L e c t u r e

The biocrystalloid structure of man: an extracellular theory

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Abstract. Medical science based solely on the postulates of the cellular theory does not describe the structure and functions of biological organisms in full or meet the needs of modern medicine. Biological organisms, man included, can be regarded as biocrystalloids that are composites of crystals and paracrystalline media at the level of the whole organism and individual cells alike. The core component of biocrystalloids is represented by extracellular components of the connective tissue. The paper describes major features of biocrystalloids and highlights their similarity to mineral organisms in which a growing or weathering crystal also regulates the flows of the paracrystalline medium. The paper concludes that further research into the force fields of a biocrystalloid will allow developing new diagnostic and treatment modalities. (www.actabiomedica.it)

Key words: Biocrystalloid, mineral organism, homology, self-organization, acupuncture, nomogenesis

Introduction

The search for new technologies in the diagnostics, prevention and treatment of various diseases is largely spontaneous and heavily relies on slowly gained empirical data. This is due to the lack of a valid theoretical foundation that would support a truly targeted development of novel technologies. Indeed, man so far has been considered within the framework of the cellular theory. Its core postulate is that man consists of cells that are minimal living entities. The study of cells and attempts to modify cellular processes are the essence of modern medicine. The cellular theory turned out to be very productive and gave medicine an impetus for an active and sustained development over a long period of time. Further research into the cell may bring additional benefits to medicine. Nevertheless the science of medicine based solely on the cellular theory cannot describe the human organism or processes that occur in it in full.

Historical background

It is well known that the human organism is built not only of cells but also of non-cellular materials that come from various tissues and from the outside. These materials are not passive and dynamically interact with the cells.

During embryogenesis mesenchyme becomes a tissue-like structure before the anlage of the other organs. It induces the formation of numerous structures, in the first place of connective tissue. Mesenchymal cells are surrounded by matrix. Its composition that can be different at different sites of the embryo determines further specialization of mesenchymal cells in various tissues. The connective tissue with an abundance of structured elements in it accounts for a bigger part of the human body mass. It has bearing, protective, plastic and morphogenetic functions (1). Non-cellular components of the connective tissue are the basis of the biocrystalloid and have an organism-forming function. The connective tissue consists mainly of fibrous elements of crystalloid structure and a primitive amorphous substance that serves as a metabolic medium with an integrative and buffer function.

Traditional embryology describes mainly the development and movement of cells during the embryo development though there are data (2, 3) showing that various forms of collagen, mucopolysaccharides and proteoglycans are the most important factors in the induction process. Non-cellular materials are more important than cells as they are the basis of the biocrystalloid of the human organism and have the organism-forming function. Cells will develop in the human organism where the non-cellular medium provides necessary morphogenetic conditions for their development and similar cells will develop differently at different locations because the non-cellular medium will be different there. Cells and non-cellular materials are in a constant interaction. A series of new non-cellular structures is formed consecutively during embryogenesis and all of them modify the development of cells. The basic component of the extracellular matrix is collagen. This fibrous protein is a major building block of basal plates. Mucopolysaccharides, another important component of the matrix, are polymers consisting of different numbers of simpler compounds such as chondroitin and chondroitin sulphate, hyaluronate, dermatan sulphate, keratan sulphate and heparan sulphate in various combinations. They can bind to proteins to produce proteoglycans. At an early stage of embryogenesis, actually all the cells are in a close contact with extracellular matrix of a certain type and it is natural to assume that some of its properties play a role in the initiation, stabilization or modification of morphogenesis and cell differentiation in the germ (4). Many epithelia have been shown to secrete their own basal plates. These and mucopolysaccharides seem to be associated with both intracellular and cellular factors that play a role in the formation of bulges along the central groove that ultimately fuse to form the neural tube. The cells of the neural tube and chorda are shown to secrete collagen and glycosaminoglycans. At this stage, somites have an epithelium-like structure and a basal plate surrounds each of them. It becomes evident then that the extracellular matrix somehow mediates the impact of the chorda on the neural tube and somites (4).

It should be noted that non-cellular components of the connective tissue are not passive auxiliary elements, they rather are in a constant interaction with the cells of the connective and other tissues producing a crystallochemical effect on them and regulating proliferation and differentiation of cells of various tissues.

Minerals and polypeptides capable of aggregation, self-organization and catalysis played an important part in the pre-biological developments and organization of primitive cells. There are numerous data on the catalytic effect and pre-biological role of mineral substrates (5-9). Ions of mineral iron, copper and chromium have been shown to influence by induction the biosynthesis of fibre (1). Cells most likely evolved from certain mineral structures and mineral polypeptides capable of aggregation, self-organization and catalysis. At the level of a multicellular organism these structures influence by induction the development of both individual cells and of the organism as a whole. These structures play a similar role in modern biological organisms by virtue of conservatism inherent to biological systems (10).

