes that can effectively respond to the weak regulatory signals and generate their own response signals with sufficient intensity in the communicative, linking and interactive systems.

Fig. 11. Examples of f r a c t a l and quasi fractal structures

Accordingly, the additive property of their coordinated functioning is proved in the same way. In this case, the cooperative properties are not only based on the principle of complementary interactions but also on the basis of a number of similar structures and processes.

The number of similar structures and processes creates a concentration of the field, that is, based on the principles of the additive property and the superposition of the field, will reflect the degree of information density or the degree of entropy density. In the work of scientists from the Institute of Geochemistry and Analytical Chemistry, (V.I. Vernadsky Russian Academy of Sciences (Vernadsky Institute) L.A. Gribova and V.I. Baranova), "From Molecules to Life" especially stressed that "...the principle of complementarity, followed by concentration (density) of information and the emergence of a single synthesis feature is the fundamental principle that explains the perception, transmission, processing, and storage of information in the molecular world."

The Hologram Effect in Biological Systems

So, we have considered a fundamental biological principle about the conservation and propagation of genetic information based on the formation of self-similar matrix structures, (the same type of molecules, cells, etc). by the fractal principle.

Biological fractal structures can also be considered from the standpoint of the properties and principles inherent to holography. If you recall, one of the characteristics of the hologram is that each of the self-similar (fractal) hologram fragments carries information about all of the (whole) object.

This feature of holograms may be familiar to many of you by the example of the "Phantom Kirlian effect" done with leaves of a tree. Even during the first experiments with gas discharge visualization, S. Kirlian decided to check how a fresh cut leaf from a kakogonibud tree would appear holographically. To the surprise of the researchers, the cut part on the photographic plate appeared to be a completely whole leaf. This effect was maintained for many hours. Only on the following day had the severed part ceased to be reflected on the negative.

In the 1970s, experiments on photographing leaves in high-voltage, high-frequency fields with strictly defined parameters have been repeated in many laboratories around the world. The Phantom leaf effect appears in the form of a glowing image of a full leaf, even if it lacks some part.

Essentially this effect reflects the principle of holographic storage of biological objects, where a remote part of the leaf maintained its presence in the phantom image by virtue of its recovery of the remaining portions of the leaf within the gas chamber at the time of the experiment.

The manifestation of such a holographic effect will occur for any self-similar (fractal) biological structures, which, at a particular time, were placed in a single space environment, and therefore had synchronous (may say coherent) communication with each other. Upon changing the space-sync, this connection will be broken, which is what was seen

in the example of the leaf when the leaf in current time is not reproduced in the image of the phantom leaf.

Dennis Gabor, considered the universally recognized founder of holography, also made significant contributions to its development. In 1947, he improved the quality of the images obtained by an electron microscope by using the mechanism of transferring electric fields in the optical range for the first time. (The same Dennis Gabor has proven the fundamental principle of unity between the wave fields of different natures). In 1971, Dennis Gabor won the Nobel Prize in physics "for his invention and development of the holographic principle".

We've recalled that the basis for the formation of holograms lies in the principle of producing an interference pattern in a region of space with the addition of several electromagnetic waves different in phase, but similar in frequency. The interference pattern will convert the phase relations to the amplitude of the waves. For the registration of amplitude, it is necessary to use photographic film which registers amplitude, by converting it into a corresponding darkening of photographic emulsions. If such a plate (interference pattern) is held to a nearby light wave that illuminates the real object at the time of taping it onto the plate, then a phantom copy of this object is created. Such a hologram, despite the effect of the surrounding reproduction, is called two dimensional because the interference pattern is formed in the plane of a fixed medium like, for example, the photo emulsion film.

Great contributions to the development of optics and holography was made by the Soviet Russian physicist Yuri N. Denisyuk who, in 1962, showed the probability of recording a hologram onto a three-dimensional environment. Y.N. Denisyuk proved that two-dimensional holograms include only part of the material properties of the three-dimensional model. Three-dimensional holograms are able to recover the complex amplitude of the objects' wave and its spectral composition, thus it is able to reproduce information on the chemical composition of the object. The application of Y.N. Denisyuk's findings concluded that the photographic film, with a thick emulsion, may not only recover the shape but also the color and chemical composition of the original object.

Subsequently, the Dutch scientist Van Hierden showed that three-dimensional holographic angiography can significantly increase the density of data recording, as well as sharply increase the number of independent wave fields that simultaneously recorded and reproduced the same holograph [18]. This means that three-dimensional holographs in the same space allows it to fix a number of different objects which do not mix and in the process, may end up as independent. This determines the increased density information in the recording. The technology of CME uses this given physical principle such as information recording and compensatory adjustment.

