

Functioning of the Human Heart in the Bioelectronic, it, and Cybernetic Paradigm.

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Abstract

Biological and mental life should be considered not only from a biochemical perspective, but also from a bioelectronic and informational perspective, as biological and mental effects depend largely on the information transmitted, not on the amount of energy. The biochemical model of life, existing for over 100 years, is insufficient in explaining life processes. Alongside traditional, well-understood chemical reactions, a new reality is emerging, operating on a bioelectronic model of life. In this model, the human body is understood as an electronic integrated circuit composed of piezoelectric, pyroelectric, and semiconductor elements, with a biochemical, bioelectronic, informational, and biocybernetic design, responsible for modeling the structure and function of biological, optical, and quantum biocomputers. Quantum processes are electronically managed, surrounded by electrostasis, and filled with bioplasma that emits a biological field. Biological systems are controlled through a network of information channels: electron, photon, phonon, soliton, spin, ion, and bioplasmic. (Sedlak 1979). (Adamski 2023).

Keywords: heart; soliton waves; free radicals; spin waves; electric field

Introduction

In the human biological system, blood moves in ordered layers (laminar), minimizing friction and energy loss. In large arteries (e.g., the aorta or femoral arteries), blood moves three-dimensionally, rotating clockwise or counterclockwise. Traditionally, laminar blood flow is described by Poiseuille's law, where the velocity profile is parabolic (fastest in the center, slowest at the vessel walls). This spiral motion is a result of the twisted anatomy of the heart (left side of the heart) and the natural arcs and branches of the vascular system. This spiral motion stabilizes the flow, preventing dangerous turbulence at the branching points of the vessels. Thanks to rotation, blood evenly washes the vessel walls. This prevents the formation of areas of stasis and low shear stress, which are the main factors contributing to the buildup of atherosclerotic plaque. Irregular movement, the "tumbling" of blood cells, the mixing of layers, and the formation of turbulence—these occur at higher blood flow rates, vascular narrowing (e.g., atherosclerosis), or at branching points (e.g., arteries), resulting in heart disease. Medical engineering designs vascular prostheses (stents, bypasses) that force spiral flow to improve their patency and durability. Forcing spiral blood flow is nothing more than generating aqueous solitons. Stable spiral motion determines the energy and information balance of the biological system, while turbulence disrupts this system. An electric field generated by

biological piezoelectrics, pyroelectrics, and ferroelectrics plays a significant role in this process. The electric field is the carrier of solitons [Adamski 2020, 2025].

The human biological system is an integrated circuit of piezoelectric, pyroelectric, and protein semiconductor elements, nucleic acids, DNA, RNA, and melanin. This integrated biological system includes a central soliton-generating system in the heart, which is responsible for life's energy balance and emotional states. It should be understood that life's energy balance is not only the structure of chemical bonds, but also energy and information carried by electromagnetic, acoustic, and soliton waves.

The action of solitons and spins in the human biological system provides a basis for viewing psychobiological processes in a different light than is currently assumed by biology, psychology, and medicine. Spin and soliton waves create a different image of the world than the electromagnetic wave perceived by the visual receptor. Solitons generated in the heart are responsible for heart rhythm activity, but also for emotional states in humans. They stabilize mental states and maintain them in a certain balance, shaping our inner world. We can conclude that we are dealing with a second center

that structures the worldview and is responsible for human psychophysical development, health, and disease.

Contemporary biosystems in science are considered at the level of corpuscular structures, ignoring energy and information structures. By shifting the cognitive emphasis toward energy and information structures, the organism can be viewed as a quantum generator of electromagnetic, acoustic, spin soliton, and bioplasmic information.

