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AGING AND ONCOGENESIS (ONTOGENETIC, EVOLUTIONARY, ENVIRONMENTAL AND SOCIAL ASPECTS)

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Aging and Oncogenesis (Ontogenetic, evolutionary, environmental and social aspects)

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1 ANNOTATION

A hypothesis is presented that offers an explanation of how and why the mechanisms of aging and oncogenesis arose. The first Metazoa on Earth did not have these pathological processes, but their evolutionary predecessors were contained in the program of their normal ontogenesis. The destruction observed in the body during aging and cancer are atavistic adaptive morphogenetic reactions of the first Metazoa on Earth. The views of immortalists are discussed. In the course of evolution, the formation of the property of aging in systems with a rank higher than the organism is considered. The work was written on the basis of articles previously published by the author [1-27].

2 INTRODUCTION

Human aging is a commonplace reality, but it causes public concern. There is no consensus on its nature and on the role in human life. This gave rise to a reckless intention to free a person from the inevitability of aging [28,29]. Oncogenesis is also gradually becoming the everyday reality of our lives [30,31]. There are more and more cancer cases among us. What cancer is - oncologists still do not know. Therefore, the efforts made by them to combat it do not lead to the desired result. It will become possible to develop effective methods of treating an organism affected by a tumor that are united by internal logic when it becomes clear how the body regulates oncogenesis. Biologists often use the evolutionary approach to solve the problems they face. Oncologists use it less often. Is this the reason that the cancer problem remains unresolved? Apparently, oncologists do not know about tumors of something like that, writes L.B. Mekler [32], which refers to the field of sciences that are beyond their knowledge, but knowing what they really need to answer the question of what is a malignant tumor. Every problem is a problem that cannot be solved because those who solve it are connected with erroneous initial hypotheses [2,33]. The hypothesis that a cancerous tumor fights the body's defenses is erroneous. In this work, another hypothesis is proposed - the body does not fight a cancerous tumor, but lovingly grows it, as a woman grows a child in her womb.

Key selection for a scientific riddle, writes V.A. Jerichin [34], an exciting pastime. In this work, the key to the mysteries of aging and cancer is proposed. It is based on an evolutionary approach. Therefore, much work is devoted to primitive invertebrates, in which the property to age and form a malignant tumor has not yet arisen, but in the individual development program of which evolutionary precursors of these pathological processes are contained.

Aging and oncogenesis are the result of the physiological regulation of the body. This system is multi-stage. It is built on a hierarchical basis. It was formed in the course of evolution by developing more and more efficient and economical compensatory-adaptive mechanisms. Wasteful and ineffective morphogenetic mechanisms of ancient adaptive reactions lost their activity, but their program remained in the genome of the individual. They are realized in pathological situations. Aging and oncogenesis are a consequence of their implementation. Therefore, in order to understand how the processes that occur during aging and during oncogenesis by the body are regulated, it is necessary to find out how their evolutionary predecessors were regulated by the body in the normal ontogenesis of their ancestors. And for this you need to know which of our ancestors they were an integral part of normal ontogenesis and what processes of normal ontogenesis they had evolutionary precursors of aging and oncogenesis.

Aging and oncogenesis are observed not only in highly organized species, but also in very primitive species, located near the base of the Metazoa phylogenetic staircase. This leads to the opinion that the processes that have now become aging and oncogenesis were an integral part of normal ontogenesis in the earliest, the first on Earth, Metazoa. These Metazoa became extinct, leaving no paleontological traces. Opinions about what they were are an area of speculation and conjecture. By A.V. Ivanov [35], some authors, including himself, believe that the first Metazoa on Earth were freely mobile, others think that they were sedentary, that is, they led a lifestyle attached to the bottom and to underwater objects. When answering the question of which of our ancestors aging and oncogenesis were an integral part of normal ontogenesis, one has to base on the assumption. The answer to it is probably the knowledge that oncologists lack, which according to LB To Meckler [32], they need to answer the question of what is a malignant tumor.

The attractiveness of the hypothesis of the origin of Metazoa from sedentary ancestors, which prompted the author to accept it and put in the basis of the hypotheses below about the physiological mechanisms that regulate aging and oncogenesis, is that it allows us to see the sequence of changes in regulatory and adaptive mechanisms for all Metazoa evolutionary lines as advancing from the bottom up the phylogenetic ladder of Metazoa. Accepting this hypothesis, we can understand how the formation of the mechanisms governing aging and oncogenesis progressed during evolution. If we assume that Metazoa had a free-moving lifestyle as the primary one, then this fails to be understood.

The body of most modern sedentary primitive invertebrates located closest to the base of the Metazoa phylogenetic tree consists of several, often many, usually the same blocks, or modules. Sedentary modular species are sponges, hydroid and coral polyps, bryozoans, intrapowder and colonial ascidia. They reproduce sexually and asexually. In asexual reproduction, an individual is formed from a complex of somatic cells. Modules in these invertebrates are formed by complete asexual reproduction [36]. Species that reproduce only sexually are called unitary [37-39]. They are descendants of modular ones. Probably, the first Precambrian Metazoa on Earth were not only sedentary, but also modular.

Different types of modern sedentary modular invertebrates adapt to the environment in a similar way. Their life strategy is fundamentally different from the life strategy of unitary species. Therefore, if the hypothesis according to which the first Metazoa on Earth were sedentary and modular is true, then they adapted to the environment in the same way as modern sedentary modular species, and the normal ontogenesis of modern sedentary modular species was part of their normal ontogenesis. Recognizing this, it should further be recognized that the basis of the multistage hierarchical system of physiological regulation of highly organized animals and humans is based on reactions similar to the normal ontogenesis reactions of modern sedentary modular species and that their reactions can be considered evolutionary precursors of aging and oncogenesis. And the mechanism of regulation of these reactions in modern sedentary modular species underlies the mechanism of regulation of aging and oncogenesis in unitary species. This assumption is used in the work as a key to scientific riddles - how the body regulates aging and how it regulates oncogenesis.

Formation of mechanisms of aging and oncogenesis the evolutionary precursor to aging and oncogenesis - asexual reproduction

According to existing ideas, the fate of sexual and asexual reproduction during the evolution of Metazoa was different. Sexual reproduction persisted throughout evolution. The ability to asexual reproduction after the body reached a certain level of integrity in different evolutionary lines disappeared [36]. But whether without a trace? Or did his traces remain, but in such a way that their nature is still not understood? The basis for the second assumption is that the mechanism of sexual reproduction during evolution has changed greatly. Its difference in species located at the top of the Metazoa evolutionary tree (in birds) and at its base (for example, in sedentary modular animals) is so large that it took several generations of researchers to understand that gametogenesis and gamete fusion are universal processes.

The mechanism of asexual reproduction, that is, the formation of a new individual from the totality of somatic cells, is probably also universal. In unitary species, it has been preserved and underlies the mechanisms of aging and oncogenesis. Biologists studying asexual reproduction of animals, and doctors looking for answers to questions about how aging and oncogenesis are regulated by the body, are probably dealing with the same morphophysiological mechanisms, which manifest themselves only differently in representatives of Metazoa, located at the top of the evolutionary ladder and at its base. If this is true, then knowledge of the mechanism of asexual reproduction of animals is necessary for oncologists and gerontologists to decipher the mechanisms of aging and oncogenesis.

In sedentary modular animals, new modules are formed using asexual reproduction. There are many freely moving modular species among ctenophores, turbellaria, nemerthins, annelids, and echinoderms. Some ctenophores, turbellaria, nemerthins, annelids and echinoderms are unitary. In freely moving modular animals, modules lead an independent life; in sedentary species, they do not lose physiological connection with the parent and become part of their body.

The practical value of modular animals is small. Therefore, asexual reproduction has been little studied. For studies that do not have practical value, there is a negative attitude. They are considered satisfaction of curiosity at public expense. However, knowledge that does not have practical value at first acquires it later. Achievements in the study of asexual reproduction, writes OM Ivanova-Kazas [36], may turn out to be key in solving the problem of aging. Knowledge of the mechanisms of asexual reproduction of animals would have in our time, when the problem of cancer became acute and when the problem of aging was given a lot of attention, it was of practical importance. Insufficient knowledge of the mechanism of asexual reproduction of animals is an obstacle to deciphering the mechanisms of aging and cancer. It is precisely this knowledge that gerontologists do not have to answer the question - how does the body regulate aging, and it is precisely these knowledge that oncologists do not have to answer the question - how does it regulate oncogenesis.

A summary of the available information on asexual reproduction of animals was written by O.M. Ivanova-Kazas [36]. This book of hers and the book of B.P. Tokina "Regeneration and somatic embryogenesis" [40], also devoted to asexual reproduction, were fundamental in the formation of the hypothesis described below on the mechanisms by which the body regulates aging and oncogenesis. Asexual reproduction is always associated with destruction in the body of an individual [36,40]. Among modern primitive animals that reproduce both sexually and asexually, the largest amount of damage in normal ontogenesis is observed in sedentary modular species. Probably, these damage are evolutionary precursors of damage that occur in the body during aging and oncogenesis.

A sedentary modular animal is one whole. It reacts to environmental changes as a single organism. Therefore, a colony should not be considered as an individual in sedentary modular species. The patterns of the functioning of the anchored lifestyle of a modular extravertebrate are similar to the patterns of plant functioning [41-44]. This is also evidenced by the fact that the obsolete name for sedentary modular animals is zoophytos. In plants, as in sedentary modular animals, an individual is also a combination of physiologically connected modules. Modules of plants - shoots and leaves. In them and in sedentary modular animals, parts of the embryonic tissue are present in the body, the cells of which divide to form new modules, and the ontogenesis program is carried out many times during the formation of each new module [37,38]. Probably, the processes that regulate the destruction occurring in normal ontogenesis are similar in sedentary modular animals and plants.