When recording information, such conditions are satisfied by the coincidence of the radiation phase of the electric field of the same type of structures and the presence of the radiation phase shift between the differing structures. Through CME compensatory correction we are able to simultaneously use 27 markers because the generated parameters and reproducible electric field intensity markers are spaced from each other in phase and thus, do not overlap each other. Each of the 27 markers will be complementary in their impact, but is only significant within in-phase structurally similar biological objects, systems, and processes.

In the years [19-21], a number of researchers have shown that three-dimensional holograms are able to reproduce not only the spectral distribution of the wave field used to record the hologram, but the complete base of the optical signal, including both, the amplitude and phase fluctuations.

Due to the existence of such dynamics of real, physical processes, the information density dynamic (changing over time) of a three-dimensional hologram increases substantially.

It should be noted that only the three-dimensional holograms can carry information on the chemical composition of the subject.

Since the human body has the property of self-similarity at different levels of the system hierarchy, the properties and principles of "holographic" effects will also apply to all the related phenomenon of structural levels and information systems.

Value of Bifurcation and Fluctuations in the Management of the Dynamics of Biological Systems

This information density concentration will be determined by the amount of a single type of structure. Thus, one of the prerequisites of information interactions in biological systems will be their fractals. This is the basis of structural and systemic organization of biological systems, and the basis for its operation and management of a multi-dimensional fractal. If fractals of biological systems are viewed not as static or dynamic (evolution in time) then the analogical models will be a specific fractal (a specific fractal is a snapshot of a chaotic process). On one hand, chaos describes the state of the unpredictably in a dynamic system, on the other hand, such a random process of a fractal describes the extreme irregularity or inherent irregularity of a geometric configuration. We must note again the chaotic processes and their corresponding strange attractors because their relative frequent occurrence have a fractal structure. In the previous dynamic mode, there is some chase sequence of alternation in a certain order of chaotic motions, so-called chain of "bifurcations" or strange attractors. Next to bifurcation points, internal or external fluctuations play an important role. The transition to a new state under the influence of fluctuations is called the "phenomenon of bifurcation".

Bifurcation is the split, division, or branching of anything. The state of this process within a dynamic system in which there are sharp increases and fluctuations in the output, is possible by two significantly different and unpredictable directions: chaotic or orderly.

The bifurcation point is the critical state of the system in which it becomes unstable with respect to fluctuations. There is uncertainiy as to whether it is the state of the system or the movement to a new, more differentiated state with a higher level of orderliness. The terms are in relation to the theory of self-organization.

Elena Burlakova, Doctor of Biological Sciences, Professor, Deputy Director and Head of the laboratory of the Institute of Biochemical Physics, N.M. Emanuel (IBCP RAS) devoted many years to the study of properties, effects and mechanisms in biological object receiving small and ultra-low doses of different natures. They noted that the "weak effects" play the most important role in the so-called "bifurcation transition" to a new state system. During such transitions, the role of fluctuations which determine which plurality of possible states of the system will pass increases sharply. When such

