

## Some Characteristics of the Multiindividual Level of System Organization

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**Abstract.** *Some characteristics of the multiindividual level of systemic organization and of its systemic units are presented, which support and perpetuate the life of the systems at this level and of the systems at other organizational levels of the hierarchy of living systems.*

**Keywords:** hierarchy of living systems, multiindividual level of systemic organization, characteristics.

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### 1. Introduction

In the last 50 years, much has been discussed about of the levels of organization of the living world, about the living systems that are on these levels and about their hierarchy.

An unity of conceptions has not been reached yet. However, it is recognized that each level has its own specificity through the structures and functions of living systems and of the mixed living-nonliving systems that are formed at that level. However, few references are made to this specific [2,8,11,12].

This is also the case of the multiindividual level of organization<sup>1</sup>, that is of that level which lies between the individual levels and the multicenotic levels spatial, from the hierarchy of living systems.

Since there is still no unified conception regarding the number of levels of life organization, nor of the systems found at each level, we shall refer to the hierarchy of living systems proposed in previous works [3,7]. From our point of view, the systemic hierarchy of the living world has 8 levels of organization.

<sup>1</sup> The terms „multiindividual” and „multicenotic” are used because they concretely show the nature of the systems that these levels contain.

-Three individual levels: the first is that of prokariotic unicellular organisms. The second is that of eukariotic unicellular organisms, and the third is that of pluricellular organisms;

-One multiindividual level, with three living systemic units : that of population, that of species and that of biocenose, but also a mixed living-nonliving systems – the ecosystem – formed by biocenose and biotope (abiotic environment of the biocenose);

Four levels with spatial multicenotic systems – biolandscape, bioregion, biozone and biosphere, formed by complexes of biocenoses which are functioning in mixed systems living-nonliving: the landscape, the region, geographic zone and the ecosphere.

At each level, new living systems with characteristic structures and functions emerge from the systems of lower levels, all these contributing in some way to the existence and perpetuation of life at planetary level.

Some characteristics of the multiindividual level of system organization

The level of multiindividual organization is the level at which population, species, biocenose arise, all of these being made up of individual organisms from lower systemic levels. These multi-individual systemic units are new forms of life in which organisms are integrated into new structures and which function in life-supporting and life-perpetuating processes.

The multi-individual level arose and developed from two vital needs :

- to avoid the risk of total extinction of organisms by producing a greater number of descendants in the reproduction process, which leads to the formation of populations, species and biocenoses;

- to intensify and use more efficiently the energy and matter they take from the abiotic and biotic environment in which they live, through their adaptive ecological functional differentiation of organisms and species and their compulsory integration into biocenoses and ecosystems.

## **2. Some characteristics specific to the multiindividual organizational level**

### **2.1.First characteristic**

At this level, three multiindividual systemic units are formed from organisms, systems from lower individual levels:

- The species, as a genetic system, but also with ecological functions [4,5],  
- Biocenose, as ecological system, but in which genetic processes also take place [6,7,10], and

- Population, as a common subsystem of both systems, with dual ecological and genetic functions.

Although species and populations can be identified and studied separately, they cannot function autonomously because of their different ecological functions.

Some are producers of biomass, other are consumers of biomass, or consumers and decomposers of necromass. That is why species and populations can only exist integrated in biocenoses through their populations, one in each biocenose having their precise place and role in ecosystems.

The main peculiarity of living systems at the level of biocenose is their mass character, which acts as multitudes of organisms. They are not amorphous, but are organized interactively through the relationships that are created between organisms in populations and between them in biocenoses.

## **2.2. The second characteristic**

At this level, contact occurs between organisms, populations, species, biocenoses, as open systems with the abiotic environment that is necessary for them as a place of life, but also as a supplier of energy and matter.

The contact begins through the installation in the first phase, of the populations producing primary biomass and those consuming and decomposing necromass. After that, the populations consuming primary and secondary biomass also appear. In this way, through their structural and functional integration, the biocenose is born at the multi-individual level. Biocenose, together with the biotope in which it exists and with which it constantly interacts, makes up a mixed system, living and non-living – the ecosystem. In ecosystem all vital important processes will take place at this level.

In the biocenose, through the relationships between organisms and populations, a biotic environment will also be born, which, together with the abiotic one, will ensure the integrity, self-regulation and proper function of the ecosystem. Only at this level, individual and multi-individual systems acquire their specific place of life and energetic and material support needful for their existence, function and perpetuation.