In plants, the embryonic tissue is called the meristem. Its cells remain embryonic from the time of its emergence from the meristem of the seed embryo [45]. In sedentary modular animals, embryonic tissue is formed each time before the act of asexual reproduction by de-differentiation of specialized module cells [36]. The differentiated totipotent cells of embryonic tissue in sedentary modular animals begin to multiply, and then differentiate in new directions in the developing daughter modules. This method of asexual reproduction is called somatic embryogenesis [40].

Two universal functional systems

To discuss the question of how, during evolution, an individual developed the ability to age and form a malignant tumor within himself, it is convenient to use the terms of the theory of functional systems proposed by P.K. Anokhin [46]. According to him, the unit of activity of the body is a functional system. It is a set of coordinated interconnected processes aimed at achieving a result that is useful to the body. A functional system requires motivational arousal. It appears due to a particular need of the body. A functional system is being developed by going through the steps of synthesizing signals from endo- and exoreceptors, making decisions, shaping actions, and evaluating the results achieved.

Along with functional systems of normal ontogenesis, pathological functional systems exist. They are the functional systems of the normal ontogenesis of the ancestors. The motivational arousal that forms them is aimed at satisfying needs that the individual does not have, but which were at the passed stages of its evolution. To understand how pathological functional systems are regulated, it is necessary to find out how their evolutionary predecessors were regulated in the normal ontogenesis of ancestors. For this, it is necessary to compare in descendants and ancestors not separate processes, but their interconnected aggregates, that is, functional systems.

Plants and sessile modular animals adapt to environmental changes during a favorable season for life with the help of a functional system for updating their modular composition. Her work of sedentary modular animals consists in the killing and resorption of some modules and in their formation with the help of asexually reproduced asexual reproduction of others. This functional system of sedentary modular animals is probably the evolutionary predecessor of the functional aging system of unitary species. Due to the fact that new modules do not appear on the site of the lost, but on another part of the body, the shape of the modular individual changes. The need for this change is due to the fact that some modules, due to a change in direction or flow rate, growth of adjacent sedentary modular animals or algae, and for other reasons, find themselves in a position that makes it difficult to collect food, and in the plant in the shade, and photosynthesis in them because of this reduced. The cost of individual resources to maintain their structure and functioning ceases to pay off. They consume more resources than they extract from the environment, therefore become a burden for an individual and therefore gets rid of them. But not only is this need the reason for the constant change in the modular composition of the colony. The colony module is mortal. His life expectancy is limited. The death of modules is the local destruction of a modular individual. In sedentary modular animals, it is carried out by senile involution. In plants, shoots that find themselves in the shade dry up, the leaves fall off. Replacing one module with another makes it easier for an individual to extract energy from the medium. During a favorable season for life, the modules are iterative, that is, before they die of old age, they form daughter modules several times through asexual reproduction at regular intervals. A functional system for updating the modular composition of an individual in different evolutionary lines of animals and plants arose independently.

Let us now consider in sedentary modular animals and plants another functional system — the functional system of formation of resting somatic embryos, that is, the functional system of preparation for experiencing an unfavorable season of the year. This functional system is the evolutionary predecessor of the functional system of oncogenesis of unitary species. Sedentary modular animals and plants in the genome have two programs of asexual reproduction. One is discussed above. It consists in the formation of actively functioning modules. Another is the formation of resting modules (resting kidneys) and the dying of actively functioning ones. In sponges, resting modules are called gemmules, in strutting modules - podocysts, in bryozoans - statoblasts, in intrapowder, wing-winged and colonial ascites - resting kidneys. Sponge gemmules are similar in structure to morula, resting embryos of other sessile modular species - usually with gastrula [36]. In plants, resting modules are also buds. In trees and shrubs, they are located on branches, in herbaceous plants underground on tubers, root crops and rhizomes. The bulb is a resting kidney [47]. The resting modules of plants and animals are similar structures. They are supplied with a supply of nutrients and serve to survive the season unfavorable for life, and in sedentary modular animals - and for resettlement.

The experience of an unfavorable season for life with early somatic embryos is characteristic of the most low-integrated Metazoa - sedentary modular ones. Among freely mobile invertebrates, whose organism is more holistic, somatic resting embryos are described, as far as the author knows, only in the Phagocata velata turbellaria [48]. Unitary primitive animals - turbellaria, oligochaetes, gastrotrichs, rotifers and crustaceans, as well as hydras, form not somatic resting embryos, but zygotic ones originating from the zygote. They are called latent eggs.

The formation of resting somatic embryos in animals and plants before seasonal environmental degradation occurs not alternately, but at the same time, and is accompanied by the simultaneous and rapid aging of all actively functioning modules. In trees and shrubs, leaves fall, in grassy plants the aboveground parts age and dry out, in sedentary modular animals, actively functioning modules dissolve. In preparation for seasonal environmental degradation, the modules of sedentary modular animals and plants are semiparous, that is, reproduce asexually only once, and then die.

The formation of somatic resting embryos in sedentary modular animals occurs in each species according to a hereditarily fixed program, and peace occurs at a strictly defined stage of embryonic development. These resting stages arose during evolution as an adaptation to annually repeated changes in nature. Therefore, they should be called diapausing. Diapause is a condition of hereditarily fixed physiological inhibition of metabolism and the stopping of morphogenesis.

The functional system of formation of resting somatic embryos in sedentary modular animals and plants is included in response not to seasonal environmental degradation, but to signaling factors warning of its imminent deterioration (for example, to a change in the duration of daylight). The formation of these embryos in sedentary modular animals and plants is a sharp simplification of the structure of an individual. The ability to quickly complete the transition to the formation of resting embryos was independently developed in representatives of different evolutionary lines of sedentary modular animals and plants. Individuals who did not have time to prepare in time for the time of the year unfavorable for life or who began to prepare for it too early were eliminated. Thus, in plants and in sedentary modular animals, two functional systems were formed due to the attached lifestyle and low level of integrity of the individual on a different genetic basis and on the basis of the same mechanism - asexual reproduction mechanism. An important role in their work is played by adaptive destruction in the body. These functional systems are universal. They probably lie at the base of the regulatory physiological system of all Metazoa. If the first Metazoa on Earth were sedentary and modular, then they used them to adapt to the environment. In sedentary modular species, these two functional systems ensure the passage of normal ontogenesis, in unitary species - pathological. Knowledge of the regulatory mechanisms of these functional systems in sedentary modular animals is necessary for understanding the regulatory mechanisms of aging and oncogenesis by the body. The author is not aware of the works devoted to the regulation of these functional systems in sedentary modular animals. In plants, their regulation is studied [45,49-51].

Regulation assumption local destruction of sedentary modular animals

To explain how the organism of modern sedentary modular invertebrates regulates the destructive processes during the operation of the two functional systems considered, means, firstly, to explain how they were regulated by the first Metazoa on Earth, and secondly, to explain how aging and oncogenesis are regulated by the body . However, the lack of information on the regulation of these two functional systems in sedentary modular animals stands in the way of this explanation. Studies of the regulatory physiological system of sedentary modular animals, from which, practical benefits were not expected, were probably not conducted. They are unknown to the author. An explanation of the mechanisms of regulation of aging and oncogenesis can be given only hypothetical.

In plants, the meristem produces auxin, a hormone that travels through the body and induces the ability of the meristem to attract nutrients from the formed modules and absorb them [45]. Between old and emerging modules (meristem) a donor-acceptor bond arises. The formed modules are donors, the formed ones are acceptors. With the formation of dormant embryos (buds) in plants, the outflow from the formed modules of nutrients into the meristems is enhanced in comparison with this outflow occurring during the formation of actively functioning modules. This explains the simultaneous and rapid aging and destruction of the formed modules at the end of the growing season. The property of multiplying meristem cells to attract nutrients from formed modules is called apical dominance [50]. The destruction of the formed old modules in the plant is the result of the apical dominance mechanism.

The life strategy of sedentary modular animals and plants is similar [37,38,43,44]. Therefore, we can assume that the mechanisms that regulate adaptation to the environment are similar for them. If this is so, then in sedentary modular animals, the destructive processes that occur during the operation of functional systems for updating the modular composition of an individual and its preparation for seasonal environmental degradation are also controlled by the mechanism of apical dominance. The centers attracting nutrients in them then are probably also the multiplying dedifferentiated cells of the forming modules. These centers, like the plant meristem, probably secrete some substances that have a remote effect on the whole organism. In the embryos of sedentary modular animals preparing for diapause, as in the embryos of plants preparing for rest, the ability to attract nutrients from other modules is more pronounced than in the embryos of modules preparing for active life. The aging of modules in sedentary modular animals, as in plants, is a consequence of the redistribution of resources in the body. Aging in them, like in plants, does not capture the whole individual, but has a local character and does not age the individual, but, on the contrary, rejuvenates it. Apical dominance is probably the universal mechanism of interaction between old and newly formed modules in different phylogenetic lines of sedentary modular animals and plants.

Plants of germinal tissue in plants and in sedentary modular animals participate in the management of functional systems for updating and preparing for seasonal environmental degradation only at the local level. At the level of a whole modular organism, resources are redistributed between the newly-formed and formed modules by the regulatory physiological system of the whole modular individual. Its existence is evidenced by the fact that the responses of a sedentary modular to environmental changes are timely and appropriate [52].

