BIOELECTRONIC INTERPRETATION OF HUMAN COGNITIVE PROCESSES

Abstract

The idea of coupling chemical-electronic processes with cybernetic-informational processes in a biological system is currently completely foreign in the area of classical life research. The aim of this work is to direct attention towards filling this type of cognitive gap. Human life is not only a matter of biology and biochemistry, it is also a quantum-cybernetic-informational and bioelectronic construction that affects human health, disease and behavior. Chemical power supply of a biological system is combined with electronic processes operating on organic semiconductors together with the function of piezoelectrics, pyroelectrics and ferroelectrics. The control of the human biological system is carried out through a network of information channels, electron, ion, photon, phonon, soliton, magnon - free radical, as well as bioplasmic - each of these channels can be a carrier of information for the biological system in itself, or can function collectively in the bioplasma system (Sedlak, 1980; Adamski, 2006a).

The action of solitons and spins in the human biological system provides a basis for viewing psychobiological processes in a different light than biology, psychology and medicine currently do. Spin and soliton waves create a different image of the world from the electromagnetic wave received by the visual receptor. Solitons generated in the heart are responsible for the electrical activity of the heart, as well as for emotional states in humans. It can be was concluded that we are dealing with a second center that creates the structure of the image of the world and is responsible for the psychophysical development of humans, health and disease.

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Key words: biological system, sensory perception, biocomputer

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Introduction

1. Bioelectronic properties of the human biological system

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The biochemical model that has existed for over 100 years is insufficient in explaining the phenomenon of life. Translating everything into the criteria of classical chemistry or electrochemistry gives the impression of going backwards. In addition to the traditional, well-known chemical reactions, a new reality is opening up, operating on the bioelectronic model of life. In this model, the human organism is understood as an electronic integrated circuit made of piezoelectric, pyroelectric and semiconductor elements, with a biochemical, bioelectronic, informational and biocybernetic construction, which is responsible for modeling the structure and functions of biological, optical and quantum biocomputers, managed by quantum processes in an electronic way, surrounded by electrostasis, filled with bioplasma emitting a biological field to the outside. In this integrated circuit, referred to as the soma, there is a central system in the brain that can control and coordinate the whole.

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Control is achieved through a network of information channels: electron, photon, phonon, soliton, spin, ion and bioplasmic (Sedlak1979),(Adamski 2011).

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The novelty of the bioelectronic model is that it takes into account the submolecular level of organization of the biosystems of a living system and assumes that the beginning of life occurred in the course of the coupling of chemical reactions with electronic processes in biological structures. This model reaches to quantum foundations and shows the material unity of man with the natural world, as well as the unity of being itself and recognizes that the quantum level is the level to which soma and psyche can be reduced together with their structure and function. Here, at the quantum bottom of life, there is no longer a difference between life and consciousness, between psyche and bios. Here there is quantum unity. Here the cooperation between chemical and electronic processes has been established. At this level, consciousness has an energetic and informational nature and is a factor activating the soma, by activating bioelectronic processes (Sedlak, 1979).

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From the entire electromagnetic wave band, the visual receptor selected only a wave with a length of 330-750 nanometers. The rest of the spectrum is received by the entire mass of protein semiconductors to a much weaker extent than the senses, but constantly. A similar problem occurs in the sense of hearing. Only sounds in a narrowed range of hearing from 16 to 20,000 hertz reach the ear. Again, the biological system "hears" with the entire mass of biological piezoelectrics in a wide range of frequencies, both infrasound and suprasound. It "hears" with the change of polari-zation and electrostriction of biological piezoelectrics. The organism, possessing this electronic material, will never escape from information, it receives it widely and subtly (Sedlak 1988 p. 130).

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Modern biosystems in science are considered at the level of corpuscular structures, omitting energy and information structures. By shifting the cognitive emphasis towards energy and information structures, the organism can be understood as a quantum generator of electromagnetic, acoustic, spin soliton and bioplasmic information. In a biological system, information is superior to mass and energy. It affects all psychobiological processes and is responsible for their structure, function and their entire development. Thanks to the properties of semiconductor proteins and melanins, electrons can move long distances without losing energy. Ionic currents are extinguished at short distances because ions are much larger than electrons. In protein semiconductors, the energy of the electron would be preserved and transmitted as information. The term information is analogous to the term energy. Information is defined as the ability to organize a system or maintain it in an organized state (Latawiec, 1995). Information, alongside mass and energy, is currently considered the third basic structural element of reality. The characteristic feature of biological information is transformed mass and the energy associated with it. This is a different case than that considered in physics. For a physicist, energy is a carrier of information, for a biologist, information transport takes place on a carrier of mass and energy. Biological information combines the corpuscular features of mass transport and wave-like electromagnetic and acoustic features. (Stonier, 1990 p. 26).