1. Biological System as an Electronic Device

Piezoelectricity, pyroelectricity, and semiconductor are at the heart of biological systems. Piezoelectrics can convert mechanical energy into electrical energy and vice versa. A pulsating electric field applied to a piezoelectric cause it to vibrate, known as electrostriction, generating a quantum acoustic wave (Krajewski 1970, p. 59). As a result of stress, the piezoelectric crystal polarizes, electric charges appear on the corresponding crystal planes, and an electric field is generated (Soluch 1980). Crystals with a center of symmetry do not exhibit piezoelectric properties. Some piezoelectric crystals exhibit constant polarization even in the absence of external interactions. Such crystals are called pyroelectrics. The ability of piezoelectric crystals to polarize due to mechanical interactions and to deform due to applied electric fields allows them to be considered electromechanical transducers (Kleszczewski 1997).

In biological sciences, the piezoelectric phenomenon is attributed a significant role in the functioning of many biological tissues. Athenstaedt noted that collagen and keratin structures exhibit electrical polarization in two directions. Longitudinal polarization occurs in the direction of the fiber orientation, while external-internal polarization occurs in the direction of the cross-section through the fiber layer. This means that collagen, as the basic organic component of a biological system, contains a crystalline structure (Athenstaedt 1987, p. 459). Piezoelectricity was also studied in blood vessels (Fukada, 1968) (Fukada, Hara, 1968), as well as collagen fibers, leading to the conclusion that fibrous proteins are responsible for piezoelectric behavior in biological tissues. Fukada and Ueda (1971) also studied the piezoelectric effect in muscles – in actin and myosin fibers. In keratin and collagen, the piezoelectric modulus decreases with increasing humidity (Fukada, 1974, p. 146). Other researchers, such as Giuzelsu and Akcasu (1974), demonstrated piezoelectricity in nerves, while Shamos and Lavine (1967) demonstrated piezoelectricity in the intestine. Every organism needs polarization of a biological piezoelectric material; the lack of this polarization leads to pathological conditions in the body, for example, when children do not experience touch, demonstrate reduced motor and mental functioning (Restak, Richard (1988, p. 87).

In the piezoelectric process, the generated electrical energy affects the arrangement of extracellular macromolecules, cell behavior—their nutrition, movement, byproducts, specialization, reproduction rate, synthetic efficiency, membrane permeability, and can also cause significant changes in bone architecture (Fukada Yasuda 1957). The pyroelectric phenomenon causes the formation of electric charges on the surface of dielectric crystals during heating or cooling. During heating, one end of the pyroelectric material acquires a positive charge, while the other acquires a negative charge (Soluch 1980, p. 34).

This process is associated with the formation of electrostasis, which forms the body's electronic protective layer. It is particularly located on the skin and acts as a receiver and transmitter of electromagnetic, soliton, phonon, and spin information. Electrostatics is an expression of the body's electrical level, resulting from metabolism, piezoelectricity, pyroelectricity, and

ferroelectricity. In pyroelectricity, the generation of charges depends on the rate of temperature change. Varying temperature produces spontaneous polarization, which leads to the alignment of dielectric charges in a specific direction, even in the absence of an external electric field. All pyroelectric crystals are also piezoelectric. Inhomogeneous temperature changes cause their deformation, resulting in secondary piezoelectric polarization, which adds to the primary pyroelectric polarization (Chełkowski 1979, p. 324). Pyroelectric crystals can also experience the reverse phenomenon, the electrocaloric effect, which involves a change in the temperature of the pyroelectric medium under the influence of an electric field (Kawai 1970, p. 416).

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 during heating and a positive sign during cooling. 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 reactions during heating) (Athenstaedt 1974, p. 72). Athenstaedt et al. (1982) demonstrated that some organic structures possess a double pyroelectric axis, and that electric polarization can occur in two directions: longitudinal and external-internal. The first axis runs parallel to the longitudinal direction of the fibril, while the second runs perpendicular to the outer surface of the structure. The orientation of the pyroelectric axis determines the direction of electric polarization. Membrane-type receptors operate primarily through the moment of external-internal electrical polarization, and an additional effect is created only by longitudinal polarization (Athenstaedt 1987, p. 464).

