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ORIGINAL PAPER

Enigmas and Profoundness of the Homochromy and Mimicry and Their Biological Significance

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Abstract.

Homochromy and mimicry are mechanisms of evolution that ensure the survival of species in their struggle for existence. They are considered forms of adaptation that have reached in the superlative. It is about integration in environment, a fusion with it, or assimilation, not a perfect adaptation. It cannot exist a perfect adaptation in a variable and changeable environment. Homochromy and mimicry represent the creation of natural selection, but not only that. It demonstrates the existence of a permanent dialogue of the beings with their vital universe, a semiotic dialogue among species, regardless of their evolutionary level that the living world forms a single whole. The homochromy and mimicry are not only attributes of the higher beings, but of life; we can meet them in the representatives of all kingdoms: Monera, Protista, Fungi, Plantae and Animalia. It is nothing casual and meaningless in nature. We can speak without fear of making mistakes about the intelligence of the living in its ensemble and the intelligence of every human partly, no matter the evolutionary level.

Key words*:* homochromy, mimicry, adaptation, imitation, natural selection.

1. Introduction

Mimicry, as a biological phenomenon, was discovered and released in science by Henry Walter Bates in 1862, eleven years after Darwin published his masterly book, *The Origin of Species***,** so, after the substantiation of the theory of evolution.

Even if Darwin was not concerned with these phenomena it does not mean that they cannot be integrated into the concept of biological evolution.

Both the Darwinism and the Synthetic Theory of Evolution (post-Neo-Darwinism) accept that homochromy and mimicry are the work of natural selection, that these had a gradual emergence^ and were achieved with small steps, in which the closest model variations were promoted by natural selection, while those realising the contrast were removed. The theory of punctuated equilibrium (punctualism) considers that the homochromy and mimicry could

have evolved by major leaps, determined by macromutations as Goldschmidt imagined himself (1945).

Homochromy and mimicry are evolutionary mechanisms that ensure the survival of species in the struggle for existence.

Darwin was and still is criticized for the fact that he saw everywhere only the struggle for existence and that he did not also see the mutual assistance of species (commensalism, ammensalism, symbiosis).

Entering into the mysteries of homochromy and mimicry, as vital phenomena, we realize that the struggle for existence is a reality and the capacity to survive in a hostile environment is a real art or evolutive magic. Homochromy and mimicry are joined in what we call art, agony and ecstasy: nature cannot be surpassed even by the most creative human imagination.

All forms of camouflage and mimicry are "chromatic clothes" which ensure the integration of bearers in the environment, most appropriate "wedding clothes", but only for weddings in which the bearers were invited. This means that the bearers know how they are dressed, that they acknowledge the quality and the effect of costumes and they know to capitalize intelligently the clothes they carry.

The art of camouflage became an obsession in the living world, from the lower beings, to those higher ones, including man too. Indeed, we, the humans, do we not often try to present another face of our personality? Do we not try to disguise us in many ways, to mimic, in order to convince our interlocutors that we are not what we are, but what we want others to believe about us?

A being cannot live if it does not enter in dialogue with its universe, with the microcosm and the macrocosm. It is necessary to take into account what it is being said more and more nowadays, about the intelligence of nature (the intelligence of living beings).

2. The homochromy and mimicry as biological phenomena

By homochromous colour we must understand a colour similar to the environment, in which the respective being lives, a colour that advantages it against predators giving it the possibility to lose its outline in the environment. The homochromous animals seek their best suited environment to their chromatic clothes, when they feel threatened. The homochromous colour does not protect the individual carrier anytime and anywhere, but it is necessary that this, acknowledging the characteristics of its chromatic cloth, to look for the best place in the environment to favour it. Otherwise, although it has a protective chromatic clothe, it can make a contrast with the environment.

It is natural that in the polar areas the animals be white (the predominant colour of the environment) and in sandy deserts to have the colour of sand in order to be difficult to be seen. But even in these areas there may occurs other

spots of colour too, so the animals must find those places that allow them to hide from predators, or they can make a contrast with the environment.

Homochromous colour is of several kinds.

Martin and Marilaita (2001), Ruxton et al., (2004), Abbott and Dukas (2001), Abbott (2006, 2010) carry out a certain classification of forms of homochromy and mimicry.

Thus, the homochromous colour is of several kinds: uniform and permanent, uniform, but seasonal, changeable, colour of disintegration, cryptic shadow; allosomal; warning colour; demonstration; transparency; intermittent fusion; imitation.

Imitation is also considered a "colour" of protection. In this case, it is not imitated just the colour, but also the shape of the environment. Imitation is widespread in the animal world. Some animals imitate the plants among which they live to be confused with. It is interesting that some plants also imitate other plants or inert objects in environment, such as the stones.