Sometimes a sedentary modular individual interrupts preparation for an adverse season. So do some colonial ascidia. In them, somatic embryos that began to form sometimes dissolve, while the vital organs of actively functioning modules that began to decay are restored during this process [53,54]. Such a transition of an individual from the formation of resting somatic embryos to the formation of actively functioning modules has also been described in the Jerusalem artichoke plant (Heliánthus tuberosus) [55]. In this case, donors are not specialized tissues, as in preparation for a season unfavorable for life, but somatic embryos preparing for rest. Their resorption indicates that the direction of the flow of nutrients from one module to another in a sedentary modular individual is controlled not by areas of embryonic tissue, but by the regulatory physiological system of the whole modular organism. Each module detached from a modular sedentary can give rise to a new modular. This means that the program of this regulatory system is contained in each module. Since the mechanisms of functional systems for updating and preparing for seasonal environmental deterioration are in sponges that have no nervous and endocrine systems, it should be thought that these functional systems are controlled by them, as well as by other sedentary modular invertebrates, intercellular interactions. As mentioned above, the functional system for updating the modular composition of a sedentary modular animal is an evolutionary precursor to the functional system of aging of unitary species. The fact that the aging mechanism arose at the doner stage of evolution, wrote A.B. Kogan [56].

The adaptive value of the multiplication of dedifferentiated cells preceding the onset of diapause of the somatic embryo

In preparation for diapause, sedentary modular animals reproduce the de-differentiated cells of the somatic embryo preparing for diapause. An explanation of the cause of this phenomenon is necessary to understand what the multiplication of malignant cells is. An increase in the number of homogeneous elements making up the system is a reaction to damage in systems of different levels. Proliferation is a universal response to damage by Metazoa [57] and Metaphyta [58]. In hydroid polyps, after exposure to harmful substances, the formation of new hydrants is accelerated [36]. After the accident at the Chernobyl nuclear power plant in trees in the zone of acute radiation exposure, the formation of shoots intensified [59], that is, new modules. Low concentrations of heavy metal ions accelerate the growth of bacteria [60], yeast [61] and algae [62]. Damaging effects on populations of primitive animals stimulate their asexual reproduction [36]. The demographic system also obeys system-wide laws [63]. Birth spikes were recorded after the First and Second World Wars in the countries that took part in them. The birth rate increased in China in 1962-1970 after the food crisis of 1959-1961 [64], as well as in Armenia in 1989-1990 after the 1988 Spitak earthquake [65]. The rise in the birth rate in Prague in 1974-1978 [66], may have been related to the invasion of Czechoslovakia in 1968 by troops of the Warsaw Pact states. The surge in fertility is a common occurrence after social and natural disasters [65]. In a biocenosis, in response to damage, the number of its homogeneous elements also increases. With adverse effects on it, a return to the initial stages of succession occurs. In this case, slowly breeding K-species (coenophiles) are replaced by rapidly breeding r-species (coenophobes). Reproduction of cells of the somatic embryo of sessile modular invertebrates preparing for diapause is a reaction to the threat of damage, to the approaching season unfavorable for life.

The adaptive value of local destruction of an individual during the operation of the functional system of formation of resting embryos

It was said above that the destruction in the body of a sedentary modular individual during the formation of diapausing somatic embryos by it is an evolutionary precursor of the destruction that occurs during oncogenesis. Therefore, the answer to the question - what adaptive significance are these destruction in sessile modular invertebrates, is needed in order to answer the question - why destruction occurs in the body during oncogenesis.

A system can have two strategies for adapting to the environment - resistant and tolerant. Resistant is an active counteraction to adverse external influences, maximization of functions. It allows in difficult conditions at the limit of possibilities to solve important life tasks. A tolerant strategy is submission to the environment, minimization of functions [67], What strategy the body will resort to depends on the degree of its integrity and on the strength of external influences. The degree of integrity of an organism is measured by its ability to retain its specific characteristics in spite of influences seeking to disrupt them [68]. It characterizes a greater or lesser interdependence or, conversely, autonomy of parts, greater or lesser subordination of parts to the whole [40]. The degree of integrity of the system is associated with its complexity. The complexity of the system is determined by the number of elements performing different functions and the number of connections (interactions) between them [69]. As examples of complex integrated systems, we can cite individuals of mammals and birds, modern human society, and the ecosystem at the stage of menopause. Examples of simply arranged low-holistic systems are individuals of sponges and intestinal cavities, Indian tribes living in the jungle of Brazil, an ecosystem at the pioneer stage of succession.

The degree of integrity of sedentary modular animals and plants is very low. Therefore, they have reactions aimed at maintaining the structural integrity and functional activity of the body, are used in a narrow range of fluctuations of environmental factors, that is, with a weak effect. Outside, that is, with a stronger external damaging effect, reactions are included that ensure the destruction of the structural integrity of the body and its rejection of functional activity.

Tolerant strategy is associated with destruction of tissues, the creation of which was spent resources of the body. The selection of sedentary modular animals and plants by this wasteful strategy is thermodynamically determined. At Protozoa, each cell independently adapts to environmental changes. The systemic response to these changes, that is, a response based on the separation of the functions of the body between its cells, arose with the advent of Metazoa and Metaphyta on Earth. In sedentary modular animals and plants, it is still at a very low level of formation and its effectiveness is therefore low. The energy level of modular animals and plants is very low. Regulatory processes are associated with energy consumption [70]. The force opposing external forces seeking to destroy the system is a set of integrative interactions between its elements specialized in different directions. Any interaction is a waste of energy. The more complex the system, the more functionally different elements it consists of, the more intra-system interactions it has and the more it must do work to maintain its integrity.

When the force of external influence exceeds the adaptive capabilities of the response based on intra-system interactions, the waste of energy necessary for these interactions does not pay off and the system is forced to reduce the number of functionally different elements that it consists of. This reduction reduces her energy needs and allows her to maintain an energy balance in conditions when her metabolism by external forces is impaired and its power is therefore reduced. In this way, sedentary modular animals and plants adapt to seasonal environmental degradation when they use the functional system of formation of resting somatic embryos.

In addition to the functional system for the formation of diapausing somatic embryos in primitive invertebrates, there are other functional systems based on a tolerant adaptation strategy. One of them is a functional reduction system. If the formation of diapausing somatic embryos is a preventive adaptation to the forthcoming seasonal deterioration of the environment, then reduction is a response to its direct deterioration, not associated with the alternation of the seasons, and to hunger. By means of reduction, sedentary modular invertebrates, turbellaria and nemerthins are adapted. During reduction, differentiated cells dedifferentiate or die, the size of the individual (and the modules of the modular individual) decreases, and the individuals (modules of the modular individual) are converted into reduction bodies, similar in structure to the early embryos. They are able to tolerate a period unfavorable for life and restore the previous structure of an individual (individual modules) when conditions improve [36].

Plants are also capable of reduction. They can be caused by placing pieces of tissue in a nutrient solution. In this case, the cells are differentiated and transformed into totipotent callus cells. The accumulation of callus cells is a structure similar to the reduction body of animals. The functional system of the formation of reduction bodies in various phylogenetic lines of animals and plants arose many times independently.

Functional systems based on a tolerant strategy also include functional self-healing systems. They are realized when the environment deteriorates (spoilage of water in the aquarium, a sharp change in salinity, temperature) and when the enemy attacks. Colonies of hydroid polyps are discharged by hydrants, phoronids separate the crown of tentacles, nemerthines, polychaetes and oligochaetes are divided into segments, holothurians break up into pieces or throw intestines, water lungs and part of the gonads through rupture of the cloaca, starfish break off rays, ascidia eject through the cloacal intestines and gonad [36,71-75]. The rupture of intraorganismic integrative bonds that occurs during the implementation of functional self-healing systems allows an individual to reduce the energy costs of the interaction of body parts and thereby bring their energy needs into line with reduced energy capabilities. Lost body parts invertebrates restore.

Why in sedentary modular invertebrates diapause is embryonic?

This section is needed in order to understand what malignancy is and why malignancy of cells is their dedifferentiation. But we will first discuss why sedentary modular animals form somatic diapausing embryos, rather than zygotic ones, as hydra, turbellaria, oligochaetes, gastrotrich, rotifers, and crustaceans do. Sedentary modular animals form somatic diapausing embryos rather than zygotic ones, probably because they are the lowest integrated among Metazoa. They are less holistic than primitive invertebrates (with the exception of hydra), which form latent eggs for experiencing adverse seasons. The integrity of the plant individual is also very low and therefore it forms also somatic embryos for experiencing an unfavorable season for life. But in plants, along with somatic resting embryos, embryos and zygotic - seeds fall into a state of rest. Why is hydra, a low-holistic organism, forming not somatic but zygotic embryos? The author cannot give a convincing answer to this question.

The resting embryos are zygotic, that is, latent eggs, diapause at the blastula or gastrula stage. Species in which diapause would occur before the formation of a blastoderm are written by Lees [76] and Breny [77], is unknown. One exception to this rule was found: in the Microstomum lineare turbellaria, an eight-cell zygotic embryo falls into the diapause [78]. In sedentary modular animals, somatic embryos diapause in most cases, as mentioned above, at a stage similar in structure to gastrula. Thus, embryonic diapause independently in different evolutionary lines of sedentary modular species and primitive unitary species arose at morphologically similar stages of development. Why did evolution create this similarity?