The presence of semiconductors in a biological system is equivalent to the presence of an integrated electronic device. Therefore, a living organism can be viewed as a complex electronic device, analogous to technical devices. Proteins, DNA, RNA, and melanin, from a biological perspective, are biological structures; from a biochemical perspective, they are chemical compounds with different chemical formulas; and from a bioelectronic perspective, they are electronic materials. Enzymes are considered not only biochemical biocatalysts but also act as transistors and nano processors (Wnuk 1995, p.134; Wnuk 1996). Enzyme transistors have been constructed from these materials (Caras, Janata 1988) (Cardenas 1991). Information, alongside mass and energy, is currently considered the third fundamental structural element of reality. Stonier (1990, p. 107) believes that information can not only organize matter and energy but also information itself, for example, 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 metalevels of information. Information can also be considered from the perspective of signs, symbols, carriers, semantic meanings, and matters related to the transmission of this information over distance and exchange via so-called communication techniques (Kowalczyk 1981, p. 67).

To date, contemporary biosystems in science have been considered at the level of corpuscular structures, ignoring energy and information structures. The term information has many meanings; it is generally understood as something that carries a message. Information is also defined as the ability to organize a system or maintain it in an organized state (Latawiec 1995, p. 33). Thanks to these properties of biological structures, intracellular and intercellular communication can occur electronically, using electromagnetic and quantum-acoustic signals (Bistolfi 1991, p. 83). The cytoskeleton, along

with microtubules, is considered the natural intracellular information processor. The cytoskeleton plays a key role in maintaining the information balance needed for proper cell functioning (Hameroff, Watt 1982, p. 551), (Hameroff, Rasmusen 1989,).

2. Soliton and Spin Image in Biological Systems

In physics and mathematics, a soliton is understood as a single, solitary wave traveling alone, caused by so-called nonlinear effects in matter. It can be imagined as a shifting increase (or decrease) in the density of matter. Such waves can propagate in a wide variety of media and are known for their stability. Once excited, a soliton travels without changing shape over long distances. Unlike linear waves, a soliton does not change its speed or shape upon interaction with another soliton. Interference does not occur. It overcomes it and returns to its original shape after the collision (Hirota (2004).

A nonlinear wave is characterized by the fact that it does not obey the principle of superposition and its speed of propagation depends on the amplitude. It turned out that nonlinearity and dispersion are responsible for the existence of these waves (Xu 2004). Solitons are generated in nonlinear optical media, in water, air, solar plasma, in lines in Josephson junctions, optical fibers, in Bose-Einstein condensates, but also in the human biological system such as: vision, hearing, DNA, the heart, etc. (Adamski 2016, b, 2023), (Jadaun 2021).

Solitons are responsible for the proper functioning of the biological cell. The human biological system has the ability to generate and receive soliton fields, which actively participate in human life processes and determine their health, illness, and personality development. The movement of solitons is influenced by the density and thickness of the biological membrane in the cell, as it determines the magnitude of the piezoelectric, pyroelectric, and ferroelectric effects from which the electric field flows, interacting with solitons (Adamski 2016 c). Soliton waves carry encoded programs for proper cell functioning and maintaining homeostasis, etc. Solitons can propagate without distortion over very long distances and are the wisdom of the laws of the universe's development (Brizik 2015).

Spin waves in biological systems most often result from the functioning of free radicals. Free radicals are atoms that lack a pair of electrons. Oxygen atoms in our bodies should have an even number of electrons; sometimes, during oxygen metabolism in mitochondrial processes, an electron is lost.