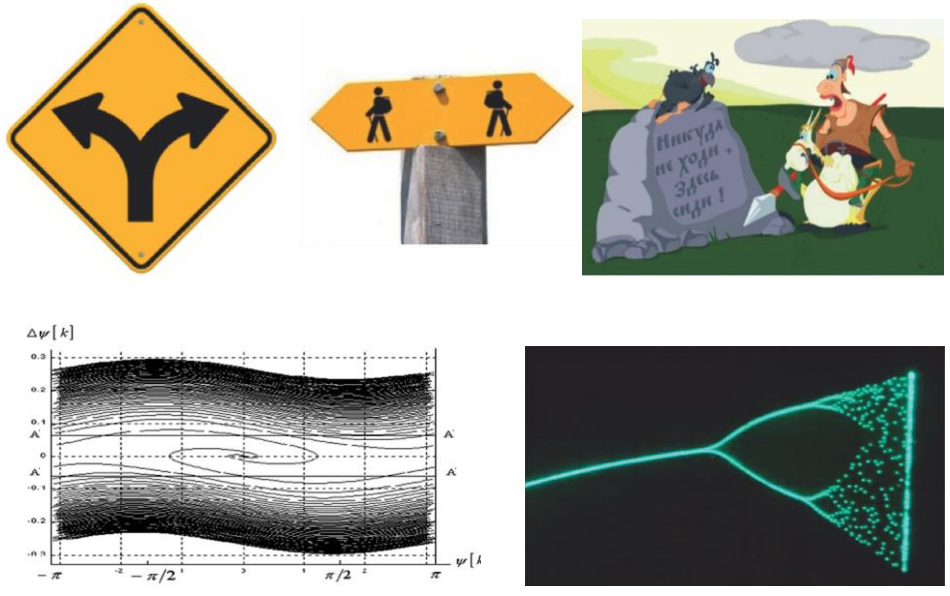


Fig. 12. Examples of bifurcation processes and bifurcation points

actions are not working to help the system adapt, the body is only able to adapt to the "usual" effects of lying in the normal range of intensities. This will mean disrupted management of internal and external controls, changing the ratio of positive and negative feedback loops between relationships, and ultimately changing the process of development and homeostasis. A constant influence of these factors, or a long "memory" of these actions upon a system may allow these weak effects to play a decisive role in the passage of the entire system of critical bifurcation points.

Elena Burlakova pointed out that similar properties and effects in small and ultra-small doses have substance as well as electric, magnetic and electromagnetic radiation.

For dynamic systems, depending on a certain parameter or characteristic, the smooth change of behavior of the system is contributed by the changing in its setting. However, the parameter itself may have some critical (bifurcation) value at the transition through which the attractor system undergoes a qualitative restructuring and thus dramatically changes the dynamics of the whole system, for example, the loss of stability. This principle is the formation of a critical (bifurcation) parameter value, a control attractor of the system that is realized by maximizing the value of its approach by including the parameter (control signal) of the reference marker within the process of the CME base.

The attractor is a line of maximum tension of a dynamical system. At the bifurcation point, a reset mechanism for the tension attractor system occurs.

The CME technology in compensatory correction mode, signals that it is coming from the machine and generates the same fluctuations that affect regulated process, changing the degree of orderliness and, in some cases, under certain conditions, its orientation (system bifurcation). The results of these changes have a positive effect on the dynamics of a physiological process so that it is closer to a normal functional process. CME extrapolates (mathematically calculate and predict) with some degree of probability, in what time an interval adjustable process will be approaching individual norm. This feature is implemented in the section "Step of the compensatory adjustment".

It should be noted that for dissipative structures, which are characteristic of biological systems and dynamic stability is both structural and functional. Therefore, methods for managing dynamic processes in CME allow for the changing in the dynamic stability system and translates it into other sustainable dynamic state for you to achieve both functional and structural correction of the biological system.

It should be noted that its processes of non-deterministic chaos in biological systems are virtually completely neglected.

Non-Deterministic Chaos

Non-determinism informs us of messaging that is random and stochastic. If the message were deterministic, i.e. known with certainty, then to transfer it would be meaningless. This message must include information that is not deterministic and therefore messages should be regarded as a random event (or random variables, random functions). In other words, there must be a set of options for the message (for example, many different temperatures, issued by the sensor) of which will realized in all probability to become one message. Therefore, the signal is a random function. A deterministic signal cannot be a carrier of information. It can only be used for testing the strength of communication systems or individual components thereof.

The random nature of messages, signals and interference is caused by the critical probability theory in the construction of communication theory. It will be shown below that the probabilistic properties of signals and messages, as well as the environment in which the transmitted signal can determine the amount of information transmitted and its loss. The theory of quantum entropic logic allows for the principle possibility of forecasting future events, in the absence of initial information (non-linear prediction). Consider the following example of non-linear programming

Problem solving the elementary arithmetic equation 2 x 2 = 4

In the non-linear prediction, when the original information is not provided, the key condition is the result of the assumption (or the likelihood of such an outcome). So, in terms of the non-linear equation above, it can be expressed as *x1* multiplies by an unknown *x2* equals *4*.

This feature is implemented in the CME technology at the forecast of individual compensatory correction and at the required frequency of its sessions.

The study of dynamic systems with discontinued time derivatives helped physicist Michael Jeffrey from the University of Bristol to discover a new type of chaos. He studied the behavior of the system in cases close to becoming critical. The scientist found that in cases where the parameters of the system do not reach critical values, and only fluctuate within the limits of those values, the system starts to behave randomly.

By only considering the behavior of the system in a non-deterministic chaos, it becomes possible to describe all the processes in the body, because dissipative structures in the body exist in a state of unstable, non-equilibrium processes, i.e., in such circumstances, when one or more external or internal factors influence the course of these processes in dissipative symptoms.

Synchronization as a Criterion for the Ordering of the Structure and Processes in Biological Symptoms

We have considered fractal biological systems as an important criterion that determines the density of the information system. At the same time, the information system density will depend on the degree of synchrony of motion of these same elements (structures). From this it can be determined that if the radiation of biological objects are in association with the synchronized architecture of certain biochemical processes, such synchronization failure will inevitably lead to a change in the electric field configuration of the entire structure.