Attempts to draw an analogy between living organisms and crystals have been made since long. Buffon found a similarity between the growth of crystals and living bodies back in the 18^{th} century. Schleiden in his fundamental work regarded the vegetative cell as a structural unit in which the membrane is the most important component that imparts a particular form of a crystal to the cell. This line of thinking in biology was boosted after Haeckel had proposed the concept of living matter crystallization (11).

In 1904, Koltsov (12) was the first to postulate a theory based on the idea that the cell and its components are a complex colloidal system consisting of fine crystals rather than of amorphous particles. The author noted that more or less orderly oriented elongated crystalline particles form the basis of the cell structure and that the chromosome is a molecule or a micellar bundle of molecules that grows like a crystal. Regarding the cell as an integral structure, he described electromagnetic interactions inside the cell as well as the mechanism of chemical reactions through the prism of the cell crystalline structure. The author however made no attempt to extrapolate this approach onto the whole organism to regard it as a particular form of crystal or crystalloid and analyze how its field influences its own form and structure. The gap was filled by A. Ermolenko, one of the authors of this paper (13, 14). Vitamineralogy, a new science that considers minerals (crystals) as organisms with their phylo- and ontogenesis, genetic codes and evolution, has been intensively developing of late. This science finds similarities in the origin and development of mineral and biological worlds, studies biomineral interactions and conducts comparative analysis of biological and mineral systems.

A group of scientists from the Syktyvkar School of the Komi Geology Institute (of the Urals Department of the Russian Academy of Sciences) found similarities in the structure and functions of mineral and biological systems in their attempt to prove the existence of biological and mineral homologies at morphological, functional, ontogenetic, phylogenetic and paragenetic levels. A crystal is not a living entity, but it is not dead either as it can grow and develop under certain conditions. An attempt to compare the growth layer of a crystal taken together with the crystal-forming medium to biological organisms may bring to light numerous similarities between the two.

In this comparison a mineral object should be considered with the emphasis on the active near-the-surface part of the crystal and the crystal-forming medium around it as the latter controls the crystal growth and adapts to the changing structure of the growing crystal. The structure of concentration flows is reflective of crystal nutrition and elimination of wastes. Crystallographic analysis of biological and non-biological minerals does not show any basic differences between the two, which is indicative of common crystallization process in them (15). The boundary zone of a crystal is an integral component of the growing crystal-medium system and is in itself an integrated system consisting of concentration, thermal and dynamic layers. The boundary zone "is not just an area of physical and chemical regulation but also a kind of membrane filter sorting crystal-forming particles on their way to the crystal. It is in this zone that metabolic processes take place and concentration waves and flows are formed with a resulting stratification of the solution". The growing layer of a crystal together with the boundary layer of the mineral-forming medium where concentration flows of crystallogenetic stratification are in action is characterized by the most important feature of biological matter - an ability to extract, transform and utilize energy from outside. It is probable that additionally to maintaining it can also build up by inertia its energy reserve. It is here that self-regulation processes take place to prevent the disintegration of the whole structure and maintain the stability of the organism. This is indeed a living mineral organism (15).

R.J. Haüy studied the effect of pressure on the electrical properties of crystals (tourmaline). Other numerous authors have studied the effect as well. The piezo effect discovered has found a wide range of practical applications. Electromagnetic fields are empirically used in medicine. However there are no consistent studies of the electromagnetic properties of the organism and the interaction of cellular and extracellular energy has not been yet described. There are no general concepts of the organism as an energy system with certain inherent properties and processes. Yu I. Afanasyev (1) believes that bone tissue possesses a piezoelectric effect. A mechanical pressure on bone will change the potential on the bone plate – a negative potential will increase at the impression site and this will activate the growth of osteoblasts while a positive potential will increase at the bulging site and activate the growth of osteoclasts. This property of bone is a vivid proof of similarity of biological and mineral crystals.

The above shows there is a slowly increasing awareness in biology and medicine that some general laws underlying the development of biological bodies are similar to the laws of crystallography. Mineralogists and crystallographers alike see many similarities in the development of minerals and biological organisms. Mineralogists however would more readily admit that a crystal is a particular organism with its specific onto- and phylogenesis, genetic code and evolution. And it is much more difficult to agree that biological objects, the human organism in particular, are crystals or crystal-like objects.

Based on embryonic anatomy information widely published in medical textbooks and scientific literature and data from mineralogy and crystallography data, the author of this work has put forward a hypothesis that biological organisms, including man, have a crystalloid structure with inherent to crystalloids symmetry while segmentation and aggregation of primary organisms most likely took place in the pre-biological period.