## **2.3. The third characteristic**

At this level, in ecosystem, through multiple ecological interrelations within the biocenose and between this and its abiotic environment the process of production and consumption of biomass takes place, as well as that of consuming and decomposition of resulted necromass.

Thus, a flow of energy and a circuit of matter is formed, through which the necessary resources are provided for the support and perpetuation of living systems – both at this level, but also from lower levels and also from higher multicenotic levels.

Biocenose therefore has a special role in supporting and perpetuating the life of all systems in hierarchy of living systems, through its complex ecological activity in the ecosystem, both at the level of multi-individual organization [6],

and through the fact that it is the structural and functional component of all higher multicenotic systems.

#### **2.4. The fourth characteristic**

At this level, the abiotic environment changes in ecosystems through the presence and activity of biocenoses, transforming from ecotope in biotope.

These changes are noticeable, without measurements, even on a small local level. The modifications are all the more significant, as the biocenoses are more structurally developed and more diversified.

In terrestrial ecosystems changes occur in the atmosphere from and above the respective ecosystem, but also in the solid substrate.

In the air, the content of oxygen and that of carbon dioxide change continuously. During the day, the supply of oxygen produced through photosynthesis predominates, but during the nights predominates the supply of carbon dioxide resulted from the respiration of organisms and from necromass decomposition processes. Both temperature, humidity and air movement change. Part of precipitation is retained by the living cover, then evaporate; another part is used in biocenose and returned to the air by evapotranspiration, and the rest infiltrates into the soil or drains on its surface. The light intensity decreases from the surface [upper part] of the biocenose to the ground, when it passes through the living cover that covers the surface of the land. So a specific climate is born, with small amplitudes of variation. At the same time, many biogenic substances are emitted into the air.

In the solid environment, in underlying rocks, pedogenetic processes develop under the influence of the ecoclimate and humic acids resulted from the decomposition of necromass. This way the soil is formed as a component part of the ecosystem, as a reservoir of water and nutrients for the biocenose.

In aquatic ecosystems, the content of oxygen and carbon dioxide constantly changes due to the activity of biocenoses. At the same time, through consumption and recycling, the content of nutrients dissolved in the water changes. As in the terrestrial environment, many biogenic substances are emitted into water. The massive presence of biocenoses, especially in continental and coastal waters actively influences water transparency and light penetration. There is also an alteration of the rocks on the shore and on the bottom of the waters, which, over time, forms deposits of organic and mixed sediments (components of calcareous necromass that mixes with different materials from the water-scarred lithosphere).

The local changes of the abiotic environment, however, take on a large scale at the level of multicenotic organization. Different climates, special hydrological regimes, coverings of different types of soils are formed on land. In the aquatic environment are born areas characterized by certain water qualities, areas with special sediment deposits. This is how the great process of modification of the

abiotic environment on the surface of the Planet takes place and a more favorable environment for life is born for the existence, perpetuation and evolution of life.

### **2.5. The fifth characteristic**

At this level, in the organisms and populations (species) integrated in biocenoses and ecosystems, most of the genetic processes specific to the perpetuation of life at planetary level, both those in the genome of organisms and those in populations (species) take place.

In populations, as multitudes, an important factor of evolution occurs – variability, and in the ecosystem intervenes another factor of evolution, natural selection [1].

### **Conclusions**

At the multi-individual level of systemic organization:

- New living systemic units are born, through the integration of organisms from the lower levels – the population, the species, the biocenose, as multitudes with their own operation laws;

- These units, as open systems, are constituted in abiotic environments that they use and with which mixed living- and non-living systems are formed – ecosystems;

- In ecosystems, through trophic relationships, the process of biomass production and consumption, and necromass consumption and decomposition occurs. This process provides the energy and matter necessary for the existence of all living systems; other ecological processes also arise in ecosystems;

- In ecosystems, through the presence of biocenoses, and as a result of its relations with the abiotic environment, radical local changes occur in this environment;

- These are amplified at the upper spatial levels creating a new environment of life on the surface of Planet;

- In ecosystems, simultaneous with the ecological processes, most of the genetic processes of perpetuation., adaptation and evolution of living systems take place.

Consequently, it can be stated that the multi-individual level of systemic organization has a special role in the hierarchy of living systems, because its systems, the existence of all living systems is ensured, as well as their perpetuation and evolution ....

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