The answer, apparently, is this. The cells with the least differentiation have the highest tolerance to damage. The necessity of crushing the zygote before diapause of the early embryo is due to the fact that the oocyte, and, consequently, the zygote, are highly differentiated cells and therefore they are sensitive to damaging effects. Their tolerance is low. Differentiated somatic cells, from which somatic diapausing embryos of sedentary modular species are formed, are also sensitive to them. During crushing of the zygotic embryo and cell divisions of the somatic embryo preparing for diapause, the traits of specialization inherited from the zygote and from specialized somatic cells are lost and, therefore, cell tolerance increases. Diapause in a zygotic embryo occurs at the blastula or gastrula stage and at stages similar in structure to the development of the somatic embryo because at this time the loss of specialization traits inherited from differentiated somatic cells and from the zygote ends, but specialization associated with further post-diapause differentiation of embryonic cells.

At that time, all genes were turned on in somatic and zygotic embryos, and their shutdown had not yet begun, caused by the post-diapavous differentiation of its cells. At this stage of development of the organism, the interactions between its cells are still very weak and therefore its energy needs are minimal [79-81]. The diapause of sedentary modular animals and unitary animals forming latent eggs is based on the maximum reduction in the role of systemic adaptive reactions requiring energy costs and on the increase in the role of individual cell resistance. Diapause of a zygotic embryo at the blastula or gastrula stage and a somatic embryo at a stage similar in structure to them are two different ways of using a tolerant strategy, two ways of solving the same vital task of an energetically poor person - maintaining viability in a state of physiological rest by maximum exclusion of active opposition to a hostile environment.

The arrest of early embryo development is also known in birds. Their eggs are at the stage of late blastula – early gastrula before they begin to hatch. The tolerance of their embryo to the cold has the form of a curve, the peak of which falls at the end of blastulation – the beginning of gastrulation, that is, at the very stage to which egg laying is confined [79,80]. This allows the eggs to endure cooling until they begin to hatch. Increased tolerance of these stages of embryogenesis was found in the embryos of mammals [82], frogs [83] and fish [84]. The stages of late blastula – early gastrula have the greatest degree of ability to reversibly halt development. This was found on the eggs of frogs [27] and fish [84].

With the end of an unfavorable season for an individual, it is important to start using the environmental resources as soon as possible, while other individuals who left their diapause earlier and started active life have not used them up. However, primitive diapausiruyushm invertebrates, before starting to use them, are forced to spend precious time on individual development. They cannot diapause at a later stage of ontogenesis, which allows them to quickly transition to an active state, because of the low power of their metabolism. Diapause at later stages of development requires more energy than embryonic diapause. They are forced to use these environmentally unfavorable ways of experiencing an unfavorable season of the year because of their low energy content.

The influence of the potential immortality of sedentary modular animals on

their adaptive capabilities

An individual in sedentary modular animals dies only from external, but not from internal causes. She is potentially immortal. The property of self-destruction, that is, aging, has not yet formed in sedentary modular animals (there are exceptions to this, about which below). The potential immortality of a sedentary modular individual is ensured by the reversibility of its ontogenesis. It can, when the environment deteriorates by the formation of diapausing somatic embryos or reduction bodies, return to the embryonic state and then return to adulthood. A sedentary modular individual allows a potentially immortal update of its modular composition. Thanks to him, the old modular individual consists of young modules. She is always young. In relation to an individual sedentary modular animal, the term "individual" (indivisible) is not applicable, since each module, separated from it, can become the founder of another modular individual. Instead of the term "individual", the term "geneta" is used. Geneta is a collection of modules arising from one zygote. It can be represented by one or many modular individuals. All genet modules are genetically identical to each other. A genet can be considered ageless if its fertility does not decrease with age and mortality does not increase. Watkinson and White [43], believe that plant genes meet this requirement. Martinez and Levinton [85], observed the hydra genes for 4 years. During this time, her mortality did not increase. In favor of the potential immortality of genets, one can also say that 1) some types of turbellaria and oligochaetes [36] and many plant species reproduce only asexually; 2) in a large number of plant species, the embryo in the seed is formed from somatic cells (apomixis), that is, their reproduction by seeds is asexual; 3) plant cell cultures do not age.

In unitary species, that is, in species, due to the high integrity of the individual, the ability to reproduce asexually lost, the number of genotypes in the population is greater, since the genotype of each unitary individual (except identical twins) is unique. This, along with the presence of guaranteed death from old age, facilitates the screening of the least adapted genotypes. The selection of the most adapted genotypes from unitary species is also facilitated, since the genetic diversity in their populations is higher than in populations of modular species. The property of aging has an adaptive value [28,86]. In unitary species, it accelerates the change of generations and, due to this, makes the adaptive genetic rearrangement of the population faster necessary for its adaptation to a changing environment. The adaptive role of aging is evidenced by the fact that Metazoa species, whose individuals possess the property of aging, have reached a much higher abundance on Earth than species whose individuals are potentially immortal.

The formation of the property of aging is a consequence of evolution along the path of complicating the structure of an individual

Now let us consider how modular species, whose adaptive capabilities of populations were limited, turned into unitary ones during the evolution, the adaptive capabilities of whose populations became higher. Metazoa evolved from the colonial Protozoa, which embarked on the path of evolution along the path of separation of functions between the cells that made up their colonies. At first, Metazoa's cell specialization was very low. And the lower it is, the higher the ability of cells to re-specialize. The cells of the body of the first Metazoa on Earth were easily re-specialized and the cellular composition of their bodies was continuously updated. There were no non-renewable cells in the body of the first Metazoa on Earth. And their presence is a necessary condition for the individual to have the property to age [87-90]. Therefore, we can assume that the first Metazoa on Earth, like modern sedentary modular invertebrates, were potentially immortal.

In the struggle for existence, those individuals who used resources more efficiently than others, that is, those who used less energy and material resources to spend on adapting to the environment than others, won. And the effectiveness of their use increased with the separation of body functions between its cells, that is, with the specialization of its cells. Therefore, under the influence of natural selection, the specialization of body cells during phylogenesis increased, the number of functionally different types of cells in it grew, its structure became more complicated, and its integrity became larger.

System complexity is an endothermic process. To complicate it, energy is needed [91]. On this path, the first on Earth Metazoa faced an obstacle caused by the lack of ability to move. Being attached to the bottom, they fed on those organisms that accidentally appeared nearby. The low efficiency of this method of extracting energy from the medium limited their energy capabilities. Therefore, the growth in the number of types of cells that perform different functions of the body, having reached a certain size, has stopped. Modern sedentary modular invertebrates are species that have stopped at this stage of evolution. They continued to complicate the structure of their body when they acquired the ability to move. Modern freely moving modular animals, that is, animals that have not yet lost their ability to reproductive, are, I recall, ctenophores, turbellaria, nemerthins, annelids, and echinoderms. They lost their physiological connection with their modules, which began to lead an independent life. The ability to actively move around made their search and pursuit of prey feasible, which opened up new energy sources for them, which allowed them to continue their evolution along the path of complicating their body structure. A freely movable modular individual, having existed for some time, was dying of old age. This death of hers is an atavistic death from the old age of a module of sedentary modular ancestors. But it has not yet accelerated evolution and has not increased the adaptive capabilities of the population, since its descendants, which arose through asexual reproduction, and therefore genetically identical to it, continued to exist. A freely movable modular individual turned into a unitary one when, due to the growing specialization of its cells, its ability to differentiate even more decreased, and as a result, asexual reproduction became impossible. Using the example of modern freely moving modular species, one can observe an independent in different phylogenetic lines loss of the ability to reproduce asexually, that is, the transformation of modular species into unitary ones. In each of these groups of animals, some species are still modular, that is, they can reproduce asexually, and some have already lost the ability for asexual reproduction and have become unitary [36], that is, they have acquired the accelerating evolution property of aging. The complication of the structure of the individual, which made its asexual reproduction impossible, is a turning point in the evolution of Metazoa, which increased their ability to adaptive evolution.

A unitary organism is a module of a sedentary modular individual, which has lost the ability to reproduce asexually due to the growth of integrity. In a sedentary modular, aging was a local process. In a unitary, it began to capture her all. The program of ontogenesis of a unitary individual is a program of the life cycle of a module of a sedentary modular individual, the final part of which was senile involution. The functional system of aging of a unitary individual is a transformed functional system for updating the modular composition of sedentary modular ancestors, that is, a greatly changed functional system of asexual reproduction not fully completed. The destruction of homeostasis of a unitary individual that occurs during its aging is an atavistic local destruction of homeostasis of sedentary modular ancestors that occurred when their modular composition was updated. (Homeostasis is the ability of systems to maintain their internal essence in spite of external changes. At each level of the organization of biological systems, homeostasis has its own characteristics and mechanisms [70]. Reproduction of dedifferentiated connective tissue cells that accompanies senile involution is atavistic reproduction of cells of a newly formed module that replaces the dying.

Thus, the functional system that ensured the potential immortality of individuals of sedentary modular ancestors, among unitary descendants, turned into its opposite - into a functional system that limits life expectancy. Motivational arousal leading to the implementation of a functional aging system is the need for sedentary modular ancestors to change their body shape in response to a change in environment. The formation of the aging property in a unitary Metazoa individual occurred due to the far-reaching specialization of the cells of her body.

A property has arisen to age in a unitary individual during evolution, but it is realized during ontogenesis. Aging is a consequence of the previous stages of ontogenesis, during which undifferentiated cells of an early embryo turn into highly differentiated cells of an adult and non-renewable cells appear.

On the formation of an individual's property based on the parametabolic

theory of aging

Having taken the position of the parametabolic theory of aging [87-90], it should also be concluded that the formation of the property of aging in an individual is the result of its evolution along the path of complicating the structure and increasing its integrity. According to this theory, an important role in aging is played by parametabolic reactions that are harmful to it. Parametabolic reactions are chemical reactions that occur in the body, but are not catalyzed by enzymes. They are inevitable companions of reactions useful to individuals. The products of parametabolic reactions accumulate in non-renewable cells. Because of this, these cells die. Non-renewable cells are highly specialized cells. They play an important role in the body. Their death is a loss for him. It leads to a decrease in the homeostatic properties of the organism and to its death from external or internal causes. But parametabolic reactions are powerless to damage individuals if there are no non-renewable cells in it [87-90]. Therefore, an indispensable condition for the individual to have the property to age is the presence in the body of non-renewable cells.