Here, it is appropriate to make the analogy with an antenna where the spatial distribution of the radiated power for synchronized emitters directly depends on the amount of the initial phase values for each wavelength of the individual emitters.

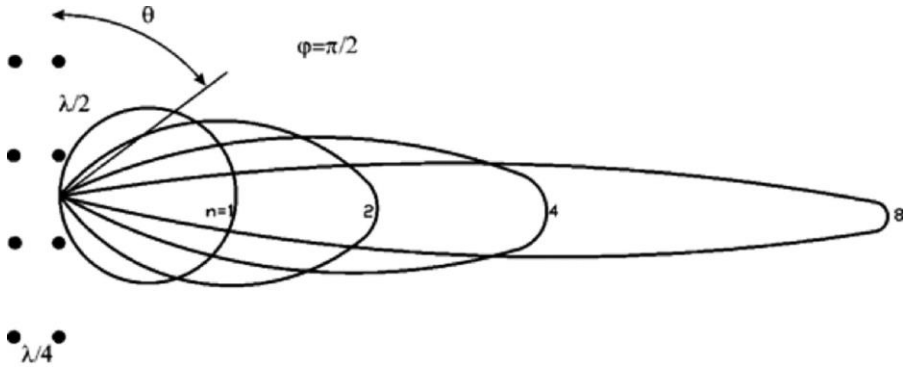


Fig.13. Modifying the directional pattern phased sources, depending on the number

The trend towards the synchronization behavior is typical for a large class of natural and technical objects of a different nature. This phenomenon can be regarded as a form of self-organization of matter, as a kind of trend of dynamic systems for orderly behavior. "Self-synchronization of physiological oscillatory processes is the main mechanism of self-organization." (11)

The Principle of Formation and Removal of the Control Signal Correction Compensatory CME

Let us see how, in practice, we can apply the above concepts in an assessment of the state (sync) of the biological system and therefore notice the possibility of controlling the parameters of the system. Recall that the basic physical signals recorded in the CME is the strength of the

electric field, where the distribution density changes with certain dynamics. It is because of these parameters that we can extract information about the actual physiological processes in biological objects. Between these characteristics of the system is the following sequence of differential constraints:

- **The first derivative of the velocity-acceleration.**
- **The second derivative of the velocity-entropy.**
- **The third derivative of the velocity-sync.**

Thus, to determine the entropy of the system (the degree of chaos in the system) it is necessary to calculate the second derivative, which is the rate of change of the electric field. To assess the synchronization process in the system, it would be necessary to calculate the third derivative, which is speed.

This raises the question: how is it that with so many random parameters within it, the system technically can realize a mechanism though it is controlled with such non-deterministic, unstable, non-equilibrium processes? How, in these conditions, does it result in a controllable signal within the required spatial and temporal characteristics?

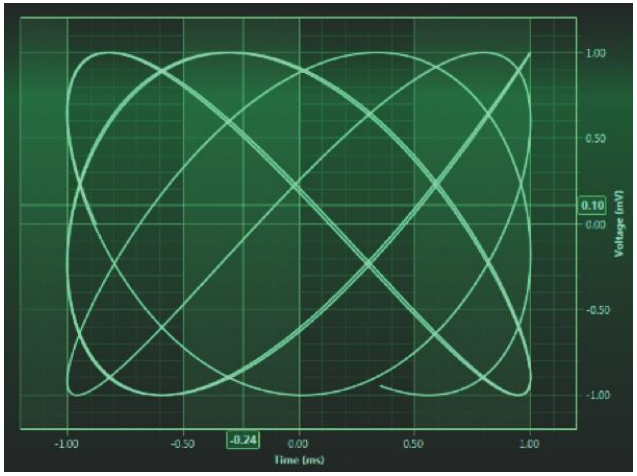
The technical solution might look like this: a stable formation of the controllable signal consists of two non-synchronous random number generators, one of which is a deterministic, chaotic oscillator of CME, while the other generator is a real, non-deterministic, chaotic input signal taken from a biological object.

Markers of the process, used for compensatory adjustment will be a synchronizer of the two random number generators. At a certain time in the operation of these generations there is a point (area) along the intersecting line of a strange attractor within a real process, which will meet the maximum conditions and match the real value that can affect the controlled process. This situation corresponds to the synchronization process in the spatial and high-speed characteristics of the electric field strength (in the analog representation) participating in a real process of compensatory adjustment.

Due to the fact that the real processes take place in space and time in mathematical form, strange attractors can be represented as Lissajous figures. During the synchronization of the two processes (external, taken from the biological object and the internal of the CME, from the corrective process), the two Lissajous figures in different planes intersect into a single plane, representing an oval. A full synchronization of these two processes crossing the plane of the circle, will in the end, both become circular and move into one plane.