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Stonier believes (1990 p. 107) that information cannot only organize matter and energy, but also information itself, e.g. a process that occurs in our brains and computers. This refers not only to the process of creating meta-information (i.e. information about information), but also to information meta-levels. Information can also be considered from the perspective of issues related to signs, symbols, carriers, semantic meanings and issues related to sending this information at a distance and exchanging it using the so-called communication technique (Kowalczyk, 1981 p. 67). The biological effects conditioned by these mutual interactions depend no longer on the amount of energy brought into a given system, but on the information brought into it (Sedlak, 1980).

2. Piezoelectricity as a permanent feature of a biological system

The essence of a biological system includes piezoelectricity, pyroelectricity and semiconductivity. Piezoelectrics can convert mechanical energy into electrical energy and vice versa. A pulsating electric field applied to a piezoelectric causes it to vibrate (referred to as electrostriction), genera-ting a quantum acoustic wave. Applying a variable electric field to a piezoelectric crystal causes continuous mechanical vibrations to be forced, which are the strongest when the excitation is equal to the natural frequency of the mechanical vibrations of the crystal. During electrostriction, the piezoelectric vibrates and emits phonons in the form of a quantum-acoustic wave (Krajewski, 1970).

The piezoelectric phenomenon was discovered in 1880 by the brothers Pierre and Jacques Curie. It occurs in anisotropic dielectric media with a specific crystallographic structure. It consists in the fact that during compression or stretching of some crystals, opposite electric charges appear on their edges. As a result of the stress, the piezoelectric crystal will polarize, as a result of which electric charges will appear on the appropriate planes of the crystal and an electric field will be created (Soluch, 1980, p. 231).

If there are no external electrical and mechanical interactions, the piezoelectric crystal lattice is undeformed and electrically neutral. Crystals with a center of symmetry do not exhibit piezoelectric properties. Some piezoelectric crystals are characterized by constant polarization even when there are no external interactions. Such crystals are called pyroelectrics. The ability of piezoelectric crystals to polarize at the expense of mechanical interactions and the ability to deform at the expense of applied electric fields allows them to be considered as electromechanical transducers (Kleszczewski, 1997, p. 370).

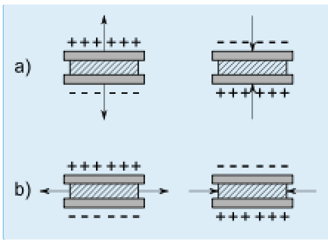

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Fig. 1. Piezoelectric effect occurring during compression and stretching of a plate.

In biological sciences, the piezoelectric phenomenon is attributed to a significant role in the functioning of many biological tissues. Yasuda (1954) discovered the occurrence of piezoelectric polarization during bone compression. Fukada and Yasuda (1957; p.119) conducted further experiments on the piezoelectric effect onf bone, collagen and tendon (Fukada, Yasuda, 1964, p.119). (Bassett, Andrew 1968). Shamos, Lavine 1967 confirmed the existence of deformation-induced electric potential in bone and other tissues. The generation of electric charges by walking depends on cyclic changes in the acting mechanical force. The application of a mechanical force to bone produces an electric potential, which then decays exponentially as the force is maintained. Eventually, the potential drops to zero when the deforming force is removed and the displaced charges return to their resting state and a pulse of opposite polarity is generated.

Athenstaedt conducted research on the piezoelectricity of collagen and keratin. He noticed that collagen and keratin structures exhibit electric polarization in two directions. Longitudinal polarization - occurs in the direction of the alignment fibers, again the outer-inner polarization in the direction of the cross-section through the fiber layer. This means that collagen, as the basic organic component of the biological system, contains a crystalline structure (Athenstaedt 1987).

Piezoelectricity was also studied in blood vessels (Fukada, 1968, p. 203), (Fukada, Hara 1968, p. 778), as well as collagen fibers (Goes et al. 2002, p. 468), from which it was concluded that fibrous proteins are responsible for piezoelectric behavior in biological tissues.

