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The principle of substance stability is the driving force of evolution

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ABSTRACT

The principle of substance stability describes the thermodynamic interactions between hierarchical structures in chemistry and biology. The note contains links of author's recent survey studies published online.

Keywords: thermodynamics, hierarchical thermodynamics, principle of substance stability, the origin of life, evolution, aging, thermodynamic theory of aging, Darwinism, thermodynamic dietetics

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The principle of substance stability is used in hierarchical thermodynamics, created on the basis of the extended theory of JW Gibbs [1]. Hierarchical thermodynamics is applicable to dynamic hierarchical natural systems close to equilibrium.

The principle of substance stability or the principle of feedback in hierarchical thermodynamics describes the thermodynamic relationships between all adjacent hierarchies of organized matter. For the first time, the principle was formulated and used by Gladyshev in 1977 to explain the enrichment of energy-intensive chemical substances by living beings in the course of biological evolution [2 - 4]. In the future, the principle of substance stability was extended to all hierarchies of living matter and began to be regarded as the driving force of evolution. The principle was named the principle of Georgi Gladyshev. One of the known formulations of the principle can be represented in the form [5]: during the formation (self-assembly) of the most thermodynamically stable structures at the highest hierarchical level (j), e.g., the supramolecular level, in accordance with the second law, Nature spontaneously uses predominantly the (available for the given local part of the biological system) least thermodynamically stable structures belonging to a lower level, for example, the molecular level (j-1).

In other words, the principle of substance stability asserts that each hierarchical structure of the biologic world evolves in the search for a minimum of the specific Gibbs free energy of its formation. In this case, enrichment of the said structure by the energy-intensive substance of the adjacent lower structure is observed. The desire to minimize this parameter is observed against the background of non-spontaneous processes initiated by the environment [6-8].

The principle allowed to explain many facts and to make a series of predictions.

From the position of thermodynamics, the principle of substance stability explains the origin of life, its evolution and the aging of living beings. Hierarchical thermodynamics, including the principle of substance stability, is the foundation of extended Darwinism. Known facts and phenomena considered from the position of principle are presented in monographs [3-4], review articles [6-14] and encyclopedias [15-17].

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