Mimicry is the capacity of living beings to adapt their colour, the body shape and behaviour under the influence of the environment (animate or inanimate) as a strategy to avoid the enemies and to survive by their deceiving. It is the result of millions of years of evolution, in which the two parts (preys and predators) have perfected their art of disguise, weapons and war tactics.

Mimicry is not just a game of nature, because depending on its existence and improvement this becomes a matter of life and of death.

We can speak of mimicry of shapes, of colours, of an acoustic, olfactory, tactile, sexual mimicry, etc.

Starting from the first and most common forms of known mimicry, now we can find that there is a complex of forms, which are divided into:

- *Defensive mimicry:* Batesian, Miillerian, Vavilovian, Emsleyan, Wasmannian, Gilbertian, Browerian, olfactory, acoustic, tactile, simulated death;
- *Aggressive mimicry:* Wignallian (Taylorian); sound; nidicolous; Gershenzian (macabre pretence - simulation); tail bait; lingual bait; mimetic parasitism;
- *Competitive mimicry:* Raineyan;
- *Pseudocopulation;*
- *Sexual mimicry;*
- *Intersexual mimicry;*
- *Mimicry in plants (Lithops);*
- *The reason of the eye;*
- *Myrmecomorphism;*
- *Automimicry.*

3. Mysteries and profoundness of mimicry and homochromy

An animal copies another species, a stone, a leaf, a branch, etc. It conceals its relational functions and enters in the assumed role. Why some species of spiders and insects have chosen to imitate the droppings of some birds? Have these beings understood the philosophy of nothing, of the decaying matter that nobody needs? Have they understood that they can survive when they substitute to nothing?

It comes us, though, easier to understand that an insect or a lizard mimic a leaf, because they live among them, see them and seek their shelter against predators. But why they imitate the eaten leaves, attacked by viruses, bacteria, fungi, or even the dead leaves? Why? Because they live among them, they represent their vital environment.

The mimic does not "photograph" some leaf, it does not realize a hologram of a leaf, it realizes a statistical "analysis" of the healthy and diseased leaves and it chooses as a model the leaves which dominate its environment to be able to lose its identity easier in this way. It realizes what we name a *photograph - sculpture, a teleplasty* (Callais, 2000).

The camouflage became an art, a mimetic magic, a luxury and still a dangerous luxury. This does not presume only the wearing of a protective chromatic clothing, but also the use with intelligence in the right place and at the right time.

The homochromy does not presume the similarity of the beings with a certain space (unique and precisely located), but with a lot of similar spaces, they need to seek for them and use them with much caution and intelligence.

The mimicry gets unexpected dimensions in the world of plants. As we said, we accept more easily that an insect imitates a healthy or sick leaf, a bird dung, because it analyses the environment through the usual apparatus, but it comes us more difficult to understand that a plant (an orchid) imitates an insect to deceive it and to attract it to its flowers to achieve pollination. Where does the plant know from how the respective insect looks like, what colour and what shape does it have and even more, where does the plant know from, what sex pheromones synthesize the female for the attraction of males, in order to synthesize them as well? These are mysteries hard to explain, but they are realities of nature.

To understand these aspects we have to appeal to what we name the *intelligence of living.* All the beings have the capacity to communicate with peers and with other species in the biocoenosis in which they live and to go into the dialogue with the universe. Tackling from the semiotic point of view these aspects, we will be able to enter in what we call the intelligence of living. Just so we can understand the performance of some plants, the so-called *lithops* to imitate the stones, not any kind of stone, but the stones among which they live.

Modern genetics research tends to elucidate some genetic mechanisms underlying homochromy and mimicry. Turner's research (1981), Shepard et al., (1985) and Maletic et al., (1999) suggest the idea that the mimicry can be realized in two stages:

- A major mutation determining an approximate resemblance with the model. This would facilitate the crossing over the adaptive path among the models of protected colour;
- The improvement of the similarity on the genes with weaker effects, by natural selection.

Goldschmidt (1945) proposed the existence of some major mutations with role in the achieving of mimicry.

The punctualists, including Gould and Eldredge (1977) consider that the evolution is not made linearly, gradually, as Darwinists and Neo-Darwinists support, but in leaps. The mimicry, as speciation is achieved by mutational processes that may open new evolutionary directions. The directions would not be made by the process of natural selection in the Darwinian sense, but by a process of selection of species, which means macroevolution. They believe that: *Macroevolution (selection of species) = punctualism + genetic drift*

Turner (1989) does not fully accept the punctualist theory, but he admits that the modifications are produced because of some combinations of genetic mutations and of modifications of the ecological balance. The ecological modifications determine the eliminations of some species and favour some new phenotypes to the detriment of those old ones. Turner considers that the existence and coexistence of the groups (circles) of mimicry in the butterfly species of the genus *Heliconius* could lead to the elucidation of some aspects regarding the genetic mechanisms of mimicry.