Fukada, Ueda, (1971) also further studied the piezoelectric effect in muscles – in actin and myosin fibers. In keratin and collagen, the value of piezoelectric modules decreases with increasing humidity (Fukada, 1974. Other researchers such as Giuzelsu and Akcasu (1974) demonstrated piezoele-ctricity for nerves, while Shamos and Lavine (1967) demonstrated piezoelectricity for the intestine. Giuzelsu and Akcasu (1974) believed that the piezoelectric effect depends on the amount of water, protein and fatty acids in the membrane. In the human biological system, bioelectronic processes resulting from piezoelectricity and pyroelectricity occur in: - mechanoreceptors (sense of touch and hearing), - thermoreceptors in the sense of temperature; baroreceptors; - the process of breathing and speech;- the process of fertilization of the egg cell,- during sexual arousal; in the blood circulatory system; - during intestinal work – peristaltic movements, etc.; - proprioceptors;

Every organism needs polarization of the biological piezoelectric, the lack of this polarization leads to pathological states in the organism, e.g. when children do not experience touch, they show reduced motor and mental functioning (Restak, Richard (1988, p. 87).

Infants touch everything in their environment, through touch they learn the dimensions of surfaces, lines and colors. Touch is very important for vision. A child reaches out for a new thing to touch it. A child sees the world in such a way that the image of the object falls on the retina, in an inverted way. Touch and movement adjust the newly seen world to the true physical orientation. The lack of

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experiencing touch and the possibility of touching can inhibit the development of nerves and can lead to the underdevelopment of essential body functions and even death. Experiencing constant touch in newborns significantly reduces the number of deaths, stimulates sensory-motor development, the growth of the nervous network and the skeletal system (Pearce 1986, p. 79).

In the piezoelectric process, the generated electrical energy affects the arrangement of extracellular macromolecules, the behavior of cells-their nutrition, movement, by-products, specialization, rate of reproduction, synthetic efficiency, membrane permeability and can also cause major changes in bone architecture (Andrew, Bassett 1967, p.267).

Cellular and extracellular piezoelectric influences, expressed as an electrical stimulus (electric field) have a decisive influence on cellular and intercellular biocommunication, as well as on the work of the protein, DNA and melanin biocomputer .

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3. Pyroelectric properties of biological structures

The pyroelectric phenomenon causes the formation of electric charges on the surface of dielectric crystals during their heating or cooling. During heating, one end of the pyroelectric acquires a positive charge, and the other one, a negative one (Soluch, 1980, p.34). The formation of charges depends on the rate of temperature change. Variable temperature produces spontaneous polarization, which leads to the alignment of dielectric charges in a specific direction, even when there is no external electric field. All pyroelectric crystals are also piezoelectrics. Inhomogeneous temperature changes cause their deformation, as a result of which, secondary polarization of piezoelectric origin occurs, adding up to the primary pyroelectric polarization (Chełkowski, 1979, p.324).

Any mechanical change in length or any deformation of a pyroelectric body causes a change in its dipole moment and produces a piezoelectric effect. In pyroelectric crystals, the opposite phenomenon can also occur, which is the electrocaloric effect, which consists in changing the temperature of the pyroelectric under the influence of an electric field. It should be mentioned that the action of an electric field on a piezoelectric can cause the phenomenon of electrostriction (Kawai, 1970, p. 416). In 1966, S. Lang proved that collagen fibers exhibit pyroelectric properties. Two years later, Athenstaedt (1967a; 1967b) dealt with the pyro and piezoelectric problem on a larger scale. He proved that teeth, bones, tendons, collagen fibers and keratin exhibit pyro and piezoelectric properties. The epidermis of animals and plants exhibits pyroelectric and piezoelectric reactions, which are directly related to external temperature changes, or touch and pressure. Pyroelectric reactions of the outer surface of the epidermis always have a negative electric sign when heated, and a positive sign when cooled. Piezoelectric reactions always have a positive sign during compression (corresponding to the pyroelectric reaction during cooling) and a negative sign during stretching (corresponding to the pyroelectric reaction during heating) (Athenthaedt, 1974, p. 72).

