

Golden law of development of living organisms

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The development of forms and electromagnetic interactions of atomic and molecular structures obey the universal laws of dialectics. The mechanism of action of quanta of electromagnetic energy is a manifestation of the law of the unity and struggle of opposites and its simplest and universal mathematical expression is the formula of the golden division. The paper presents a geometric model of isoenergy transformation of the structure of a micro and macro-object obeying the golden proportion. Changes in linear and volumetric forms of living organisms obey the golden section.

Keywords: golden section, atomic-molecular structure, isoenergy transformation, electromagnetic vortex.

The law of the golden division should be dialectical necessity A.F. Losev [1].

The simplest mathematical formula for the golden section is the division of a segment in relation to:

$$1/X = X/(1-X) \quad (1)$$

The positive root of equation (1) is:

$$\beta = (-1 + \sqrt{5})/2 = 0.6180339... \quad (2)$$

Various combinations of the number β are also referred to the golden section. In particular, the inverse $1/\beta = \alpha = 1.6180339...$ is called the base of the golden ratio.

From the equilateral pentagon and pentagram the expressions of the golden section through the trigonometric functions and angles are multiples of 36° ($\pi/5$), 108° ($3\pi/5$): $\cos 36^\circ = \alpha/2$; $\cos 108^\circ = -\alpha/2$. Pentagonal symmetry is often found in wildlife. For example, in cross section the double helix of DNA is a regular pentagon, and the ideal proportions of a human figure satisfy the geometry of a pentagram. With the growth of living organisms, its individual parts can make spiral movements, as evidenced, for example, by various climbing plants, spiral shells and animal horns. The snail of the human ear, for example, consists of three curls, the lengths of which correspond to the golden section ($1 : \beta : \beta^2$) [2]. Spirals are described by a logarithmic function (Archimedes spiral). Increasing its pitch is always uniform, and its proportions are subject to the principle of the golden section.

Changing the form of any developing system is possible if there is free energy inside it and an informational mechanism or law regulating the action of energy within the framework of the laws of dialectics [3]. For a living organism, the role of free energy is played by the rotational energy of electrons of the ATP molecule, which is converted into the translational energy of quasiphotons [4] in metabolic reactions. The program encoded on the structure of its genome is responsible for the anatomical development of a living organism. In the case of a person, it is necessary to add to this program the possibility of his conscious choice of the direction of spending his psychophysical energy.

To start any chemical reaction, it is necessary to bring together the reacting elements (particles, nuclei, atoms, molecules) at distances comparable to the size of the elements themselves. At such distances between reagents, repulsive forces arise that are electromagnetic in nature. The work of these forces determines the magnitude of the reaction energy barrier, and the energy required to overcome it is called the reaction activation energy. The actions of these forces in the course of the reaction are presented as an exchange of electromagnetic energy quanta between the reagents - virtual photons. In the case of molecules, photons responsible for interactions are emitted and absorbed by the electron system of the molecule, called electron clouds or orbitals. When a photon is emitted, the cloud geometry changes. These changes in the electron system of the molecule can be illustrated by “dancing” the flames of the fire in the wind.

In living organisms, all important reactions occur through the mediation of large molecules - enzymes. The main purpose of the enzyme is to reduce to almost zero the barrier of a chemical reaction. Therefore, during such reactions, isoenergetic rearrangements of the chemical structure of the reacting molecule occur.

Equation (1) in view of (2) can be represented as:

$$1 \times 1 = \beta \times (\beta + 1) \quad (3)$$

and give it the following geometric and energetic interpretation. The square of a unit area is transformed into a rectangle with sides β and $(\beta + 1)$ (Figure 1). In the next step, a square with side β^2 is transformed into a rectangle with sides β^2 and $(\beta + \beta^2)$ and so on. As a result of n -transformations, a stepped figure of rectangles with sides $(\beta \times 1)$, $(\beta^2 \times \beta)$, $(\beta^3 \times \beta^2)$... $(\beta^{n+1} \times \beta^n)$ is obtained, the total area of which for any n is equal to the area of the original square. We will call this model a golden transformation and involve it in explaining the mechanism of the development

of structures whose energy state is mainly determined by their surface (water and soap bubbles, drops; membranes and flat cells, neuroglia, neurons, leaves of plants).

The golden transformation of such structures will formally refer to isoenergy rearrangements for which the reaction barrier is zero. When this condition is fulfilled, the probability of a reaction will increase substantially, which will predetermine the choice of a path for changing shape.

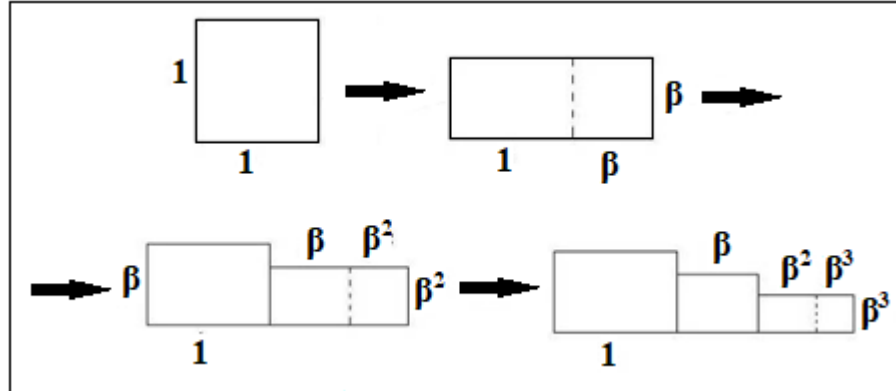


Figure 1. Diagram of the isometric transformation of a square into a multi-stage rectangle with the golden proportion.