The author of this theory is A.G. Lebedev, when discussing the aging process, focuses on the biochemical side of things. But the aging process is due, according to his theory, and the structure of the body, the presence of non-essential cells in it. Their presence is evidence of the complexity of its structure and its high integrity. The complexity of the body structure was achieved during evolution. At its early stages, there were no non-renewable cells in it. They appeared during evolution, which went along the path of complicating the structure of the body. Therefore, from this theory it also follows that the emergence of the property of aging is an inevitable result of evolution, which went along the path of complicating the integrity of the individual. And the units of natural selection, leading to the emergence of an individual's aging properties, were individuals.

The property of an individual to age arose in different evolutionary lines of Metazoa independently, along with an increase in its integrity. Most species of Metazoa possess this property. But the most low-integrated species - sedentary modular ones, as already mentioned, do not. They do not have it because their bodies do not contain non-renewable cells. It is widely believed that not only sedentary modular invertebrates are potentially immortal, but also animals standing on much higher steps of the evolutionary ladder - sea urchin, crabs, clam pearl mussel, pike, shark, sea bass, toad, giant tortoise, crocodile, raven, albatross , whale, naked mole rat and bat [86]. This is a strange misconception. Based on the parametabolic theory, individuals in the body of which there are non-renewable cells necessarily age. And these animals, especially mammals and birds, cannot have them. Based on the theory of phylocenogenesis (about it below), a highly holistic system, whether it is a system of an organismic, supraorganismal, or supraspecific level, is always a temporary formation. And the organisms of these animals are highly integrated systems. The reason for classifying these animals as ageless is that they were not observed for long enough. Potential immortality is an ancestral property of Metazoa. It was preserved only in sedentary modular species. The property of aging, appearing, sometimes in the course of evolution, disappeared, but in rare cases. So, O.M. Ivanova-Kazas [36], believes that the ancestors of ascidians led a freely mobile lifestyle. If she is right, then these invertebrates have become potentially immortal as a result of the transition to a sedentary lifestyle and the stubbornness of their structure.

There is debate about whether the property of an individual to age is hereditarily fixed [92-95], that is, whether it could arise through natural selection, the units of which were individuals. From the above it follows that it is hereditarily fixed. It is fixed hereditarily in the complex structure of an individual, in the highly specialized nature of its constituent cells, in the presence of non-renewable cells in its body, and in the low ability of its cells to differentiate.

The property of aging arose independently and repeatedly among representatives of different evolutionary lines

The functional system of accelerating the evolution of aging independently and repeatedly appeared in different evolutionary lines of Metazoa, since the functional system of updating the modular composition in different evolutionary lines of the first Metazoa on Earth appeared independently and repeatedly. About the independent occurrence of the aging mechanism of representatives of different evolutionary lines of animals, I.I. Mechnikov [96]. Along with the considered functional system of aging (it can be called the functional system of senile involution), other functional systems of endogenous weakening of individual homeostasis were formed, the mechanisms of which in most cases are not clear. Protozoa [97], fungi [98-100] and plants [43,101] are aging. In Metazoa, aging mechanisms arose not only in unitary species, but also in modular ones. So hydra (modular organism) is potentially immortal during asexual reproduction [85]. Having begun sexual reproduction, it becomes semiparous, that is, mortal. Ascidia Botryllus schlosseri is also a sedentary and modular organism. It is subject to aging. Her life span is 2-3 months [102].

Females of the branchy crustacean Moina macrocopa die for unknown reasons until their ability to reproduce has been exhausted. Their life expectancy is about a week. The ovary of these inhabitants of rain puddles who died of old age contains oocytes at the final stages of growth, and their brood bags are filled with juveniles that completed embryogenesis [19]. Another branched crustacean is Polyphemus pediculus during parthenogenesis, that is, during the formation of eggs developing without diapause, iterative, but females forming latent eggs are semiparous [1]. In the imago of some insects, the mouth organs are underdeveloped. They cannot eat and, having exhausted the reserve of fat accumulated during larval life, die from exhaustion [103,104]. In a honeybee, ontogenesis is interrupted for an unknown reason until its motor activity and learning ability decrease [105]. Drosophila aging is the wear of its wings [106]. Probably, senile involution in these unitary species did not make evolution fast enough, which made it difficult for their populations to adapt to an unstable environment. To adapt to it, other functional aging systems were needed, interrupting life at an earlier stage and accelerating evolution more strongly.

Body restructuring that occurs in a unitary individual during aging

During the operation of the functional aging system in a unitary individual, donor-acceptor relations arise, which arose in the primitive sedentary modular Metazoa individual when its modular composition was updated. The role of donors in the module of a sedentary individual during the operation of the functional system for updating the modular composition was performed by differentiated cells of specialized tissues of the individual. In a unitary individual, as they age, they also became donors. But the units that the modular ancestors were acceptors, the unitary individual does not. Instead, the connective tissue became the acceptor, replacing dying specialized cells during senile involution. She is probably the homolog of the modules of the ancestors. If this assumption is correct, then in old age the unitary individual turns into a modular one. The functional system of aging is controlled in a unitary individual, as the functional system of updating in sedentary modular ancestors was controlled by intercellular interactions.

The formation of the mechanism of oncogenesis

This section is devoted to the presentation of the hypothesis of the formation of a functional system of oncogenesis during evolution [13,25,107]. During the transformation of sedentary modular species, the mechanism of the functional system of the formation of diapausing somatic embryos in the genome was preserved. Over the long period of existence on Earth, unitary species of mutation unrecognizably changed this functional system, turning it into what is now called oncogenesis. Oncogenesis is a perverse atavistic process of transition of an individual to a diapausing state, inherited from Precambrian sedentary modular ancestors. The property of a unitary individual to form a malignant tumor within itself is a by-product of evolution, which went along the path of complicating the structure of the individual and increasing its integrity. Oncogenesis is the payment that unitary individuals have to pay for the evolutionary advantages that their complex structure and high integrity gave them. A tumor is an atavistic somatic fetus of sedentary modular ancestors preparing for diapause. Like the aging mechanism, the mechanism of oncogenesis is a transformed mechanism of asexual reproduction. Motivational arousal that activates the functional system of oncogenesis is caused by the need for sedentary modular ancestors to remain viable during seasonal environmental deterioration, and oncogenes are the genes that controlled their functional system for preparing for diapause. The destruction of the body that occurs during oncogenesis is the atavistic destruction processes that occurred in sedentary modular ancestors in preparation for diapause. Oncogenesis, based on this hypothesis, is an atavistic process of returning an individual to an embryonic state, rejection of a resistant strategy of adaptation to a deteriorating environment and transition to an atavistic tolerant strategy. It is not possible to complete the return to the embryonic state of a unitary individual with cancer. Death interrupts him long before completion. The notion that all tumor cells are descendants of a single transformed cell [30], the proposed hypothesis contradicts. If a tumor is an atavistic embryo preparing for diapause, then it, like this embryo, arises as a result of dedifferentiation and proliferation of cells of an isolated multicellular zone.

Reproduction of cells of the somatic embryo of sessile modular invertebrates preparing for diapause is a reaction to the threat of damage, to the approaching season unfavorable for life. The propagation of malignant cells is an atavistic reaction to the threat of damage, an atavistic adaptation of the somatic embryo preparing for diapause to the forthcoming seasonal deterioration of the inevitable damage to the environment. Their reproduction is a consequence of the cell not escaping from the regulatory influence of the body, as E.M. Imyanitov (2017) [30], and the process initiated and regulated by the body, since the reproduction of dedifferentiated cells of the emerging somatic embryo preparing for diapause in sedentary modular ancestors was a process regulated and initiated by the body.

Any regulation is carried out by inhibition and stimulation. The immune system inhibits tumor growth. But the tumor can grow, and there is reason to believe that its growth is not the result of the tumor cells overcoming immunological surveillance, but the result of the body stimulating their reproduction. The connective tissue of experimental animals promotes the proliferation of cells of the grafted tumor [108]. The growth of vessels in it also favors him [109]. Immune and humoral cellular responses can lead to increased tumor growth [110]. Among the lymphocytes infiltrating the tumor, T-, B- and plasma cells capable of stimulating tumor growth were found [111,112]. During metastasis, lymphoid cells and macrophages destroy tissues, facilitating the spread of the tumor [113]. Macrophages, fibroblasts, dendritic cells, T-lymphocytes, pericytes, endotheliocytes, nerve cells, as well as non-cellular components, contribute to the initiation of tumor growth and its control at all stages of oncogenesis [114-118].

Malignization of cells is their dedifferentiation. It is an atavistic reaction, which provided the maximum reduction in the individual of the first Metazoa on Earth the role of systemic adaptive reactions and an increase in her role of defense reactions based on individual cell resistance. The differentiation of the cells of the first Metazoa on Earth during the formation of diapausing somatic embryos was aimed at reducing the energy requirements of the individual. Her specialized tissue dying and the formation of diapausing somatic embryos made it possible to reduce energy requirements, thereby maintaining energy balance and avoiding death during an unfavorable season. A unitary individual cannot solve its energy problems in this way. She has the inclusion of a mechanism of outdated adaptation based on a tolerant strategy - pathology.