4. Semiconductor properties of biological mass

A semiconductor whose conductivity depends on the number of electrons transferred from the base band to the conduction band is called an intrinsic semiconductor. When an electron from the base band is transferred to the conduction band, a gap remains and is called a hole. Such a hole in the base band behaves in a sense similarly to an electron in the conduction band. Semiconductors in which there is a predominance of electronic conductivity over hole conductivity are called "n" type semiconductors. Semiconductors in which there is a predominance of hole conductivity over electronic conductivity are called such a semiconductor of the "p" type (Kleszczewski, 1997).

In a semiconductor, the electrical conductivity increases with increasing temperature. In semiconductors, two types of charge carriers occur simultaneously - electrons and holes. A hole, similarly to an electron, can be assigned a certain wave function. Due to the fact that a hole is equivalent to a single positive charge and polarizes the area around it, it can bind a free electron after applying an external electric field with simultaneous interaction of thermal lattice vibrations, or tear an electron from an adjacent bond, creating a hole there. If impurities are the cause of holes, we will call these levels acceptors and if they are the source of free electrons appearing in the conduction band, we will call them donor levels (Watson, 1999, p. 90). The Hall effect provides a direct numerical measurement of current carriers in semiconductors and allows us to decide whether a semiconductor is of the "n" or "p" type. The p-n junction acts as a rectifier, i.e. it has the ability to conduct electric current in one direction much better than in the other. Light incident on a semiconductor can transfer electrons from the valence band to the conduction band, provided that the energy of the light is greater than the width of the energy gap. Semiconductors respond not only to light energy, magnetic and electric fields, heat, but also to mechanical forces (Brophy, 1966).

When an electron receives a certain energy under the influence of an absorbed photon or thermal motion, it passes into an excited state in an electric field and creates a common system with a positive hole - called an exciton. In 1946, Szent-Györgyi demonstrated the existence of electronic conduction in dried protein layers. In his work, he proved that the molecular structure of many parts of the cell is sufficiently regular and that semiconduction is possible there. Protein particles are equipped with a kind of stopping place for mobile electrons and can be connected in long chains. Thanks to this, electrons can move over long distances without losing energy. In protein semiconductors, the electron energy is conserved and transmitted as information.

Eley (1968), (Eley, Parfitt et al.1953) based on his studies shows that plasma albumin, fibrinogen and elastin have semiconducting properties, with a band gap of 2.1 to 2.6 eV. For other proteins, the activation energy ranged from 2.6 eV to 3.1 eV (Eley, Spivey1960).

Protein conduction is undoubtedly electronic in nature. Similar systems include the pigments melanin, neuromelanin (Stępień, Wilczok 1994), as well as rhodopsin, which, under the influence of light absorption, causes reactions of electrical impulses in the optic nerve (Rosenberg 1971).

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Melanin is characterized by the following features from an electronic and physical point of view: the ability to conduct protons;

- the ability to absorb light of all wavelengths;
- photoconductor and amorphous semiconductor properties (Strzelecka, 1982);
- donor-acceptor properties (Matuszak, 2001; Osak et al. 1995).
- increased resistance to light and ultraviolet radiation;
- generation of excited electrons and photons (Corry, et al., 1976, p. 321);
- selective susceptibility to phonons; in addition, melanin can act as a photon-to-phonon converter and the reverse process (Mc Ginnes, Corry, Proctor 1974).
- paramagnetism (Pasenkiewicz-Gierula 982).

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5. Ferroelectricity in biological structures

Ferroelectrics are bodies in which spontaneous polarization occurs in a certain temperature range in the absence of an electric field. Ferroelectrics undergo deformation under the influence of an external electric field, which is proportional to the square of the field intensity. This phenomenon is called electrostriction. All ferroelectrics, apart from electrostriction, exhibit piezoelectric and pyroelectric effects (Smoleński, Krajnik 1971).

Ferroelectrics belong to dielectrics, i.e. substances with very low or zero electrical conductivity. We distinguish the following types of polarization:

□ electronic, □ ionic, □ orientational.

Electronic polarization occurs in atoms or ions when the center of gravity of the electron cloud moves relative to the nucleus under the influence of an electric field.

In ionic polarization, the electric field causes displacements of the positive and negative ions of a given substance relative to each other. Orientational polarization occurs in dielectrics whose molecules have permanent dipole moments. In the absence of a field, the dipole moments are randomly oriented due to thermal vibrations, so the resultant dipole moment of the sample is zero. After applying an electric field, the sample obtains a dipole moment parallel to the direction of the field. The total polarization of the dielectric is the sum of electronic, ionic and orientational polarization (Krajewski, 1970).