The modern genetic research has revealed some secrets hard to guess before regarding the elucidation of homochromy and mimicry. It is about the existence and functionality of the so-called *architect genes***.**

It has already become a genetic dogma that a structural gene has a certain function in the body building. It is also known that the genes do not function in isolation, but they form supergenes, which are integrated in the constellation of genes of an organism.

The modern genetic research demonstrates that the same genes can generate different organic structures, depending on the nature of interrelations among them and of the genetic program that are carrying out. Also, different genes can realize the same organic structure in different species. The genes are associated and function under the command of some higher regulatory genes which are called - *architect genes.* So, for the building of a complex structure (such as the eye) there participate many genes that interact and which are under the control of a higher regulatory gene, of an architect gene.

The experimental data demonstrated that an architect gene is responsible for the eye building (Mustata Gheorghe and Mariana Mustata, 2006), [9].

One such gene was located in the chromosomes from several species of animals. There were performed some experiments on *Drosophila melanogaster*. It was removed the architect gene from the genetic material of an egg of *D. melanogaster,* then the egg was placed in conditions of embryonation. Finally, a healthy individual was formed, but without eyes. In another egg, from that species, the architect gene for eye was removed, but it was replaced by the same gene taken from another egg. There was formed a normal drosophila with eyes. It was done in the same way in mice and similar results were obtained. They went on with the experiments; an architect gene for eye from *D. melanogaster* was replaced with one from a mouse. The result was surprising, a normal drosophila was formed, with eyes. The architect gene for eye from the mouse succeeded to coordinate the eye formation in *Drosophila melanogaster*.

The architect gene does not directly involve in the implementation of structures they control. It behaves like an orchestra conductor. Every member of the orchestra can be an expert at his instrument. However, the orchestra in order to function as a single whole it is necessary the presence of a conductor. The performance of the orchestra in the execution of a musical score depends largely on the conductor.

Like members of an orchestra, the structural genes perform their score masterly. The architect gene starts the necessary activity for the eye building, supervising the action of each gene partly. In this experiment, the architect gene for the mouse eye was put in the situation to execute a score at the first reading (a genetic program with other load information), that the orchestra members knew perfectly. It succeeded brilliantly to lead to the end the mission of building the drosophila eye. It is like the architect genes would execute the programs offered by the organism for the building of some structures. In the situation in which a new program is offered to them, then both the members of the orchestra and the conductor are striving to execute the programme masterly in the first reading.

It is like the organism, living in an environment, channels it, processes it in a personal style, depending on needs and commands to the constellation of genes and architect genes the execution of some programs or others, depending on the concrete state of the environment and necessities. Why did we not accept that, in this way, it would make the imitation of some models in what concerns the shape, colour and the behaviour? Of course, this approach should be strengthened by future research.

Conclusions

Homochromy and mimicry are based on the interaction of organisms with their biotic and abiotic environment; they represent evolutionary strategies that ensure the survival in the struggle for existence.

If J. Baptiste Lamarck considered that the environment can directly influence the transformation and adaptation of species, the post-Neo-Darwinists theories do not accept any more the direct influence of the environment. It is like it would not matter in what kind of environment the species live. We consider that it cannot be neglected the environment - organism interaction both in adaptation and in evolution.

Homochromy and mimicry cannot be achieved but in certain environmental conditions, in the dialogue between species and their environment. Organisms launch and receive some messages that, if they can decode them, they can understand them, and if they understand them, they will develop a response that would correspond to the nature and significance of the signals.

The living world is a world of signs and signals, of communication. These are the basis of the existence and the evolution of the vital.

Mimicry has at the basis the semiotic dialogue. The mimic and the model cannot be achieved, but only if they are found in the same habitat and they are often met; but if the number of mimics is smaller than of models, the models and the mimics are exposed to the same dangers, to the same predators.

If we accept what we call *intelligence of matter*, why did we not also accept this trend, the tendency of beings to progress?

We cannot afford to consider that the nature is stupid, we have to accept that the phenomena of the type of homochromy and mimicry are evolutionary strategies that ensure the survival of species in the struggle for existence.

Homochromy and mimicry are considered forms of adaptation reached to the superlative, being the result of millions of years of evolution.

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