In the framework of quantum mechanics, the isoenergy restructuring of the metric of the energy form can be represented by the equation [3]:

$$hC/r = NhC/R, \quad (4)$$

where h is the Planck constant or quantum of action, equal to $6.62 \cdot 10^{-34}$ J s, C is the speed of light, equal to $3 \cdot 10^8$ m/s; and $Nr = R$ are the characteristic parameters of the structure before and after the restructuring. These parameters can be correlated with the parameters of the structure of the electromagnetic vortex (Figure 2) [4]. Relation (4), in principle, is suitable for describing electromagnetic interaction through virtual photons or electromagnetic vortices.

The laws of motion of vortices in continuous media (ether, gas, liquid) are the same: *A closed vortex is a carrier of force. With his help, the impulse of force spreads in a continuous liquid medium. The vortex ring with its atmosphere moves in a continuous liquid medium as an independent liquid body and carries in itself the whole force of the impulse that generated it* [5].

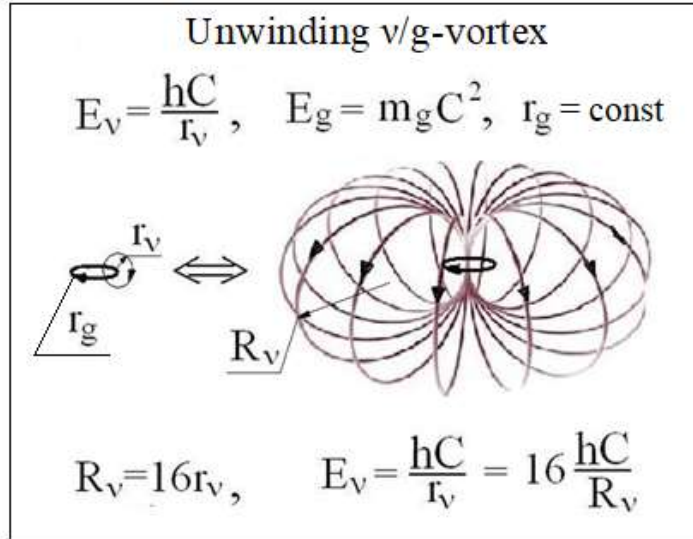


Figure 2. Isoenergy unwinding (action) of the electromagnetic v/g-vortex. E_v is the electric or translational energy, E_g is the magnetic or rotational energy of the vortex; r_v , R_v is the radius characterizing the translational step of the vortex and the radius of action of electric energy.

The formula of the golden ratio (3) will be fulfilled for linear and volumetric options for changing the shape of a living object. The steric angle of the tetrahedral hydrogen bond of liquid water, as well as carbon atoms, silicon, phosphorus in organic and biological molecules corresponds to the sp^3 -hybridization of electronic orbitals and is 109° , which is close to the value of the “golden” angle of 108° . These data allow us to consider the mechanism of gold transformation as a universal mechanism for the development of not only flat but also bulk organic and bio-organic objects. An example of such transformations can be the rearrangement and growth of microscopic objects such as biomolecules, axon microspike (Figure 3), organic and inorganic crystals, as well as macroscopic formations - the cochlea, lungs; tree leaves (Figure 4).

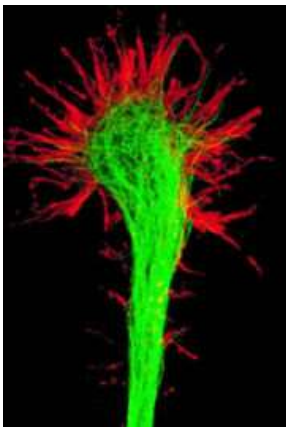


Figure 3. Neuron axon growth cone (green). Red "tongues" - growing microspike [6].

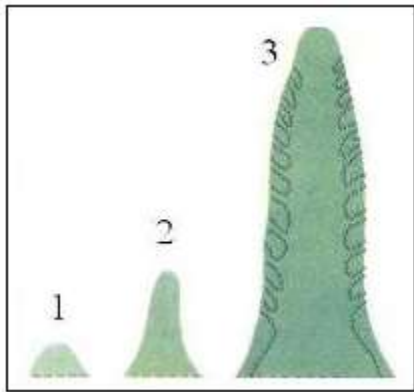


Figure 4. Three initial phases of leaf development [7].

In addition, the mechanism of the gold transformation can exfoliate spiral vortices in the turbulence zone from a linear (laminar) flow of a continuous medium (water, gas, physiological fluids) in response to an external disturbance orthogonal to the flow vector.

Since the order and development of the real world at the atomic-molecular level is determined by the laws of electromagnetism, the universal transformation of gold transformation revealed in this work indicates that the principle of motion of elementary electromagnetic vortices, whose dynamics underlies the physics of the brain [4] and the mechanism of thinking, is subordinated to the golden relation: *The fundamental dynamic idea of matter, which, thanks to its movement, is capable of becoming a reservoir of momentum and energy, is so intertwined with our forms of thinking* [8].

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