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SYMBIOSIS IS AN ADAPTATION TO THE CONDITIONS OF THE ENVIRONMENT

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In nature, every living organism does not live in isolation. It is surrounded by many other members of the wildlife. And they all interact with each other. In nature, frequent coexistence of two or more species ,in some cases, becomes necessary for both partners. Cohabitation is called a symbiotic relationship of organisms (from the Greek. Symbiosis «living together"), or symbiosis.

In countrial biological literature is rooted interpretation of symbiosis as a mutually beneficial relationship between two or more species. This understanding of the symbiosis has its origin in the works of O. Hertwig (1906), but it is contrary to the primary meaning of the term and in contrast with well-established in the world literature understanding of symbiosis in the broad sense, as all the possible forms of the existence of organisms, regardless of the nature and the consequent consequences for both parties. It is in this interpretation, the term "symbiosis" (in Greek - "living together") was proposed by the German botanist Heinrich Anton de Bary (A. de Barry) in 1879. [1]

Classification of the types of symbiosis based on the assumption, according to which any member of the symbiotic system may have only three types of effects: the benefits, harms or indifference.

Based on the analysis of the "classification of the types of symbiosis" of the American entomologist John Meyer (Annex 1) and the "Classification of biotic interactions of populations of two species" of American ecologist J. Odum (Annex 2), I had a table of "type of symbiosis," which reflects the eight main types of relationships between organisms (Annex 3).

The complex of relationship of symbiosis type contains a variety of transitions - from the relationship more or less neutral (indifferent - clarification for you) to those where both organisms provide mutual existence. D. C. Moszkowski, (1946), VA Dogiel (1947) is a symbiosis understand cohabitation of two types of individuals, in which both partners have direct interaction with the environment, the regulation of the relations with the latest collaborative

effort, co-operations of both organisms. In symbiotic system one partner (or both) impose to some extent on the other (or each other) the problem of regulation of their relationship with the environment. [1] Symbiotes partners thus complement each other, reinforcing the stability of the system to adverse conditions. [4]

As a result, the benefits are not those organisms who has managed to achieve unchallenged dominance in particular area and destroy all competition, and those who have managed to establish a mutually beneficial partnership with them and turn enemies into friends, in other words - to adapt the conditions of existence.

Without collaboration, cooperation, symbiosis can not exist (and the more developed) no living system.

In biology, the need of cooperation and symbiosis is obvious. In order to survive and leave offspring, every living being has to deal with many different problems. Need some way to get out of the environment, the substance, and missing out on their own to synthesize the material at hand, to produce the energy needed to power-intensive chemical and physical processes, you need time to get rid of waste, find the right partners for the exchange of hereditary material, take care of the offspring , protected from predators and so on - and all this in a fluid, is not always a favorable external environment. Requirements for life to each individual organism, not only are many and varied - very often they are also contradictory. It is impossible to optimize a complex system from all the parameters: to achieve excellence in one thing, you have to sacrifice another. Therefore evolution - is the eternal search for a compromise, and it follows the inevitable limitations of any single living creature. The easiest and most effective way to overcome this limitation is a symbiosis which is cooperative "multidisciplinary." [5] The coexistence allows for each of the components of the complex symbiotic reject those biochemical functions that are better partner to work out and focus on what is best obtained from him. [6]

Symbiosis and cooperation are integral aspects of life on the earth since its inception, and in the future, these trends will only intensify.

They were based on the symbiosis of many important aromorphoses. [1] One of the most important events in the development of life, which has significantly changed the structure of the biosphere and opened new possibilities for progressive evolution - is the emergence of eukaryotes. The most important difference from prokaryotic, eukaryotic organisms is much better system of regulation of the genome (in this sense, the emergence of the cell nucleus: an area of active metabolism - cytoplasm - separated from the storage area, reading, replication of genetic information and, most importantly, the regulation of transcription and post-transcriptional modifications of RNA). Because of this flexibility has increased dramatically unicellular organisms, their ability to adapt to changing circumstances without making genetic changes in the genome, ie, remaining "ourselves." It is thanks to adapt, that is, vary depending on the environment, could become multicellular eukaryotes, for in a multicellular organism cells with the same genome, depending on conditions, form a very different both in morphology and function of tissue.

This largest aromorphosis occurred, apparently, at least 2.6 - 2.7 billion years ago, at the turn of the Archean and Proterozoic. Generally accepted that eukaryotes are the result of a symbiosis of several species of prokaryotes (bacteria). Mitochondria are descended from alfaproteobaktery (aerobic eubacteria), plastids - from cyanobacteria, and the main cell - cytoplasm - from some archaea. Currently, discusses many hypotheses and models of eukaryotes. Clearly, the evidence available so far are not sufficient to give preference to any one of the hypotheses or develop a new one that would suit the majority of scientists. [7, 8]

The major functional blocks of the modern biosphere also fully kept on symbiosis and symbiotic complexes - "superorganism."