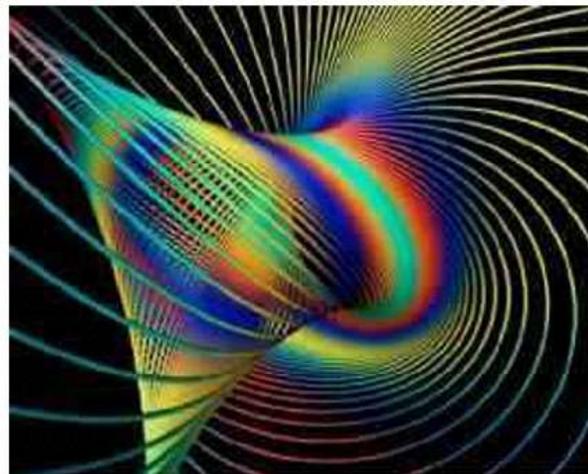
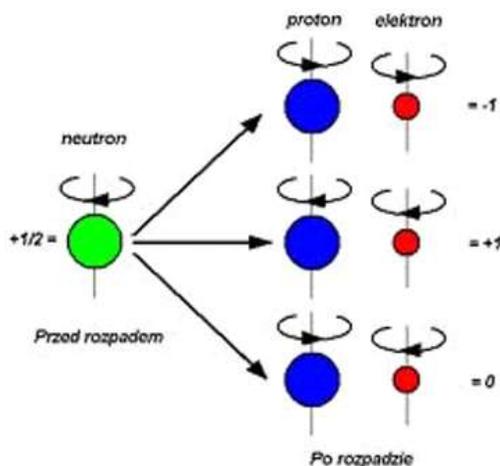


Figure 1-2 shows the clockwise or counterclockwise rotation of the spin.

The oxygen atom loses its original balance and begins to search for the missing electron in its immediate vicinity, taking electrons from other oxygen atoms, creating further incomplete atoms. Oxygen, i.e. – free radicals (Kaczmarek, Sionkowska 2013).

Melanins have the ability to react with reactive oxygen species such as the radical:

Reactive oxygen species that are radicals:

- superoxide anion radical $O_2^{\bullet-}$ hydroperoxide radical HO_2^{\bullet} hydroxyl radical HO^{\bullet}
- alkoxy radical RO^{\bullet}

Reactive oxygen species that are not radicals (those without an unpaired electron):

- singlet oxygen 1O_2 , ozone O_3 , hydrogen peroxide H_2O_2

The amount of oxidized and reduced superoxide anion radicals depends on the type of melanin polymer. Reactive oxygen species, ROS [1] (or ROS, from reactive oxygen species), are capable of participating in chemical reactions that play a significant role in the metabolism and aging of living organisms. Free radicals have the ability to activate spins: electrons, Photons, other elementary particles, and atomic particles. Activating spins into clockwise or counterclockwise rotation is associated with the creation of a spin field. Diseased biological tissue contains an excess of negative free radicals, which generate a wide range of spin waves. When amino acid bonds are broken, free radicals are produced, creating a spin wave that influences changes in the biological and psychological structures of humans (Adamski 2006 b). Adamski 2020a).

Like mass and charge, spin is integrally linked to a particle. Spin is understood as the intrinsic angular momentum of a particle in a system. Each type of elementary particle has a corresponding spin. Spin is a purely quantum concept (Shipov 1995). There are left- and right-hand torsion fields (depending on the spin's direction of rotation). Molecular, atomic, and nuclear spins determine the intensity of the torsion field. According to Shipov, each substance has its own torsion field characteristics. A spin wave is associated with the spin, or motion, of elementary particles. The direction of electron spins contributes to the magnetic moment of atoms. Imagine a magnetic material in which all spins are aligned. If I deflect one spin, it will try to return to its equilibrium point. Its motion will capture the adjacent electron spin, which will also deflect.

The deflection between spins will propagate through the material, taking the form of waves that can carry information. Spin waves are short waves, several hundred nanometers wide, with frequencies ranging from GHz to THz. Wave phenomena do not involve charge transport. A similar phenomenon occurs during the heart's oxygen uptake. From a mechanical perspective, it is impossible to explain how, with an average resting cardiac output of 3.3 W, the heart can pump blood through a vascular system approximately 100,000 kilometers long. It remains unclear how blood is delivered to organs and tissues with such a small cardiac output and enormous arterial length. It has been found that different types of arteries have different anatomical structures (23, 24, 26). It has become apparent that blood is delivered to tissues only through the action of the muscular-elastic arterial pump, which is based on soliton action. Based on this, it is reasonable to hypothesize that the cardiovascular system functions based on the action of spin waves and solitons (Mikhaylov 2018).