Dipoles without an electric field are loose and disorganized. In an electric field, the dipoles are organized, negative charges on one side and positive charges on the other. Electric dipole -a system of two opposite electric charges q, placed at a distance l from each other. The line passing through both charges is called the dipole axis; such dipoles exhibit an electric dipole moment.
Magnetic dipole -a system that generates a magnetic field characterized by a magnetic dipole moment, for example a magnet. In pyroelectrics, spontaneous polarization occurs over the entire temperature range, up to the melting point. Ferroelectrics are a special case of pyroelectrics, in

which spontaneous polarization occurs, over a certain temperature range. All ferroelectrics are characterized by a certain temperature at which the ferroelectric state completely disappears - this is called the phase transition temperature called the Curie temperature (TC), each material has its own transition temperature. When ferroelectric properties disappear, piezoelectric properties also disappear (Scott, 2013).

Ferroelectrics can be both pyroelectric and piezoelectric, which means that they have the ability to generate electric charges on their surfaces under the influence of temperature changes or mechanical pressure. In other words, if a ferroelectric is heated or cooled, or compressed or stretched, an electric charge (electric voltage) will appear on its surfaces (Tan and Li, 2015).

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6. The importance of ferroelectricity for the biological system

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Scientists from the University of Washington have investigated the ferroelectric properties of the tropoelastin protein (Wise, et al. 2014).

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Elastin, as a key protein found in connective tissues, is an important structural component of the lungs, heart and arteries, is ferroelectric (Liu et al. 2013), (Liu et al. 2012), and plays important physiological roles in the morphogenesis of blood vessels (Brooke 2003), homeostasis (Faury 2001) and in the regulation of cell functions (Debelle, 1999).

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It provides the necessary elasticity and resilience to the aorta, lungs, ligaments and skin subjected to repeated mechanical and physiological loads (Daamen et al. 2007), (Mithieux et al.2013).

Ferroelectric polarization of elastin affects the proliferation and organization of vascular smooth muscle and contributes to arterial morphogenesis (Li, Dy, et al. 1998), (Baldock, et al. 2011).

Ferroelectric switching may help to suppress increased pulsatile flow and blood pressure in arteries to reduce distal pulse stress. Elastin polarization may also help to regulate the proliferation and organization of vascular smooth muscle and contribute to arterial morphogenesis (Li et al. 1998).

Ferroelectric switching in elastin has been reported to be suppressed by glucose (Liu et al. 2013). In addition to lysozyme, one of the nucleobases, thymine, has been shown to be ferroelectric and therefore piezoelectric in crystalline form (Bdikin, I. et al. 2015).

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The authors of these studies present the thesis that thymine ferroelectricity can find wide possibilities in creating new bases that are currently unknown and at the same time for reconstructing bases occurring in the DNA of the genetic chain. This opens a new path for the use of thymine in the treatment of infectious diseases. All this will be done on a piezoelectric and ferroelectric basis, in which the electric field will play an important role (Guerin, et al. 2019).

In the DNA molecule, thymine combines with adenine through two hydrogen bonds, thus stabilizing the composition of the nucleic acid and taking part in pairing and replication. The most important feature of ferroelectricity is polarization, i.e. combining thymine with adenine in DNA through a direct current electric field and the work of solitons (Liu, et al. 2013). Elastin and collagen is a protein present in all connective tissues of vertebrates, providing the necessary elasticity and resilience of the aorta, lungs, ligaments and skin subjected to repeated physiological loads. This has found wide application in mechanoreceptors, especially in the sense of touch and hearing, proprioceptors located in muscles, tendons, joint capsules and periosteum, conditioning the feeling of movement and position of body parts relative to the environment, baroreceptors responsible for the functioning of the heart, lungs and other organs in the biological system and thermoreceptors. There is a huge unknown field to be explored in order to gain a basic understanding of biological ferroelectricity.

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7. Biocomputer information management in sensory processes

A significant element of a computer is the processor. It is a device designed to process information by transforming input data into final (output) results. In order for the processor to perform these activities, it must receive an action program that specifies the method of data processing. In addition to the processor, the computer includes a set of systems for inputting and outputting information. Programs and data are stored in semiconductor memory. Semiconductor memories are digital integrated circuits designed to store larger amounts of information in binary form. The memory capacity is given in bits or bytes (Feichtinger, 1988).