The propagation of dedifferentiated cells in the distant ancestors of unitary species during the formation of a diapausing somatic embryo with the onset of diapause stopped at a stage similar in structure to the gastrula stage. According to Gateff [119], an increase in the number of tumor cells is only a stage of tumor growth, followed by the cessation of their reproduction. It is rarely possible to observe this because of the death of a patient who usually does not survive to this stage of tumor development. This stop of tumor cell reproduction is the transition of a tumor (atavistic somatic embryo) into a diapausing state.

Reproduction of tumor cells according to A.I. Golubeva and V.M. Dilman [120], is their preparation for differentiation. They do not explain what kind of differentiation they are preparing for. Based on the proposed hypothesis, one should think that their reproduction is an atavistic preparation for the post-diapause differentiation of cells of the forming atavistic embryo. Diapausing somatic embryos of sedentary modular animals can be formed from derivatives of any of the three germ layers [36]. Tumors can also form from different tissues.

The formation of diapausing somatic embryos in sedentary modular species is not a response to damaging factors, but to signaling factors warning the individual about imminent seasonal environmental degradation. Carcinogenic factors are atavistic signaling factors that included the first on Earth Metazoa functional system of preparation for diapause. The factors causing the preparation of diapause in invertebrates can be chemical, physical or biological in nature. A variety of causes, including the mechanism of diapause, explains the variety of causes of cancer.

One of the adaptations of the diapausing embryo of sessile modular invertebrates is paranecrosis, a set of nonspecific protective reactions that, according to existing ideas [121,122], arose at the premetase stage of evolution. Paranecrosis is the switching of the body to the ancient stable pathways of metabolism. In diapausing invertebrates, oxidative phosphorylation is replaced by anaerobic glycolysis, and resistance to damaging factors is increased (Ushatinskaya 1990). These are indicators of paranecrosis [121,122]. Paranecrotic reactions are aimed at preserving the diapausing somatic embryo in a worsened environment, including in a dried and frozen state [2].

In the tumor, paranecrotic reactions also occur. Aerobic metabolism in it is suppressed. Instead, an anaerobic carbohydrate oxidation pathway is used. A tumor is able to tolerate anoxia and hypothermia [123-126]. Thanks to paranecrotic reactions, the vertebral tumor cells, when dried, do not die [127-132], but normal vertebrate cells do not dehydrate. Therefore, the tumor cells that the authors cited last worked with, acquired the property of maintaining viability in a dehydrated state during tumor growth, as did the diapausing somatic embryos in preparation for diapause. The presentation logic gives reason to think that the inclusion of paranecrotic reactions in the tumor occurs closer to the end of its growth, when the transition to the diapausing state approaches.

The predisposition to tumor formation in individuals of the population varies and is an inherited trait. Predisposition to diapause in individuals of a population also varies and is also inherited.

Since the functional system of the formation of diapausing somatic embryos in different evolutionary lines of sedentary modular species arose independently many times, independently many times in different evolutionary lines of unitary species a functional system of oncogenesis arose. The similarity of oncogenesis in representatives of different evolutionary lines of unitary species is convergent. It is explained by the similarity of the processes of formation of diapausing somatic embryos in representatives of different evolutionary lines of the first Metazoa on Earth.

In species forming diapausing somatic embryos, the formation of tumors is not possible. Their functional system for preparing for diapause has not yet turned into a functional system of oncogenesis. In plants, cancer is also impossible for the same reason.

Since the functional systems of formation of resting somatic embryos in plants and sedentary modular animals are similar to each other, the functional system of oncogenesis and the functional system of formation of resting somatic embryos of plants are similar. The processes regulating these functional systems are probably similar. Therefore, researchers looking for ways to decipher the mechanism of oncogenesis need to know the results of studying the formation processes of resting embryos of not only modular animals, but also plants. The formation of resting somatic plant embryos is best studied using the example of potato tuberization [51].

The formation of the mechanism of immunoregulation of oncogenesis

Comparison of the morphogenetic capabilities of immunocytes in animals at different stages of evolution leads to the identification of parallels between oncogenesis and somatic embryogenesis, confirming the proposal of the author and V.V. The hypothesis about the nature of cancer is thinner [13,25,107]. In sponges, immunocompetent cells — archaeocytes and collenocytes [133,134], in stereotypes — wandering cells, mesogley and interstitial cells [133,135]. It has been suggested [136], that vagal amoebocytes of turbellaria endowed with broad morphogenetic capabilities are also evolutionary precursors of hemocytes. In ascidia, the cells whose function is to realize immunological and morphogenetic potentials are lymphocytes, or hemocytoblasts, as well as macrophages and some other types of hemocytes [137,138]. In insects, lymphocytes possess morphogenetic potencies [139].

The participation of the immune system in morphogenesis consists in the fulfillment by its cells of formative and regulatory functions. The ability of immune system cells to perform a formative function, that is, to be a source of tissue construction in normal ontogenesis, is most pronounced in modular species, that is, in the most poorly integrated, located closest to the base of the Metazoa phylogenetic tree. In some sponges, through the aggregation of archaeocytes that have gone beyond the colony, modules that develop without diapause are formed [140]. Aggregation of vagus amoebocytes outside the body leads to the formation of diapausing somatic embryos (podocysts) in the polyp of the scyphoid jellyfish Aurelia aurita [141]. Sponge gemmules are clusters of archaeocytes inside her body. In some ascites, in the formation of somatic embryos, both diapausing and developing without delay, lyphocytes (hemocytoblasts) play a formative role [36]. In contrast to sponges and polyps of A. aurrita scifomedusa polyps, other cells in the formation of somatic embryos, in addition to cells of the immune system, play a formative role in them [36]. In turbellaria, probably all types of body cells can form from vagus amoebocytes [81]. In the formation of regenerative blastema, cells of the immune system participate in ascidia and insects [139]. In insects, a fatty body is formed from hemocytes [139] and in ascites, oocytes [142]. In vertebrates, cells of the immune system perform a formative function in embryogenesis, forming new foci of hematopoiesis, and in postnatal life, creating colonies of stem cells in already functioning hematopoietic organs. Formative immunocompetent vertebrate cells are also found in the regeneration of hematopoietic tissue and in hemoblastoses [143,144].

The immune system controls morphogenesis by destroying cells, stimulating their reproduction, and influencing their differentiation. Histolysis of vital organs is an integral part of the preparation for diapause of sedentary modular species. In sponges, histolysis of cells is carried out with the help of archaeocytes [36], in ascidia, with the help of macrophages and, possibly, other cells of the immune system [53,145,146]. In insects with complete conversion of tissue phagocytosis by lymphocytes, metamorphosis is observed [147-149].

Along with the histolytic, regulatory cells of the invertebrate immune system perform a trophic function. Sponge archaeocytes and ascidian macrophages, swallowing cells or their fragments, become trophocytes. Platelets migrate to somatic embryos (preparing for diapause and developing non-stop) and provide them with nutrients [36]. In insects during metamorphosis, the nutrients of lymphocytes formed as a result of phagocytosis of larval tissues serve for the growth of imaginal stages [148,149,139]. No information was found on the effect of the immune system on cell differentiation in invertebrates. In vertebrates, cells of the immune system direct differentiation of cells [150], promote their reproduction 10, or phagocytize them. Unlike formative regulatory cells of the immune system, having played a role, they die and are not part of the modules and regenerated tissues.

Thus, the formatting capabilities of the cells of the immune system decrease as they move from bottom to top along the branches of the Metazoa phylogenetic tree. In the most primitive Metazoa - sponges and bowls they can be the only material when building a new module. In ascidia, along with lymphocytes, cells that are not immunocompetent participate in the formation by somatic embryogenesis of a new module. In even more highly organized species - insects and vertebrates, due to the loss of ability to somatic embryogenesis, the cells of the immune system cease to participate in the formation of a new organism, but in the processes of normal development and during reparative regeneration, the formative role is still played. The destructive role of the cells of the immune system decreases with the organization of the individual. In sponges and ascidia, in preparation for seasonal environmental degradation, most cell types are phagocytosed by cells of the immune system. In more evolutionarily advanced species (except insects with complete transformation), the volume of destructive processes in normal ontogenesis is less.

With oncogenesis, the lost formative capabilities of the cells of the immune system are restored. In hemoblastoses, tumor lymphocytes of vertebrates, like the formative cells of the immune system of the sponges, A. aurita scyphoid jellyfish polyp and ascites, form malignant tumors, which are also constructed from incomplete differentiation of (malignant) cells. The occurrence of these neoplasms in leukemia is also preceded by migration (along the bloodstream) of immature (malignant) cells of the immune system. Lyphocytes and macrophages of vertebrates during oncogenesis, like archaeocytes of sponges and macrophages of ascidia before the onset of a season unfavorable for life, stimulate the growth of tumors and destroy vital organs. This destruction, as in sponges and ascidia in preparation for diapause, leads to the disintegration of the body, the destruction of its vital organs. Of invertebrates, vertebrates are most closely related to ascidia. In colonial ascidia and vertebrates, the following processes are homologous: 1) destruction of individual modules by immunocytes during their preparation for diapause and destruction of tumor-bearing tissues by lymphocytes and macrophages, facilitating the spread of the tumor; 2) transmission of trophocytes to the growing somatic embryo of nutrients preparing for diapause and immunostimulation of tumor growth; 3) the formative function of lymphocytes (hemocytoblasts) in the formation of diapausing somatic embryos and hemoblastosis.