Thus, the possibility of higher plants - the main producers of organic

matter and oxygen - would be very limited without symbiosis with bacteria which are able to convert atmospheric nitrogen available for plants, and soil fungi (mycorrhiza), without the cooperation of insect and vertebrate pollinators - distributors of seeds.

Among the most important there are the so-called nitrogen-fixing symbioses - cooperation plants with microorganisms capable of transfer nitrogen from the atmosphere or buried in the soil organic matter in the form available to plants (ammonia, NH4 +). The main part of the biosphere in the atmosphere of nitrogen contained in a chemically inert molecular form (N2). Recovery (fixing) of nitrogen requires huge amounts of energy. This can only some bacteria and archaea, which have special enzymes - nitrogenase. Contains a lot of nitrogen in the soil the organic matter, but this nitrogen available to plants because they do not have the digestive enzymes needed to break down this organic matter.

Two components nitrogen-fixing symbiosis - is land plants and bacteria that can fix nitrogen. In the role of the latter can act cyanobacteria, actinobacteria and alfaproteobakterii. Most studied legume symbiosis with nodule bacteria - rhizobia (Group alfaproteobaktery). Rhizobia living in specialized organs (nodules), supply the plant with ammonium in return to get a full range of nutrients, especially carbohydrates, which are formed during photosynthesis. Between the plant and bacterial symbiotic complex in a joint of adaptation components developed efficient and flexible system of mutual coordination and regulation. For example, special enzymes of plants that operate only in the nodules, "care" that the oxygen concentration in the central part of the nodule, where they live rhizobia, as low as possible, because nitrogenase work only under anaerobic (oxygen-free) conditions (and is there really is lower than in the atmosphere, by 5-6 orders of magnitude).

Yield of plants on land, one of the largest in the plant kingdom aromorphoses, also results from the symbiosis. Recently, paleontologists have found that even the earliest land plants, which appeared at the end of the Silurian

period (400 million years ago), living in symbiosis with fungi: they had a real mycorrhiza. These plants are no real roots - instead they were called rhizoids, are unable to absorb any of the soil and is only used for fixing in the ground, and, as it now appears, for symbiosis with soil fungi. Apparently, without this symbiotic, plants were not able to get out on the land.

Mycorrhizal fungal component receives from the host plant carbohydrates (glucose, fructose), and he takes on the role of root hairs (which are mycorrhizal roots often do not develop), and in addition provides the host with nitrogen and phosphorus, which are mushroom extracts, decompos sing soil organic matter. [5]

The amount of features of the structure of the flower and the vital phenomena in its existence is interrelated with certain morphological and physiological characteristics of their pollinators. Flowers "tuned" to the most important in the life of animal instincts foraging and reproduction. To do this, they use the appropriate means to attract, "Optical advertising" - a bright, large whisk, alluring fragrance, "flower food" - the nectar or pollen. To be satisfied, to have to endure pollinators pollen between many plants of the same species. After all, every single flower can offer only a tiny particle of food, so that the insect or animal has to pay a visit to the set of flower crowns to satisfy his hunger. Mimicking the smell of females, some orchids lure males of the same species, eager to mate. Other orchids "invented" even optical signals to attracting males: their flowers seem outwardly male flies some tahini (family Tachinidae) females of the same species. Attempt copulation usually lasts only a brief moment, but this is enough flowers to attach the bags of pollen to the body of the male, who then left them on the stigma of the flower for the same next attempt.

Interdependent evolutionary interaction of flowering plants and insect pollinators - a great example of co-evolution and mutual adaptation in the mutualism. These groups of organisms together tight environmental constraints,

and the evolution of each group depends in part on the evolution of the other. For example: the development of insects especially long sucking proboscis due to the fact that many of the flowers nectar is hidden deep in the corolla tube or spur of the flower from which it can be stretched only so sucking organ. In South America, home to hawk (Cocythius cluentius) with a proboscis, reaching a length of 250 mm, but to this day no known plants with flowers with nectar spur to the appropriate length. This over-extension of the proboscis can guess only prerequisite for the future adaptation and suggest that in the future there will sprayed butterfly flower, which happens to be the twenty-thirty five metres spur length and which also appear within the habitat of this particular butterfly. Then advantage dlinnohobotkovoy butterfly would consist in the fact that this new flower nectar would be reserved for her alone. This imaginary flower would create a new ecological niche. [9]

Herbivorous animals are main consumers of organic matter produced by plants - can not effectively digest plant foods without the help of various symbiotic bacteria and unicellular eukaryotes. Consumption of organic matter produced by plants during photosynthesis - the main "ecological role" of animals in the biosphere, but paradoxically, the animals themselves almost unable to cope with this task. The vast majority of herbivorous animals simply lack the enzymes to break down plant polymers (chief of which is cellulose). Therefore, almost all the animals, herbivores - it is in fact a symbiotic complexes of the host animal and a variety of bacteria, fungi or protozoa (in the latter case, the symbiotic protozoa themselves often have bacterial symbionts). The role of the symbionts can not be reduced to a splitting of plant polymers: they can also be disposed of nitrogenous waste products and host synthesize many substances required the owner, but not found in plant foods. Microbial community that lives in the gut of termites even have the ability to fix nitrogen, allowing these insects to eat inedible things such as chemically pure cellulose.