Another important role in computers is played by transistors, which can be treated as combinations of two semiconductor rectifying junctions in a p-n-p or n-p-n system. The n-p-n region is called the emitter, base and collector. Transistors can act as current amplifiers or voltage amplifiers, they are generally used in computers as electronic switches, because a small base current can be used to control and switch into a large collector current. The base-emitter junction serves as a diode junction. Depending on the type, transistors can switch currents from 50 mA to several amps and voltages from 20 to 1000 V. Such switching can occur at a speed of even several million times per second. (Feichtinger 1988 p.148)

The author hypothesizes that receptor cells are controlled by a protein biocomputer in the cell membranes, a DNA biocomputer located in the cell nucleus, and a melanin biocomputer. Each of these computers has a separate information carrier. And so:

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The protein biocomputer is powered by an electric field and a spin field. The information carrier in this biocomputer is an acoustic wave, and a soliton wave.

DNA biocomputer -is powered by an electric field, the information carrier is an acoustic wave and laser light.

Melanin biocomputer -is powered by an electric field and a spin field, the information carrier is an electromagnetic wave, an acoustic wave and a soliton wave.

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Protein biocomputer -the cell membrane is made of a protein-lipid structure. Protein is a piezoelectric. There are unpaired electrons in the protein, which create free radicals, such as: superoxide radical, hydroxide radical and nitric oxide. Free radicals have the ability to activate spins: electron, photon, other elementary particles and atomic in a rotating motion. Activation of spins into clockwise or counterclockwise rotation is associated with the creation of a spin field (torsion), which is modulated by the electric field resulting from the piezoelectricity of the protein. In biological membranes there are enzymes that act as transistors (Hu, Wu,(2003),(Shipov 1993).

Achievements in the field of molecular electronics show that it is possible to synthesize single molecules that act as ordinary transistors, diodes, wires and other important elements of today's microcircuits. Single particles can conduct electric current, as well as block its flow and store information recorded in electric charge and can act as a transistor (Zhou et al. 1997).

Due to appropriate conformational changes, enzymes can function as molecular switches and are considered natural diodes or transistors (Cardenas 1991), (Wnuk 1995).

According to Hameroff and Penrose, microtubules and cytoskeleton perform the function of a microprocessor and should be considered cellular biocomputers (Hameroff 2007),(Penrose, Hameroff, 1995).

Protein biocomputers in biological membranes create a biointernet network and constitute an information center in cellular transmission. The protein biocomputer would have the task of processing the stimulus that would reach the brain, as a central device managing the entire biological system.

DNA biocomputer - Watson and Crick in 1953 discovered that DNA consists of a double helix and contains sugar, phosphorus and bases: purines- adenine (A), guanine, (G), and pyrimidines- cytosine (C) and thymine (T). Information in DNA is recorded in a four-letter language (Crick, 1996 p.88). The structure of DNA is a matrix for protein synthesis, the sequence of bases in DNA encodes the sequence of amino acids in the appropriate protein to replicate DNA (Lewiński, 1996). Polymerase and the four-letter language constitute the structure of the DNA biocomputer. Fukada and Ando (1972) demonstrated the piezoelectric properties of DNA. Albert Popp (1883; 1992) demonstrated revealed that DNA emits laser light in the range from 200 nm to 600 nm (Popp, 1983, 1992).

The DNA biocomputer is powered by electrical energy generated from piezoelectricity and creates a biointernet network in which the information carrier is laser light and acoustic wave. Melanin biocomputer Melanin is a piezoelectric and pyroelectric, which, under the influence of temperature and mechanical energy, releases an electric field. It is also a free radical. Melanin has the ability to convert light into sound and vice versa. Light travels 300 thousand km/sec, and sound again 340 m/sec, i.e. that is, melanin converts a photon into a phonon and vice versa. Melanin also has the ability to convert light into a torsion field (spin field), or a photon into a neutrino. Melanin biocomputer would be powered by an electric field and a spin field (Adamski, 2009).