We've reported that the Lissajous figures are closed trajectories, traced by a point, executing a combination of two harmonic oscillations in two mutually perpendicular directions.

The first person to observe this was the French scientist Jules Antoine Lissajous. The type of figures depends on the ratio between periods (frequencies), the two phases and the amplitudes of the oscillations. **In the simplest case of equality, both pieces of the periods are ellipses, which are at the phase difference of 0 or π degenerate into line segments, and when the phase difference is π/2 and the amplitudes are equal, they are transformed into a circle. If both periods of oscillation are an inexact match, the phase difference changes all the time. If the periods are substantially different, Lissajous figures are not observed.**



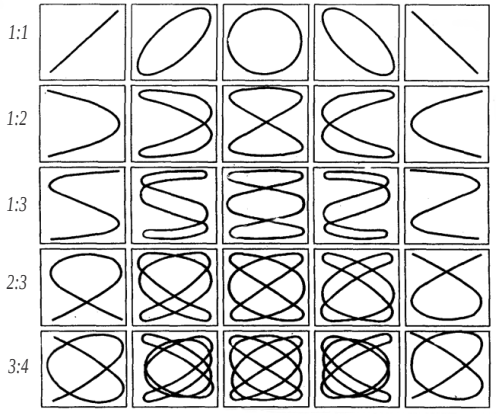


Fig.14. Lissajous Figures.

Take a look again at the previous sentence which states that if two processes are sufficiently different from each other, the Lissajous figures are not observed and therefore, the optimal solution features an anticipated synchronization process which will not become a controllable signal for compensatory adjustment and will not be found.

Here is an example of the most commonly used electrical measurements and settings. Apply the input "X" and "Y" as oscilloscope signals with close frequencies. This method is widely used to compare the frequencies of two sources and to adjust one source to another frequency. When the frequencies are close, but not equal to each other, the figure on the screen is rotated and the rotation period of the cycle is the reciprocal of a different frequency. For example, when the turnover period is 2 the difference in the signal's frequencies it is equal to 0.5 Hz. Theoretically, with equal frequencies, the figure should freeze and remain motionless. In practice, at the expense of short-term instability of signals, the figure on the oscilloscope screen is usually slightly shaking. This is used for purposes of comparison, not only with the same frequency, but multiple relations. For example, if the model is able to output frequency at only 5 Mhz, customize the source to 2.5 MHz.

For another simple example, consider the trajectory intersection of two non-synchronous vibrating (aperiodic) pendulums of different lengths, on different orthogonal planes. The trajectories of the pendulum's movement must be appropriate to the conditions listed above. Additional factors are to synchronize their oscillations, and, therefore, not create coincidental trajectories. However, at some point in time, a random manner will intersect at one point. This point will correspond with the condition of maximum coincidence between two difference space-time processes and obtain the parameters of the control signal.

Another example of this can be observed in nature of two closely spaced anthills. If for some reason, the ants from one anthill began their activity and with this, their activity was increasing, then through a certain intersection of the environment, increasing the livelihoods of their joint activity (positive acceleration), the first anthill's ants will be given to the second anthill. Thus, the motion of a single ant causes the activation and movement in the other anthill. A dynamically stable system will at some point receive a relatively synchronized time activity in this sense. If you were to reverse the process from the attenuation of activity (negative acceleration) of ants in an anthill, the process will cause deceleration of activity in the other and, after a while their activities would be mutually re-balanced.

We raised the issue of synchronization between two random processes, the external signal from the biological object and the internal generated CME signal, as well as the synchronizing of these factor markers, as the key component for

the formation of a controllable signal. What is a token-based CME? A marker is a signal obtained by removing the (record) analog characteristics of the electric field and the strength of a reference material and stored in the CME base in digital form. Base markers in CME are large and are constantly updated. With respect to a particular controllable process just one of the base markers can form the basis of a common regulatory, controllable signal, which is conditioned by a non-linear, non-deterministic, stochastic process imposed on it by various noises. At the same time, according to the mechanism described above, the marker will tend to synchronize the process to the maximum coincidence of internal and external signals. In fact, such synchronization within this particular marker, with the token reduced to the formation of the output emitter and CME electric field having a particular dynamic spatial configuration and density changing at a certain speed and acceleration, unique to the control of regulatory signals.

In the spectrum mode, removing the biological structure of the body and creating a multi-dimensional hologram of the electrodynamic vector potential, has impact on its bio-sensory input, with the result that there is already a certain volumetric co-efficient matrix for further processing and the analysis program ESI (the mechanism of which is described above).