The human organism as a biocrystalloid

The new concept can be briefly described as follows:

1. The human organism is a biocrystalloid the core of which is non-cellular connective tissue components that function as an organism-forming material. It is these components that form the primary basis of the organism while cells are secondary and play an auxiliary part. At a pre-cell stage, the mineral structure functioned as a matrix for biological process. In more advanced organisms, the part of the great organizer is played by a non-cellular chorda, the major inductor of morphogenetic processes in all the chordates, including man. Extracellular components and cells are in a dynamic equilibrium interaction.
2. A biocrystalloid is a spatially contained dynamic biological object or its component with an inherent orderly structure and ability to self-organization and internal coordinated growth. It develops under the impact of forces the nature of which is determined by the composition of the object or its components. A biocrystalloid should be regarded as a composite of a crystal and paracrystalline medium at the level of both the whole organism and an individual cell. At the level of the whole organism or its organs, non-cellular components of the connective tissue will be a crystal while the tissue fluid around it will be a paracrystalline medium. At the level of cells, organelles (mitochondria, Golgi complex, lysosomas and others) function as a crystal while the hyaloplasm aqueous content with compounds dissolved in it function as a paracrystalline medium. In the nucleus, the crystal is represented by the chromosomes, nucleolus and other elements while the solution of the karyoplasm is a paracrystalline medium. Crystals of biological organisms are mobile living entities.
3. A biocrystalloid has a structure comparable to that of a mineral organism where a growing or degrading crystal (depending on the functional load) controls the flows of the paracrystalline medium.
4. The composition of a biocrystalloid determines its structure, symmetry and function, the latter in turn influences the object composition, form, structure and symmetry.
5. The object composition is heterogeneous, therefore the interaction of forces of its components creates certain symmetry that is different from the symmetry of the object components having a different combination in interacting forces.
6. The environment can modify the form and composition of the object, which in turn can bring about a change in the object structure.
7. A biocrystalloid has a heterogeneous morphogenetic field. Attenuation of this field will disrupt internal biochemistry and lead to diseases and aging of the organism.
8. Relative disposition of the body parts is not haphazard but is determined primarily by the morphogenetic fields of the biocrystalloid that are in their turn dependent on the biocrystalloid composition and structure.

Conclusion

In the light of the proposed concept, biologically active points used in reflex therapy or acupuncture function as receptors of the biocrystalloid morphogenetic fields. Identification of new points and zones in the human body and interpretation of acupuncture principles can be based on science rather than mythical energies Yang and Yin of the Chinese philosophy.

A greater contribution of physicists and crystallographers into biology and a wider acceptance of the concept of man as a biocrystalloid the basis of which is represented by the connective tissue non-cellular components capable of organizing the work of cells will allow to find the homology in the development of primary organisms.

This concept will give a new lease of life to some postulates of the theory put forward by J.B. Lamarck and further developed by L.S. Berg who regarded biological evolution as nomogenesis since in our view *internal purposefulness*, as Lamarck put it, can be equalled to the ability of biocrystalloids to self-organization. Further research into the physical properties of morphogenetic fields and development of adequate registering instruments, the use of substances that can modify the intensity of such fields will definitely help to bring medicine to a qualitatively higher level.

References

1. Afanasyev YI. Histology, cytology, embryology. Moscow; Medgiz, 2001.
2. Hay ED. Origin and role of collagen in the embryo. *Am Zool* 1973; 13: 1085-107.
3. Holtzer H, Mayne R. Experimental morphogenesis: The induction of somatic chondrogenesis by embryonic spinal cord and notochord. *Pathobiol Dev* 1973; 1: 52-64.
4. Carlson BM. Patten's foundations of embryology, vol 1. Moscow; Mir Publ, 1983: 225-30.
5. Cairns-Smith AG. Genetic take-over and the mineral origins of life. New York; Cambridge University Press, 1982.
6. Cuccovia IM, Quina FH, Chaimovich H. A remarkable enhancement of the rate of ester thiolysis by synthetic amphiphile vesicles. *Tetrahedron* 1982; 38: 917-20.
7. Ferris JP, Hill AR, Liu R, Orgel LE. Synthesis of long prebiotic oligomers on mineral surfaces. *Nature* 1966; 381: 59-61.
8. Luisi PL, Walde P, Oberholzer T. Lipid vesicles as possible intermediates in the origin of life. Current opinions in colloid interface. *Science* 1999; 4: 33-9.
9. Segre D, Ben-Eli D, Deamer DW, Lancet D. The lipid world. *Origins Life Evol Biosphere* 2001; 31: 119-45.
10. Galimov EM. The phenomen of life. Between equilibrium and non-linearity, Origin and Principles of Evolution. Moscow; URSS, 2000.
11. Haeckel E. Generalle Morphologie der Organismen. Berlin, Verlag von Georg Reimer, 1886.
12. Koltstov NK. The cell structure. Moscow; Biomedgiz, 1936: 461-73.
13. Ermolenko AE. The general plan of human structural organization. Moscow; Bibliographical Index of VINITY "Deposited Scientific Works", Deposited at VINITI N. 3105 B-96, 1996.
14. Ermolenko AE: Two-plane symmetry in the structural organization of man. *Medical Hypotheses* 2005; 64: 209-14.
15. Yushkin NP. Biomineral interactions. Moscow; Nauka Pub, 2002.

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