A soliton can create spin and has been named a spin soliton—a stable, isolated wave of magnetization (collective spin vibrations) propagating in magnetic materials, arising from nonlinear effects. They retain their shape and velocity even after collisions, making them promising information carriers in spintronics and magnonics. These are local disturbances of the magnetic order. Spin waves, or collective spin excitations, can appear as nonlinear solitons on the nanoscale when excited by an electric current. Free radicals, formed during UV irradiation of melanin, can alter the spin alignment and permanently record information in the atomic nucleus, which is part of the biological structure. (Huping Hu., Maoxin Wu., 2004, p. 7). (Jacak et al. 201).

Free radicals are also responsible for the formation of quantum states of entangled particles, atoms, or entire information structures and images generated in the bioplasma of melanin and neuromelanin. A change in the alignment of nuclear spins is associated with a change in the intensity of the spin field or soliton field, which is believed to be responsible for the nature of mental processes. Solitons are produced in torsion fields.



Figure 3: Formation of solitons in torsion fields. (. Shipov 1993)

Entanglement is a phenomenon in which two or more objects are connected. The process of entanglement creates a bilateral connection between the objects; their description cannot be realized without simultaneously taking the other into account. This leads to the emergence of correlations between the physical properties of the objects, even when they are distant from each other. This phenomenon is known in the scientific world as the EPR paradox.

Quantum entanglement can occur for a wide variety of objects in the microworld, such as atoms, elementary particles, or spin-entangled electrons. Entanglement is a spontaneous, timeless phenomenon, with the distance between the objects being irrelevant. For example, when two electrons are entangled, a change in the quantum state of one electron immediately causes a change in the quantum state of the other. By analogy, two quantum computers whose memory consists of electrons entangled with each other can be assumed to have the ability to communicate bilaterally in dimensionless space-time. Such a system could function as a galactic internet. The method of transmitting information using quantum entanglement in physics is well-

known and is based on quantum teleportation and dense coding (Bouwmeester et al., 1997).

Teleportation allows for the transmission of quantum messages recorded as the state of the system, while dense coding allows for increased channel capacity through the exchange of quantum information. Because the teleportation scheme can be extended to multiple qubits, longer messages can be transmitted this way (Barrett et al., 2008). The concentration of free radicals in melanin varies depending on pH, the environment, the irradiation of the biopolymer, the degree of hydration, temperature, the content of metal ions, medicinal substances, and the presence of oxygen in the sample environment. The action of free radicals has significant effects on the biological system, apart from their negative impact on the aging process. The main targets of free radical attacks in the human body are molecules with double bonds, such as proteins, DNA, or unsaturated fatty acids that make up cell membranes, polysaccharides, and lipids (cholesterol) found in the blood. (Rzepka et al. 2016).

3. Cardiac dysfunction, which negatively impacts information transmission in the heart

It should be assumed that the beating heart, through the regular ejection of blood from the ventricles, creates a pulsating movement in the arterial walls, which then become generators of water solitons. Blood pressure is the force exerted on flowing blood, which exerts an effect on the walls of blood vessels, causing polarization of piezoelectric proteins, which trigger the

electric field necessary to control the valves. Changes in blood pressure influence the opening and closing of valves. The resulting sound is heard as the heartbeat – heart sounds. The closing and opening of valves are the main source of acoustic and water soliton generation. A human pulse measurement is simply a record of water solitons, which we detect by placing our fingers on the veins in our hands. We feel the pulses appear in spikes, as shown in the figure (Kołodzińska et al. 2022).