Mode exposure compensation which are actual compensatory processes and conditions of a patient's algorithm works as follows. The doctor/operator relieves the individual patient and determines the range of the most current state and processes for a given patient. The ESI program and CME technology use a special algorithm to process the digital range of the patient's general comments so that they become compensatory and corrective.

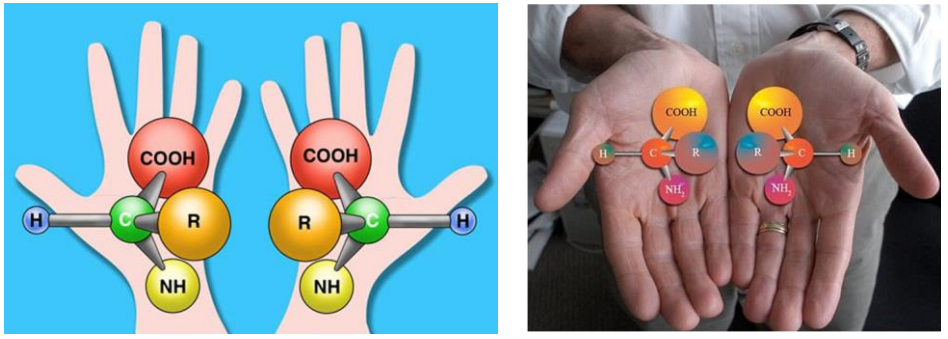


Рис. 15. Пространственная инверсия.

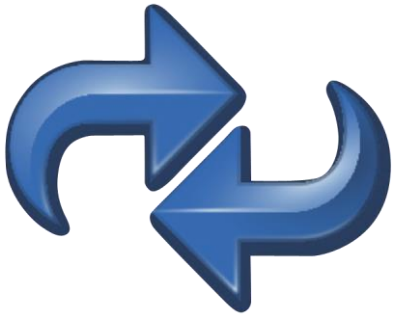


Fig. 16. Reverse movement.

Fig. 17. Details in device reverse motion.

This, formed by the sensor signal, presents itself as an electrodynamic potential vector (electric field intensity), which has a regulatory effect on the hierarchy of processes in the human body, considering the compensated and adjustable parameters of the patient during the same session. (See section "entropy"). To control "online" the change in the electrodynamic parameters of the patient, the principle of feedback is applied. When the process of repeated exposure to changes in the spectrum are removed from the patient, the extent of these changes is constantly measured and compared with the original spectrum. At the same time, the density distribution of these structures and processes is synchronized and optimized. Actions that adjusts the signal indirectly enhances the normal hypergenetic processes. In the case of hypergenetic processes through special inversion and reverse field strength formed on the CME sensor, their pathological activity is weakened.

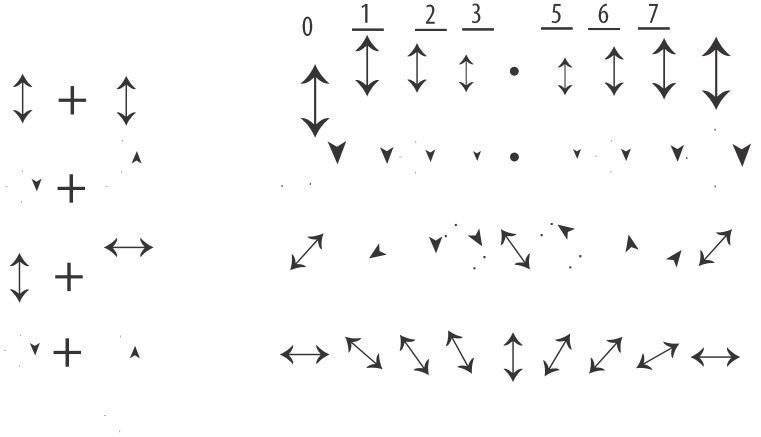
For the compensation of processes, markers from the CME base can be used if they are modulated (embedded) in a spatially distributed signal of the electric field formed on the CME sensor. Markers in the analog display of the electric field (at the output of the CME sensor) reference a multi-dimensional, spatially-distributed structure in the electric field's processes and products.

Dynamic Polarization

The maximum number of markers employed in the course of the session for compensatory correction is 27. The obvious question arises, is whether the overlay (interference) markers, in the course of a session with other molecules' orbital angular momentum, are located at the same offset?

To avoid this phenomenon, a development has been applied to the principle of formation markers at the output of the sensor with different polarizations, which eliminates the effect of interference markers. Markers in the analog display of the electric field and at the output of the CME sensor are multidimensional, dynamically polarized and spatially distributed structures of the electric field. Dynamic polarization is both plane polarization and gradient polarization over time, it variation based on the difference between a stable marker from the marker base and the person on the path to correction.