Body rearrangement for cancer

In cancer, a unitary individual goes into a modular state and it develops atavistic intermodular donor-acceptor bonds absent in a healthy organism, which arose in distant ancestors in their preparation for seasonal environmental degradation. Specialized tissues become donors, and their acceptor is a tumor, an atavistic somatic embryo preparing for diapause. The destruction that occurs in a unitary organism with cancer is the result of the depletion of specialized donor tissues, the nutrients of which are used for tumor growth. The functional system of oncogenesis is controlled by the mechanism of intercellular interactions, since the functional system of the formation of diapausing somatic embryos in sedentary modular ancestors was controlled by it. The destruction of specialized tissues of an individual with oncogenesis is faster than with aging. This is because when preparing for diapause, sedentary modular ancestors had to acquire tolerance to seasonal environmental degradation in a short time. Tardiness threatened them with death from the weather. Premature transition to diapause was harmful, since in this case the individual would underutilize the resources of the environment, which would reduce its chances of remaining in the biocenosis surrounded by individuals of this and other species competing with it.

In a sedentary modular individual, the destruction of modules when updating its modular composition and their destruction in preparation for seasonal environmental degradation are processes that are controlled by the same mechanism - the mechanism of apical dominance. So, in a unitary individual, cancer and aging are controlled by it. Both aging and cancer are, as already mentioned, the very changed mechanisms of asexual reproduction of very distant ancestors. The destruction in the body that occurs during aging and cancer has a common nature. They represent the atavistic destructive processes accompanying asexual reproduction, about which B.P. Tokin [40] and O. M. Ivanova-Kazas [36]. The similarity of changes in the body during aging and cancer, as indicated by V.N. Anisimov [151,152], is explained by the commonality of their origin.

Cancer self-healing

If we could understand how the tumor regression mechanism works [153,154], and artificially launch it in a patient, then the cancer problem would be solved. The way to decipher this mechanism is to decipher the mechanism of its evolutionary predecessor - the resorption of the somatic embryo preparing for diapause in sedentary modular ancestors. Preparation for diapause in sessile modular invertebrates is sometimes reversed. This is because diapause, in the presence of conditions that allow active life, leads to a weakening of the individual's positions in the struggle for environmental resources. Staying in a diapause under favorable conditions for life threatens, as mentioned above, by crowding out an individual from a biotope that other individuals will occupy. Therefore, if the season unfavorable for life is not very harsh and can be experienced in an active state, then the somatic embryos preparing for diapause, which have not yet completed their formation, the individual resolves, and restores the vital organs of the modules that begin to decay. This process is described in colonial ascidia [53,54].

The transition from the formation of modules preparing for diapause to the formation of modules that develop without stopping indicates the functional plasticity of the individual's reproductive system. Functional plasticity in the reproductive system occurs when the population lives in an environment in which the conditions are unstable. The environment is unstable in the waters separated from the oceans. In the oceans it is more stable. Since the mechanism of regression of the tumor in vertebrates exists, it should be thought that they came from sedentary modular ancestors that lived in reservoirs in which the conditions of existence were unstable.

The hypothesis of the adaptive role of oncogenesis

Populations ensure the reliability of their existence through natural selection. Genotypes insufficiently adapted to the environment are screened out by selection. Their screening and predominant reproduction of the most adapted genotypes is a genetic adaptive restructuring of the population. It occurs in response to changes in the environment, strengthens its position in the struggle for existence and makes its existence more reliable. In human populations, health care is opposed to natural selection. The slowdown caused by it leads to an increase in the number of carriers of mutations harmful to health, that is, to the accumulation of genetic load in populations. Genetic burden reduces the reliability of populations. Today it is growing and will continue to grow as long as health care exists. Living systems have the ability to counteract the harmful changes occurring in them. Over-organized population systems also have this property. Sommer [155] and A.V. Liechtenstein [156,157], suggests that the function of cancer is to clear the population of carriers of the genetic load. Malignant neoplasms, they write, killing defective individuals, act for the benefit of the population, increasing the reliability of its existence.

If Sommer and A.V. Liechtenstein is right, the functional system of preparation for diapause, having turned in unitary species into the functional system of oncogenesis, has retained its adaptive role. In sedentary modular species, it was an adaptation of an individual; in unitary species, it became an adaptation of a supraorganism system of a population. The functional system of oncogenesis is probably included in cases where environmental conditions change so quickly that natural selection does not keep pace with them. Cancer of modern man is probably the compensatory reaction of supraorganismal systems of populations to the activities of doctors fighting to prolong the life of carriers of mutations that are harmful to health. The activities of doctors slow down the course of evolution. Oncogenesis accelerates it. It, as a mechanism for cleansing a population of defective individuals, arose through natural selection, the units of which were not individuals, but populations. Those populations in which this mechanism was activated had an evolutionary advantage over populations in which it was less pronounced or absent. If Sommer and A.V. Liechtenstein is right, then cancer reduces the number of patients with non-cancer diseases in future generations. It also follows from their views that cancer is the price that humanity is forced to pay to counteract natural selection. Intervention in an order established in nature leads to consequences, both positive and negative. Having learned to treat non-cancer diseases, humanity was faced with the problem of the growth of genetic burden. What new problems will arise when people learn to treat cancer?

Relationship of cancer problems with other biological problems

Two questions are discussed:

- What ancient mechanism was an evolutionary precursor of tumor regression?
- What direction should research be done in order to understand the mechanism of tumor regression?

In some rare cases, cancer patients recover without antitumor treatment. If we could find out how the mechanism of resorption of a malignant tumor works and artificially launch it, then this would greatly facilitate the treatment of cancer and make this treatment painless. For future clarification of the question of how the mechanism of tumor regression works, it is useful to decide whether the problem of tumor regression is a particular case of which or what more general problems. The purpose of the article is to discuss this issue.

The system of physiological regulation of the body is multistage. It is built on a hierarchical basis. It was formed in the course of evolution by developing more and more efficient and economical compensatory-adaptive mechanisms. Wasteful and ineffective morphogenetic mechanisms of ancient adaptive reactions lost their activity, but their program in the genome was preserved. It is realized in pathological situations. In the dynamics of pathological processes, it is necessary to see not an arbitrary violation of structures and functions, but a regular retreat to the passed stages of evolution and exposure of ancient mechanisms leading to the latent activity. Pathological processes are the processes of the normal ontogenesis of ancestors regulated by the body [158]. Therefore, oncogenesis is also a process regulated by the body, the result of activation of one of the ancient adaptive mechanisms. Which one?

A hypothesis is proposed that offers an answer to this question. According to her, the evolutionary precursor of the mechanism of oncogenesis is an ancient mechanism of transition of an individual to embryonic diapause. In our time, it has been preserved in sedentary modular species, that is, in sponges, hydroid and coral polyps, bryozoans, intrapowder and colonial ascidia. In them, the transition to embryonic diapause is accompanied by great destruction in the body. These destructions are the evolutionary precursor of destructions occurring during oncogenesis. The somatic embryo preparing for diapause in the listed invertebrates is the evolutionary precursor of a malignant tumor. An individual with a cancer does not pass into embryonic diapause because it dies from destruction in the body before it becomes a diapausing embryo. The ancient program of transition to embryonic diapause, which ensured the passage of normal ontogenesis in Precambrian ancestors, is present in the genome of all modern Metazoa. Its implementation in species in which it does not participate in the passage of normal ontogenesis invokes cancer [159]. Thus, the problem of oncogenesis, according to this hypothesis, is an integral part of the problem of embryonic diapause. Hence, the problem of tumor regression is also part of this problem.

Embryonic diapause is widespread among low-integrated organisms. In sessile modular species, diapausing somatic embryos. In sponges, these are gemmules, in stereotypes, podocysts, in bryozoans, statoblasts, in intrapowder and colonial ascidia, resting kidneys. In plants, resting embryos are buds, that is, embryos are also somatic. In hydra, turbellaria, rotifers, oligochaetes, gastrotrich and crustaceans, diapausing embryos are zygotic. They are called latent eggs. Preparation for embryonic diapause in animals is a morpho-physiological rearrangement of the body. In plants, the transition to a dormant state is also a morpho-physiological rearrangement of the body. It occurs in response to signaling factors, for example, a decrease in the duration of daylight. In some cases, signaling factors precede the inevitable deterioration of the environment, in others - a possible but not inevitable deterioration of the environment. In reservoirs in temperate countries in autumn, the habitat deteriorates inevitably. Inevitably, it worsens in summer in raining puddles drying out in dry weather. Rain can prevent them from drying out.

In branched crustaceans, inhabitants of permanent ponds and in puddles not found, the body, upon receipt of a signal of an imminent seasonal deterioration in the environment, is rearranged irreversibly to form latent eggs. Females of these species in laboratory cultures, having begun to form latent eggs, continue to form them until they die naturally and do not go on to lay eggs that develop without diapause. Their reproductive system does not possess the property of functional plasticity. These species do not need it, since winter always follows winter. Other species of branched crustaceans in puddles are found. Their body, having received a signal about the drying out of the puddle, is being converted to the formation of latent eggs reversibly. In the course of evolution, their reproductive system acquired the ability to transfer from the formation of latent eggs to the formation of sub-eggs. Having made one laying of latent eggs, they usually proceed to the formation of eggs that develop without diapause. They need the functional plasticity of the reproductive system and therefore they have developed it in the course of evolution. Staying in diapause under favorable conditions for life (in those cases when the rain prevented the puddles from drying out) is fraught with crowding out the population from the biotope by populations of other species [160].