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Melanin biocomputers occur wherever melanin is found. It is most intense in the skin, hair, choroid, iris, substantia nigra of the brain and in the inner ear. The information carrier in the melanin biointernet would be acoustic, electromagnetic, soliton and bioplasmic waves. Melanin, neuromelanin, proteins, DNA contain the largest resources of bioplasma. In biocomputers, bioplasma would be responsible for programs and biocomputer language. It plays a central role in coordinating and managing all biocomputers and the entire biointernet network of the cell. Biocomputers are used to process information from sensory perception, at the same time they are capable of storing and managing information. The biointernet network of perceptive cells understood in this way can receive information from the biosphere, noosphere and cosmosphere (Adamski, 2007).

The presence of melanin in the eye is related to the function of the iris in this organ, responsible for the size of the pupil, which changes depending on the amount of light entering the interior of the eye. A small part of the radiation reaches the retina, the rest is selectively reflected from melanin particles, giving the eyes an individual color (Sarna, 1992).

Fig. 2 shows an eye containing some melanin in the iris, which gives it its color.

Melanin in the eye is very resistant to external factors, the only factor that is capable of degrading melanin is light. Melanin in the retinal epithelium is responsible for protecting photoreceptors and is responsible for visual acuity. Strongly pigmented eyes have a greater ability to concentrate light, which in effect gives better visual acuity. The author's research has shown that people with dark eyes have an easier time solving problems that require spatial orientation. The author's research has led him to put forward the thesis that melanin and melatonin are responsible for recognizing movement, perceiving time and space, for the process of adaptation to the environment, thanks to their resources the biological system can properly organize and categorize stimuli (Adamski 2009).

In albinos, light after passing through photoreceptors and the retinal epithelium is reflected, returns to the iris, which leads to damage to the blood vessels of the eye and the receptors of vision. The action of this phenomenon causes albinos to see blurrily. The vision of albinos, in addition to monochromatism, also shows other disorders; they say that something limits their ability to focus sharply and clearly on the details of the observed objects. They often have difficulty reading telephone numbers because all the numbers are mixed up. Reading vertical lines on a graph is difficult, they have to turn the paper or tilt their head to the side that matches the angle of the graph, to see them

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better. Albinos are unable to see things clearly that are far away. They see figures in the distance, but they cannot recognize them as their friends. Albinos see in a similar way to a normal person, but their image is blurry and unfocused.

Fatigue, stress or strong emotions cause nystagmus, which causes the inability to judge the distance of objects far away from them. Appropriate head tilt, head rotation, head shaking in order to limit eye movements, improves their vision. Albinos are unable to follow a point moving in space with both eyes. They solve this problem by engaging the right or left eye in the process of looking at a moving object (Pawluczak 2000). The lack of melanin in the eye of albinos is equivalent to the lack of the melanin biocomputer responsible for processing perceptual stimuli, including the sharpness of vision from different distances, spatial orientation and perspective (Placek, 1999).

The sense of hearing demonstrates the ability to receive sound waves in animals and humans. The receptor for receiving sounds is the organ of Corti located in the middle canal of the cochlea in the inner ear. The sensory cells of the organ of Corti are sensitive to acoustic waves. In the inner ear there is melanin, which comes from the crestal process. The level of melanin in the ear can determine the correlations between low and high sounds, and thus can determine the tonality of the sound, but also the sense of rhythm and musical harmony. Africans, who have higher levels of melanin, have better hearing than whites, and in both races, women predominate over men. (Kambon, 1990). Studies have also shown that people with light-colored eyes - blue, green, hazel - are more susceptible to hearing loss than people with brown or black eyes. (Azibo, 2002).

All melanins of the biological system show a variety of physical properties, such as: absorption, decay of light and sound, binding of organic chemical compounds, storage of liquids and gases, conduction of electricity and transformation of light into electricity (Bruno et al. 2005).

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8. Solitons in creating emotional and cognitive states in humans

From a physical point of view, solitons are impulsive nonlinear fields and have properties of both waves and particles (Bronsztejn et al. 2004). A soliton is an isolated traveling wave, the shape and speed of which do not change with the distance traveled and after collisions with other solitons, can be created in nonlinear dispersive media, in which the phase velocity of the wave depends on its frequency. The dispersion phenomenon causes the duration of the pulse to lengthen with the distance traveled, while nonlinear optical properties of the medium can cause the duration of this pulse to shorten; under appropriately selected conditions, both phenomena can compensate and an impulse is created that does not change its shape, i.e. a first-order optical soliton, or a periodically reproducing its shape, a higher-order optical soliton. Optical solitons are used in long-range fiber optic telecommunications. Solitons have also been discovered in solar plasma, the Bose–Einstein condensate (Brizk, 2014).