It is known that by adding the waves and parallel polarization together, it is modulated only in its intensity (interference pattern), which is used in scalar holography. With the addition of waves and orthogonal polarization, a modulated polarization state in the absence of an intensity modulation occurs.



If we imagine a certain polarization of a spiral wave, the gradient of the polarization in such a wave will be at a degree of the wave's torsion different to the pitch of the helix.

Nature has long used a similar mechanism in the separation of information signals. It is enough to imagine any protein molecule having individual orbital angular momentum. Such a difference in the molecular world of nature allows signals of the same type of molecule with one orbital angular momentum to not interfere with the matrix.

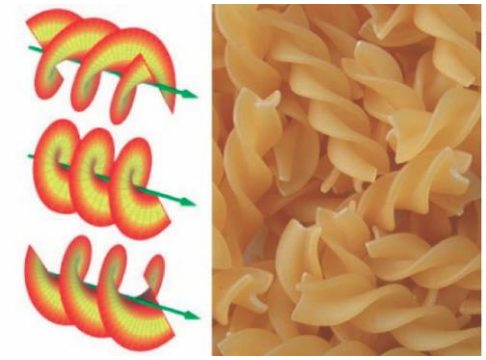


Fig. 18. Twisted wave front with nonzero orbital angular momentum resembles pasta fusilli.

Condensed State of Matter and Information, Non-locality and Quantum Phenomena in Macro and Micro views.

The CME technology's electric field sensor has no direct contact with the skin of the subject. The applied dielectric material (paper, cloth…), allows you to cut off the static surface currents and charges that are present on the skin. In this case, the sensitivity of the electronic sensor device (chip), can measure the field strength at a distance of 5cm from the skin. A similar condition exists in the compensatory correction mode. This fact in itself already indicates the mechanism of distant interaction between the biological object and the CME sensor device. However, there is a deeper mechanism for distant interactions that spreads along the quantum level of biological structures and systems. This mechanism is the non-local nature of the interaction with the availability of information and the condensed state of matter between the quantum biological objects.

Condensed matter physics is a large branch of physics that studies the behavior of complex systems (i.e., systems with many degrees of freedom), and the strong bond between the particles of such systems. A fundamental feature of quantum systems is the dynamics (evolution) of their behavior. For example, some of the impact is instantly reflected on the entire system at once and therefore all of its constituent particles are dependent on the distance between them.

Such a mechanism of interaction of quantum particles in the system is called the non-local mechanism because quantum particles are not localized to one particular site and the system may be very far apart. Since a particle in quantum mechanics is represented as a wave it has no point in localized space.

"Non-locality" is the property related to the transfer of information. More precisely, these instantaneously reactive particles (or systems) change their parameters with the changing parameters of another particle, regardless of how far apart the particles (or systems) are.

Back in 1935, it was formulated by A. Einstein that, "contrary to the theory of relativity, the equation of quantum mechanics suggests an immediate connection of all the sum of the parts of the world as a whole".

The limits of applicability within the laws of classical and quantum physics in their description of the effects of micro and macro properties of biological objects

Classical physics treats emission as the emission of electromagnetic waves rapidly moving electric charges. Its theory explained many features of the processes of radiation, but it could not give a satisfactory description of a number of events, particularly heat radiation and the radiation on a body's microsystems (atoms and molecules). This description proved possible only in the framework of the quantum theory of radiation, which showed that radiation is the birth of photons within the state of quantum systems (e.g. atoms). Quantum theory, by being more deeply concerned with the nature of light, is simultaneously pointing out the limits of applicability within the classical theory: the latter often a very good approximation in the description of the radiation remaining, for example, the theoretical basis of radio engineering.

Physicists have found that quantum mechanics does not practically work in the macrocosm, and only applies to objects no bigger than atoms and charged particles (molecules). As for larger objects, manifested by their force of gravity, they are reflected in an inhomogeneous decreasing flow of time. According to Einstein's general theory of relativity, time flows inconsistently with the presence of gravitational fields. The stronger the field, the slower will be time to go. Under the conditions of coherent gravitational communication between objects of a large mass within a system begin to disintegrate and, depending on the distance of the objects, are present in the current time with respect to the center of mass.

The behavior of most objects and systems of the world visible to us can be described by the simple laws of classical physics, not taking into account the possible influence of quantum factors, which in, as it turns out, gravity and related phenomena are suppressed.

However, in many cases we are able to observe a manifestation of quantum effects in systems composed of subatomic, atomic particles, charged particles (molecules), photons, and even cells. Such systems and its objects, may exhibit a non-local nature of the interaction.