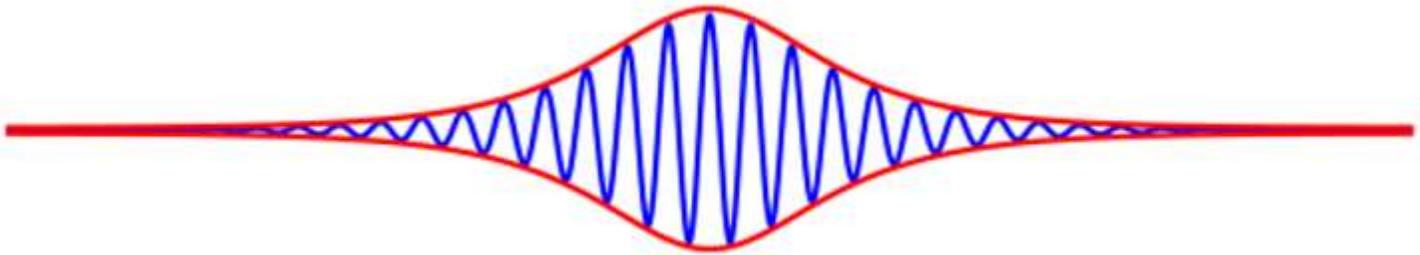


Figure 4: Soliton image for a water wave

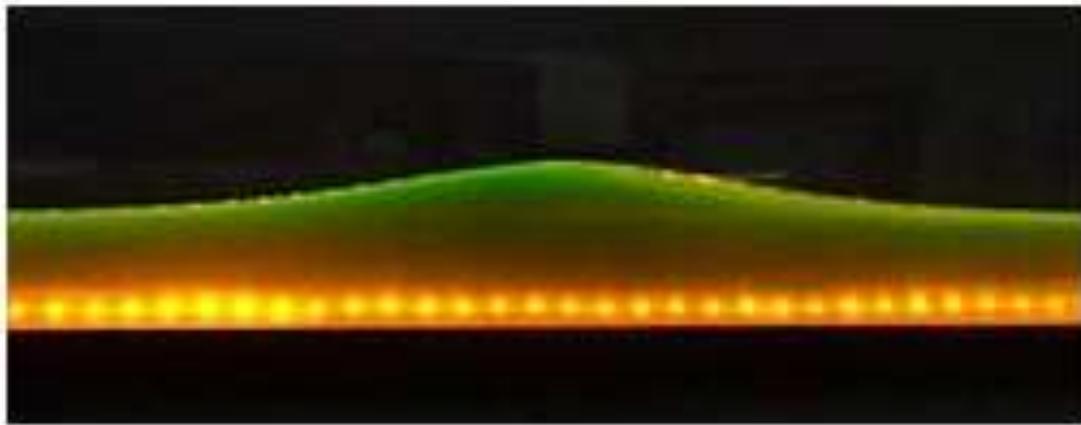
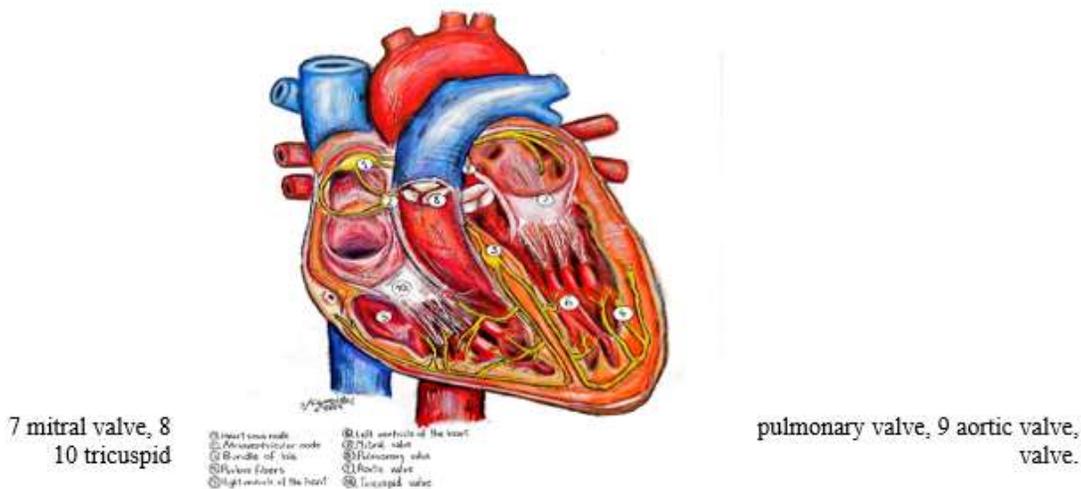


