

Symmetry of STRUCTURE

an interdisciplinary Symposium

Abstracts

I.



Edited by Gy. Darvas and D. Nagy

Buda
Budapest

August 13-19, 1989

Hungary

SYMMETRY, HIERARCHY AND EVOLUTION OF STRUCTURES

The role of symmetry in natural science as the fundamental principle of preservation and change is broadly investigated in scientific knowledge. But the role of symmetry as an element of the process of the development of natural systems' structure was less exposed. That is conditioned by specially scientific expression of symmetry based on complicated mathematic apparatus and also by the lack of investigations of correlation of the notion of symmetry with general scientific and universal categories. The solution of the problem appeared to be connected with revealing of general principles of the development of hierarchy systems. For the purpose of solution of the problem mentioned the author created a hypothetic - deductive conception, the notional apparatus of which is represented by the pithy expressed axioms /non-formalized owing to the common character of assertions/ and by partly and sufficiently formalized corollaries, deduced from the former. The object of analysis of the conception comes to be a multilevel structure of an abstract level of organization, based on the assertions of axioms and corollaries, regarded as a model of the development of hierarchy systems. The basis of formalization of the process of development is a possibility of mathematic description of the spatial structure of abstract level of organization/ALQ/. The system of notions of the conception of hierarchy, being a hierarchy system by itself, looks like the following:

1. Non-formalized axioms, expressing fundamental tenets of hierarchy as a teaching of the development of multilevel structu-

2. Partially formalized corollaries - notional apparatus of the conception.
3. Sufficiently formalized corollaries, describing topologically expressed structure of ALO on the ground of the algorithm, worked out by the author, connected with coefficients of Binomial theorem and the numbers of Fibonacci.

Proceeding from the material stated, symmetry may be considered as a notion of different levels of community:

1. Non-formalized notion, corresponding to the philosophical category of identity.
2. Partially formalized notion of correlation of identity and difference in the structure of ALO. We understand formalization as arithmetical rules of unification /addition/ and division /subtraction/, bringing to correspondence different number of levels to definite relations of identity and difference /stability and unsteadiness/.
3. Sufficiently formalized notions of symmetry, including mathematical apparatus of high level.

In the same aspect one considers a different degree of community of violation of symmetry /asymmetry/, which also appears to be a generalized notion.

The main conclusions of the conception of hierarchy are the following: The process of the development of hierarchy systems is connected with acceleration of the development by itself on the levels of higher organization. The mechanism of this phenomenon, which is an antithesis to the second law of thermodynamics, is considered to be connected with growing unsteadiness. The latter in its turn appears to be conditioned by the growth of violation of symmetry in the structure of ALO. In the conception of hierar-

chy, to overcome this contradiction, there is postulated an idea of compensation of the growing unsteadiness /asimmetry/ by means of acceleration of the process of development in evolutioning systems. That process is also accompanied by the development of homogeneous /identical by main parametres/ subsystems and by sharp spatial expansion of the structure of a newly arising system.

Corroboration of a number of theses of the conception of hierarchy is connected with empiric foundation of its hypothetic-deductive theses. The content of axioms is confirmed on the basis of empiric substantiation of sufficiently formalized corollaries, which are deduced from partially formalized corollaries. The assertions of the latter in their turn are deduced from non-formalized assertions of axioms of the conception, which expose the dependence of completeness of description of a system on the level of its organization /number of levels of system considered/.

As a corroboration of the main assertions of the conception there comes out the revealing of expressed in numbers constants of breach of symmetry in the structure of objects, different by their nature.

As constants of breach of symmetry in the structure of ALO there considered invariable for different levels numerical ratios $1, 2, 1/3, 2/3$ and the used ratios - $1, 2, 3, 3/2$, underlying in the basis of the algorithm describing the evolution of multilevel systems' structures.

Even at present stage of investigations it appeared to be possible to express, on the grounds of the algorithm suggested by the author, the elements of symmetry of crystals, the struc-

ture of the Platonic bodies, of DNA, of a certain number of amino acids, coordinative numbers arising while isomorphism in minerals and so on.

On the grounds of investigation of objects of physics, chemistry, crystallography, and biology it was shown that:

1. The main theses of hierarchy find their expression in the structures of real and ideal systems of inanimate and animate nature.
2. Notional-categoric apparatus of conception, including formal methods as well, may be used for the exposure of the regularities of systematic - symmetrical evolution of objects of nature and nature itself.