The most vivid and rich marine life of coral reef ecosystems is impossible

without coral symbiosis with unicellular algae - zooxanthellae. Community of different exotic, archaic and extreme habitats (such as terrestrial and submarine hot springs, the yield of methane and hydrogen sulfide, saline lagoons, groundwater, etc.) are also very often are complex symbiotic systems of microorganisms, which sometimes involved and higher organisms . Symbiosis with autotrophic a great opportunity for many aquatic animals, especially immobile (coelenterates, sponges, sea squirts, some worms and shellfish). Such symbiotic complexes are "super-organism", which combine features of plants and animals. Autotrophs not only supply organic host, the resulting photo-or chemosynthesis, but in some cases, to help him get rid of the end products of nitrogen metabolism (such as uric acid or urea), which serve as a valuable source for symbiotic nitrogen. [5]

Despite all the variety of relationships between organisms, any of the types of symbiosis is essential for adaptation of successful existence and evolution of each of the populations.

One of the partners of the symbiotic complex or both get a chance to win in the struggle for existence. [1]

"Without the symbiosis rates of evolution would be a million times less. Eukaryotic cell itself is the result of a series of successive nuclear-free prokaryotic symbioses. If it does not, the world would still be living only bacteria - in fact in nature and have not appeared multicellular organisms anucleated . They often come close to multicellularity - but could not overcome a limit of the organization, "- writes biologist A.Markov [10]

Thus, the symbiosis is the high road of evolution, without which the progressive development of life on the Earth would be extremely difficult, if possible.

Annex 1

Types of symbiosis by John Mayer

(John R. Meyer, Dept of Entomology, North Caroline State University, USA) [2]

Symbiosis is a close ecological relationship between the individuals of two (or more) different species. Sometimes a symbiotic relationship benefits both species, sometimes one species benefits at the other's expense, and in other cases neither species benefits.

Ecologists use a different term for each type of symbiotic relationship:

Mutualism	- both species benefit
Commensalism	- one species benefits, the other is unaffected
Parasitism	- one species benefits, the other is harmed
Competition	- neither species benefits
Neutralism	- both species are unaffected

The following table illustrates the correct use of these terms in interactions between Species "A" and Species "B".

"+" denotes benefit to the species

"0" denotes no positive or negative effect

"-" denotes an undesirable effect of the interaction.

Species "A"	+	**Parasitism**	**Commensalism**	**Mutualism**
	0		**Neutralism**	**Commensalism**
	-	**Competition**		**Parasitism**
		-	0	+
		Species "B"		

Annex 2

Classification of biotic interactions of populations of two species

(by Y. Odum, 1986) [3]

№	Interaction mode	Types		The general nature of the interaction
		1	2	
1	Neutralism	0	0	Neither population does not affect other
2	Competition, the direct interaction	-	-	Direct mutual suppression of both species
3	Competition, indirect interaction	-	-	Indirect suppression of the deficit of the external resource
4	Amensalizm	-	0	Population 2 suppresses population 1, but it does not feel the negative impact
5	Parasitizm	+	-	Parasite population 1 is one of the smaller size of individuals than the population 2
6	Predation	+	-	Individuals 1 of predator are usually larger than the individual victim 2
7	Commensalism	+	0	Population 1, commensal, benefits from the association; for population 2 ithis union is indifferent
8	Protocooperation	+	+	Interaction is favorable for both species, but not necessarily
9	Mutualism	+	+	Interaction is favorable for both species and required

"0" - means that the population does not feel any effect when interacting of species;

"+" - That it is benefited from the interaction of species;

"-" - That she is experiencing the negative impact of such interaction.

Annex 3

Types of symbiosis [2, 3]

Types of symbiosis		B		
		+	0	-
A	+	Mutualism	Commensalism	Parasitism
	0	Commensalism	Neutralism	Amensalism
	-	Parasitism	Amensalism	Competition

Mutualism- form of beneficial co-existence, where the presence of partners is required for the existence of each.

Protocooperation - a form of co-existence, which is beneficial for both species, but not necessarily for them, which is not a prerequisite for the survival of species (populations).

Commensalism - a way of co-existence of two different kinds of living organisms, in which one population benefits from the relationship, and the other does not receive any benefit or harm.

Parasitism - a form of co-existence of organisms in which one organism lives at the expense of the organism of another species.

Predation - a type of relationship in which representatives of the same species eat (destroying) the representatives of another, one type of organisms serve as food for another.

Neutralism - the type of relationship of organisms in which the partners do not have any effect on each other.

Amensalizm - type of relationship in which one species, called amensalom has inhibition of non growing and non development, and the second which is called inhibitor, such testing is not affected. For example: light-loving herbs that grow under spruce, suffer from severe blackout, while the tree itself is not affected.

Competition - the relationship between organisms of the same or different species, in which they compete

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