Figure 5: Image of a soliton for an acoustic wave

The heart generates light, water, and acoustic solitons. Without them, the heart's function would be impossible; they provide stability. Light solitons play an important role in the sinoatrial node, while water and acoustic solitons play a dominant role in the opening and closing of valves and in arteries.



The heart valves work by opening and closing during contractions and relaxations, allowing blood to flow from the heart to the lungs and the rest of the body. The valves are composed of connective tissue and are located between the heart chambers and the main vessels. The aortic valve is located

in the left ventricle of the heart, at the aortic orifice. The pulmonary valve is located in the right ventricle, at the pulmonary orifice. The tricuspid valve is located between the right atrium and the right ventricle. The mitral valve is located between the left atrium and the left ventricle. The valves work in

rhythm with the heart's contractions and relaxations, pumping blood and preventing its backflow. During ventricular contraction, the atrioventricular valves close, cutting off the outflow of blood into the arterial trunks. This forces blood into the atria. During diastole, the atrioventricular valves open, allowing blood to flow from the atria. Thanks to this mechanism, blood flows continuously in one direction. Blood flow does not occur automatically—it is driven by heart muscle contractions triggered by electrical impulses. The sinoatrial node, located in the upper part of the right atrium, serves as the pacemaker. It is composed of cells capable of spontaneous discharges. Each discharge initiates a new cardiac cycle. The sinoatrial node is responsible for the rhythmicity of heart muscle contractions (Torrent-Guasp et al. 2004). According to Francisco Torrent-Guasp, the heart has spiral anatomical structure. This arrangement of fibers reduces flow and causes a spiral movement of blood. The spiral shape of the heart is a consequence of the asymmetric structure of fibers in the heart walls (Buckberg 2010). The functional interaction of the right and left ventricles occurs not only due to their serial arrangement but also due to their shared spiral features (Torrent-Guasp 2006). The importance of left ventricular torsional motion during systole was first noted by Stenson in 1664, who observed the helix of left ventricular fibers. Shortly thereafter, Giovanni Alphonso Borelli, a student of Galileo, suggested that left ventricular ejection is associated with torsional deformation, analogous to wringing a wet towel (Torrent-Guasp 1980).

Recent imaging studies have confirmed the presence of left ventricular torsion and have characterized its location, direction, timing, and frequency in different parts of the left ventricular wall; the significance of these findings is still not fully understood. Almost all available *in vivo* data on wall motion in the normal heart refer to the left ventricle, and virtually none to the normal right ventricle. This functional integration of both ventricles requires close interaction, or "interplay," throughout the cardiac cycle, during both systole and diastole. The helical structure of the heart, as well as the helical motion of blood, influence the generation of water solitons. Contraction of the basal loop, and then the descending segment, causes narrowing and shortening of the ventricles, which in turn reduces the volume of the ventricular chambers and leads to an increase in pressure, which causes blood to flow into the arteries and simultaneously activates the generation of solitons (Torrent-Guasp et al. 2005).