Currently, the non-locality of quantum objects is a repeatedly proven experimental fact. For example, lasers operating at the same frequency, show an interaction between them for no apparent reason (12).

Modern scholars of some countries use the non-locality property of photons in the creation of quantum cryptographic systems. The main working resource of such systems are the convoluted (connected) states of photons and their instantaneous non-local communication (quantum correlation), which allow them to provide absolute protection of information against unauthorized access. The relationship between the entangled photons is not just "faster than light", namely the infinite and instantaneous, but in this case, it is used to stop the transmitting information and channel safety control communication and when accessing information the photon coherent (or quantum entanglement) is also disrupted. In such systems, there is a fiber optic link.

Today, scientists are working to develop a quantum computer. The entanglement between the qubits (that is quantum bits, and "entanglement" is nothing more than a correlation, non-local connection between two or more objects separated in space), means a quantum computer is the key factor responsible for quantum parallelism and determining advantages over a conventional computer. The quantum communication channel, in fact, combines the power and successor information in a single unit for individual degrees of freedom.

And of course, this brings to memory information about various magical rituals and rites by people of the world throughout history when using a variety of ceremonial items, pictures, etc. to obtain a certain degree of influence upon a non-local object. There are quite a lot of examples but this is a topic of magic and esotericism.

Examples of non-local interactions between biological objects have been observed for a long time. A good example that displays the properties of non-locality between biological objects is an interesting experiment with snails, which was observed by Guto Tsaymann in 1878. He joined them in pairs so that they were for some time in contact with each other, and then he electrocuted one of them in which the snail shuddered. And as the two snails came into contact, the one trembling caused the other snail to do so. Yet even when they were separated into different locations, the same effect was preserved. Even more striking results in experiments with snails was reached by French ? Alice and ? Benoit. They took the boxes, marked them with letters of the alphabet and in each of them planted a pair of snails, which was repeatedly exposed to an electric current. Then they broke apart the couples, one snail from each drawer transferred to another empty box labeled with the same letter. One set was left in Paris, and the other was sent to New York. When the snail in one of the drawers in Paris was irritated and then trembled, so did its partner in New York, located in a box with the same letter. The rest of the snails did not react to it. The result was a "snail" telegraph, by which even a simple message was passed. (12)

In the 60s in Novosibirsk, Academician VP Kaznacheev and his colleagues conducted a study that confirmed the presence of distant intercellular interactions. This work has created the so-called "mirror cytopathic effect", where a culture of living cells and tissues, hermetically separated by quartz glass

regulatory waves have exchanged information related to the functions of their genetic system. It was demonstrated that external information had a correcting effect on the cell, and the transmitted mechanism of the control information signal and intercellular interactions have a non-local character.

Take note that the brain is also in accordance with the principle of "non-locality". In macrocosms, any movement is continuous, and therefore has a motion path. In quantum mechanics, there is no concept of particle trajectories. The location of a quantum object can only be described as a function of probability in finding a given object within a certain region of space. In this regard, the processes of quantum objects and the mechanisms of their interaction can only be assessed as a probability.

Consider then, from the previous chapters, that the processes within the state of biological systems as non-deterministic, stochastic, non-linear, (described in terms of probability functions), have a fully responsible approach towards the description of quantum objects and systems. To detect the effect of non-local interactions of quantum systems is a pre-requisite to maintain a high degree of coherence (synchronization) between the particles of the system image - atoms, molecules, cells, etc.

To recap, such unified cooperation (concentration) can be achieved between the same type of cells and molecules, called enantiomers, provided that the relative timing of the oscillations of the structures and processes will allow communicative, linking and interactive systems to effectively respond to the weak regulatory signals, by generating their own sufficient intense signals. A system acquires the properties of condensed matter which is also evident from the additive property of their coordinated functioning.

We have already noted that, in the course of normal physiological processes, that the normal state of biological tissues and media can observe a relative timing between the structures that make up these biological systems, when pathologies and conditions similar to their previous synchronous communication are disrupted. The objective to correct which the CME compensatory technology is focused on, in many cases with a high degree of selectivity, is to restore impaired synchronization structures systems and processes.

The quantum nature of this mechanism is manifested in the technical implementation of the regulatory signal, based on the formation of a dynamic electric field corresponding to some probable function in a complementary system or process. If the probability density of the amplitude, phase and regulatory signal process add up they will reinforce each other, or if they are in opposite phase, they will cancel each other out. The quantum mechanism of Regulatory Impact that CME is primarily aimed at is the restoration of non-local connections in the individual quantum systems of the body by restoring their coherent (synchronous) state, thereby recovering the information, communication and regulatory processes between the structural elements within these systems, and in the consequences between other systems.

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