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There are solitons of light, water and sound that can strongly interact with other solitons, but after this interaction the form and structure remain unchanged. This means that they penetrate each other without losing their identity (Brizhik 2008).

Water solitons are observed on rivers, seabeds, they are conditioned by the topography of the seabed. There are also atmospheric solitons, e.g. for example, the Morning Glory phenomenon in the Gulf of Carpentaria cloud. It is a solitary wave that has one crest and moves in uniform motion, without changing speed and shape. It appears without the occurrence of any clouds (Roger, Rottman 2002).

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According to Jibu and Yasue (2000), there are Bose–Einstein condensates inside and outside the neuronal membrane, they can weakly connect with each other, creating the so-called Josephson connection. Bias potentials of the biological cell membrane induce self-excited oscillations and excite the Josephson junction to produce solitons along the biological membrane. Soliton waves maintain their form over long distances and can propagate to macroscopic dimensions, which may turn out that cellular conduction transmits information via ionic and soliton pathways (Karkuszewski, 2006).

Strong laser waves, a degree of nonlinearity and a high concentration of atoms in the Bose-Einstein condensate influence the formation of multidimensional solitons. Currently, the greatest degree of nonlinearity is achieved by organic substances, in which electrons seem to move over large distances (Brizik 2015).

It was noticed that a soliton can generate an electromagnetic wave or absorb it, which results in the creation of a continuous medium of conduction and transfer of information over a distance (Muryshev, et, al. 2002), (Denschlag et, al. 2000), (Bongs, et al. 2003).

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Solitons emit their own electromagnetic field with a characteristic frequency determined by their average velocity. This self-radiating field leads to the synchronization of the soliton dynamics and charge transport processes and is a source of coherence in the system. Exposure of the system to an oscillating electromagnetic field with a frequency that coincides with the solitons' own frequency can increase the solitons' own radiation, and therefore will increase the charge transport synchronization, stimulate redox processes and increase coherence in the system. The oscillating electromagnetic field also causes the soliton ratchet phenomenon, i.e. the drift of solitons in macromolecules in the presence of an unpolarized periodic field. Such additional drift enhances the charge transport processes. It has been shown that temperature facilitates ratchet drift. In particular, temperature fluctuations lead to a decrease in the critical value of the field intensity and period above which soliton drift occurs. In addition, there is a stochastic resonance in the dynamics of solitons in external electromagnetic fields. This means that there is a certain optimal temperature at which soliton drift is maximum (Wang et al., 2018).

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Soliton excitation requires a sudden change in any variable, these can be voltage pulses (commonly used in electrophysiology), mechanical stimulation, pH drops, temperature decreases (Adamski 2020

b) and other sudden stimuli that increase the phase transition temperature in ferroelectrics. The brain shows the ability to generate and receive soliton fields (Adamski 2023).

The soliton wave is generated in the vitreous body of the eyeball, again in the sense of hearing in the perilymph and endolymph. Information flowing from the electromagnetic, acoustic and soliton waves is processed by the melanin biocomputer. After processing, it is transmitted to the brain. In living organisms, the spin wave closely cooperates with the soliton wave, which has encoded programs about the proper functioning of the cell and maintaining homeostasis, etc. Solitons can spread without distortion over very large distances and are the wisdom of the laws of the development of the Universe (Brizik, 2015).

Solitons, generated from the human body, are transmitted to the Cosmos, but also to the brain of various people in the form of messages or directives. This takes place in the content of myths or telepathy. In psychology, such a phenomenon is known, a similar image occurs in synesthesia (Adamski 2016).

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In Summary

It should be stated that biological piezoelectrics, ferroelectrics and pyroelectrics are capable of transforming mechanical, thermal energy into electrical energy (electric field). This field changes the energy state of neighboring cells, integrates the entire organism, regulates metabolic processes, and directs the growth of the organism. It records perceptual impressions not only in the brain, but also in the entire organism, and directs the work of enzymes. Enzymes are necessary for digesting food, releasing vitamins, minerals and amino acids, but also serve as transistors and are used in the construction of biocomputers. The action of solitons in the human biological system provides a basis for viewing the human psyche in a different light than that described by current psychology. Current science only recognizes the action of electromagnetic waves on the sense of sight. It can be concluded that we are dealing with a second center that creates the structure of the image of the world and is responsible for the development of a person's personality.

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