4. Treating Diseases with Quantum Medicine

1. Spin waves play an important role in biological systems. The ability to direct a spin wave will allow us to better understand the etiology of disease and its treatment.
2. In living organisms, a spin wave closely interacts with a soliton wave, which has encoded programs for proper cell function and maintaining homeostasis. The soliton wave acts as a barrier to limit the intensity of the spin wave, which determines health and disease in a biological system.
3. The ability to direct the electric field resulting from piezoelectricity, pyroelectricity, and ferroelectricity will allow us to influence the proper functioning of electrostasis, which determines the functioning of a biological cell, tissue, organ, and the entire biological system.
4. A quantum-information vaccine for treatment will not be similar to traditional vaccines. It will not introduce a chemical substance into our body, but rather, it will introduce information that will produce antibodies to fight infectious diseases. This is possible thanks to the control of quantum-information processes; using electromagnetic,

soliton, spin, and acoustic waves, electric and magnetic fields, and bioplasma (Adamski 2021).

5. In medicine, it is assumed that enzymes are chemical biocatalysts, and in bioelectronics, they are transistors and nanoprocessors, which are components of biocomputers. In the near future, chemical laboratories will disappear, replaced by computer science institutes that will develop algorithms, i.e., computer programs that will be embedded in the enzymatic system necessary to treat a specific disease. Enzymes absorb the energy of electric fields to work and communicate. In schizophrenics, a significant enzyme depletion is observed in the biological membranes of nerve cells. A similar situation occurs in depression, where the main enzymatic neurotransmitters are depleted (Drożak, Kozłowski 2006).

6. Building empirical evidence for the creation of artificial consciousness.

7. A characteristic feature of melanocyte-like cells is that they are located in areas that are the source of abnormal electrical activity. These cells are excitable and electrically coupled with neighboring myocytes. They act as a buffer for calcium and reactive oxygen species (ROS), affecting heart rhythm. When they lack the dopaminergic enzyme melanin tautomerase, they produce more ROS, leading to oxidative stress. Melanin directs the reduction of free radicals in the human biological system and also has the ability to accelerate and retard the movement of photons, phonons, solitons, and their spins, which is used in the creation of information language (Adamski, Sławiński 2011), (Bartosz 2003). Melanins exhibit selective susceptibility to phonons; this means that cells containing melanin are selectively sensitive to acoustic waves. (Sarna, Swartz, 1998). Melanin can act as a photon-to-phonon converter and the reverse process (McGinnes J., Corry P. 1977). The conversion of phonons into photons in a cell can affect Bose-Einstein condensation, in which case the bosons will emit polarized (laser) light. Coherent laser light will be responsible for the creation and control of solitons. Melanins exhibit paramagnetic properties (Schultz et al. 1987, p. 45).

Melanin has a significant impact on the development and density of electrostatic matter. It is capable of splitting water molecules into oxygen and hydrogen, acting similarly to chlorophyll in plants. As a semiconductor, melanin has the ability to conduct photochemical reactions under the influence of light and helps neutralize reactive oxygen species (ROS). It has a significant impact on the functioning of spins in oxygen molecules, as it is a natural polymer with paramagnetic properties (containing unpaired electrons) and acts as an active antioxidant. This means that oxygen molecules surrounding melanin alter the parameters of free radicals, which determine the quality of the spin wave, essential for heart function.

The era of quantum medicine is approaching – were enzymes, as transistors, will be the basic medicine in the treatment of various diseases. The second medicine is the ability to build biocomputer algorithms, which will constitute the basic source for treating biological systems. Biocomputers should not be underestimated, and the laws of quantum computing should be applied to further research. Computer science shows that phenomena such as wave function interference, quantum parallelism, superposition of states, quantum entanglement, and coherence can be used for computational purposes in quantum computers (Nielsen and Chuang 2000).

Spintronics demonstrates that, instead of the level of electric current or light intensity, information can be transmitted by the direction of spin (left or right). The properties of spin can be used not only to store information but

also to process and transmit it. Spin synchronization results in memory storage (Barnas 2012).

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