The reproductive system probably has functional plasticity in many species of animals and plants in which early zygotic or somatic embryos fall into a state of rest and which, in addition to these embryos, form embryos that develop without stopping. The problem of functional plasticity of the reproductive system did not attract the attention of biologists. In addition to the above, the author knows only two more described cases of functional plasticity of the reproductive system. The first is in Jerusalem artichoke, or tuberiferous sunflower. This plant, having begun to form tubers with buds on them, can stop this process and continue the formation of buds that develop without a dormant period [161]. The second is in colonial ascidia. They can, having begun to form somatic embryos preparing for diapause, dissolve them and return to the formation of embryos developing without diapause [162,163]. Circumstances requiring the development of a functional plasticity in the reproductive system can arise not only in rain puddles, but also when living in other biotopes .. If oncogenesis is really an atavistic preparation for embryonic diapause, then the transition from the formation of somatic embryos preparing for diapause to embryo formation developing non-stop is the evolutionary precursor to tumor regression. Then the problem of tumor regression is part of the problem of functional plasticity of the reproductive system.

In sedentary modular animals and plants, the morpho-functional rearrangement of the body during the transition from the formation of embryos, developing non-stop to the formation of embryos preparing for rest, is especially deep. In this preparation, actively functioning zooids are completely absorbed in animals, and the nutrients contained in them go to the construction of embryos preparing for diapause and serve for their development after the end of diapause. In trees and shrubs, in preparation for rest, nutrients from the leaves pass into the forehead and the leaves fall off. These nutrients also serve for the development of resting embryos in the next season. In herbaceous plants, during the formation of resting buds, the aerial part dries out and nutrients from it pass into rhizomes, root crops, or tubers on which the resting buds are located. The reverse transition from the already begun preparation for the formation of embryos preparing for rest to the formation of embryos that develop without stopping also requires a deep morphological and functional reorganization of the organism in animals and plants. If the proposed hypothesis about the nature of oncogenesis [164], is correct, then deciphering the mechanism of this reverse transition is the way to deciphering the mechanism of tumor regression.

Why does humanity need a generational change?

The hope to free ourselves from the inevitability of aging and extend life indefinitely is common in us and in other countries. Evidence of a misunderstanding of the important role of generational change for the existence of mankind is on immortalism texts on the Internet. Aging according to V.P. Skulacheva et al. [28,29], are harmful atavism. It is necessary and possible to get rid of it. V.P. Skulachev et al. Believe that human populations do not need to evolve, that is, to genetically rearrange themselves by natural selection in response to environmental changes. Human populations adapt to its changes, they think, not evolving, but transforming the environment in relation to their needs. Let us discuss whether a person is evolving and what will bring V.P. Skulachev and his co-authors turn a person into a potentially immortal being.

Man, like all life on Earth, is evolving. It is susceptible to mutations, horizontal gene transfer, genetic recombination, gene drift, and the transfer of gene alleles from one population to another [165]. Mutagenic process in humans due to the action of mutagens of anthropogenic origin has accelerated in our time [166]. Man evolves through natural selection. Resistance to adverse environmental factors caused by civilization, whether abiotic, biotic or social, is a genetically determined trait [167,168]. People fall ill whose mechanisms of adaptation to the conditions of modern life contain defects. Genotypes that are unable to withstand the adverse factors of our time are eliminated, and in populations, although very slowly, their resistance to them increases. Human populations, contrary to V.P. Skulachev and co-authors [29], adapt to environmental changes not only transforming the environment, but also by restructuring their genetic composition, that is, screening of unsuitable individuals. The approximate size of this dropout can be judged by the following data: 15% of embryos die in the early stages of ontogenesis, 3% of infants are born dead, 2% of them die immediately after birth, 3% of those born die before the reproductive period, 20% of adults do not marry . As a result, in each next generation, approximately half of the population's gene pool is not reproduced [166]. By adapting the environment to his needs, man has destroyed many species of animals and plants. If the decline in biological diversity continues, then evolution will accelerate dramatically. A compensatory avalanche outbreak of speciation will occur. Some of the newly emerged microorganisms will be pathogenic [169,170]. Before they can be found to combat them, they will cause screenings of non-immune genotypes. This screening is happening in our time. Pathogens evolve, humanity in response to this by natural selection evolves towards the development of immunity to them. There is a coupled evolution of humans and pathogens. Failing to evolve the potentially immortal people whom immortalists intend to create will be due to the emergence of new microorganisms and due to the evolution of existing ones, they are doomed to extinction.

Transforming the environment, man polluted it. We breathe air containing substances harmful to our health, drink purified water from industrial and domestic wastewater, and eat food containing heavy metals and pesticides. We are affected by radiation and electromagnetic fields. The consequence of this was the widespread occurrence of environmentally related diseases. Potentially immortal people will not have a generational change. Natural selection will cease. People will face death not from old age, but from environmentally caused diseases. Therefore, it is unlikely that immortalist populations of potentially immortal people will last long. Adapting the environment to its needs, mankind has come close to socio-economic and global environmental crises. Intensively using the resources of the environment, it exceeded the capabilities of the biosphere. The unrestrained growth of the world economy has led to the fact that the resources of the planet are exhausted. Continued development of the economy along the same path is fraught with disaster. The economic collapse of modern world civilization is approaching [171-178].

In the context of global ecological and socio-economic crises, the possibilities of a person's adaptation to the environment through its change will narrow and the role of natural selection will increase. Potentially immortal people will die out in the context of global environmental and socio-economic crises. But even if the ominous predictions of the global environmental crisis and the collapse of civilization do not come true, they cannot last long. The experience of recent history teaches that periods of relative prosperity of mankind alternate with wars, during which there is a mass death of not only military personnel, but also civilians. Potentially immortal people cannot survive wars.

The intentions of the immortalists, if they could be realized, would not bring good. Swift's Tale of Gulliver's Tale describes the immortal people of strolldrugs living in the country of Laggnegg among mortal people. Swift strulbrugs are unhappy people dreaming of death, doomed to eternal impotent old age, suffering and illness. They are stubborn, quarrelsome, greedy, gloomy and talkative, not capable of friendship and love. They all hate and despise. Most likely, immortalists will not be able to realize their plans. In a unitary individual, a functional aging system is an indispensable part of ontogenesis, since a functional system for updating the modular composition of modular ancestors was mandatory. The inevitability of the cessation of the existence of a unitary individual is guaranteed in addition to the aging mechanism by oncogenesis, inflammation, and other pathological functional systems. To make a person a strollbrug, you need to simplify the structure of his body. The undesirability and impracticability of this is obvious. Genets of modular organisms in natural conditions in the mass due to various external reasons cease to exist. But they have a chance to live forever. Unitary individuals do not have it. Only the change of generations will allow a person, despite the cataclysms expected in nature and in society, to remain an integral part of the biosphere.

The habitat of a species, a member of a particular community has changed in the past, is changing at present and will change in the future, as other species of the community are evolving, on which its existence depends. The abiotic environment of the species has changed, is changing and will change. Because of this, the effectiveness of the devices developed by the former is reduced. To survive, the mind needs to evolve in response to these changes. If the development of new adaptations keeps pace with the changes in the ecosystem, the species will remain a member. Otherwise, he will die out.

Man is adapted to life in the biosphere, which is destroyed due to his economic activities. A new biosphere is being established with a new species composition and with a new chemical composition of water, soil and air. A person is not adapted to life in it. To remain an integral part of it, he needs to evolve. It can evolve only on condition of a change of generations. Aging, oncogenesis and other pathological processes provided the human ancestors with a strong position in the changing biosphere, provide it in our time and will continue to provide.

Establishing properties to age in systems ranking above organized

Can systems above the organismic be units of natural selection?: Systems of a higher rank than the organism, which we will talk about aging, are communities of social insects, human societies, and multi-species systems. Do they grow old and, if they do, do they, like systems of the organismal level, form in them the property of aging as a result of natural selection? A number of authors [179-183], deny the possibility of natural selection, the units of which are systems above the body level or doubt its capabilities. However, selection can operate at the level of multi-species systems [184-186]. This is shown experimentally [187]. In order for systems to evolve, that is, to be units of natural selection, the following conditions are necessary and sufficient: 1) they must have phenotypic variability, 2) phenotypic modifications of systems must be associated with their different usefulness for systems, and 3) useful properties of phenotypic modifications must be inherited [185]. The named systems meet these conditions. They have phenotypic variability, phenotypic modifications are associated with their different usefulness for systems, and the properties of these systems are inherited. They are inherited because they have an analogue of the genotype of the organism. In supraorganismal systems, it is the totality of genotypes of their constituent individuals and the totality of hereditarily fixed interactions between individuals. In human societies, interactions between people are not only genetically fixed. They are also determined by education, training and legal laws, which are also passed down from generation to generation, that is, inherited. In multi-species systems, the analogue of the organism's genotype is the totality of genotypes of individuals and species and the totality of hereditarily fixed interactions between individuals and between species [188,189]. Therefore, supraorganismal and multispecies systems can be units of natural selection. Let us now consider whether they age and if they appear as a result of natural selection, highly specialized non-renewable elements and, if they appear, then does their presence in them, as in systems of the organismal level, cause the property to age.

Formation of the property of aging in communities of public insects

Public insects are ants, bees, wasps, bumblebees and termites. Their community is an expanded family, all of whose members are descendants of the same parental pair. The community arose as a result of evolution, which followed the path of separation of functions in the family between its members. At first, there was no specialization of individuals in the family. Between these family communities, the ancestors of modern communities, there was an intraspecific struggle. Natural selection, the unit of which was the community, selected those that used the resources of the environment more efficiently than others, that is, those who used less resources to adapt to the environment than others. And less they were spent by those communities in which there was a division of family functions between individuals. Therefore, in the course of evolution, families appeared in which functions were divided between its individuals and in which the specialization of individuals grew. In modern communities, it has reached a very high level. The queen can only lay eggs. Working individuals are specialized to perform other functions and cannot reproduce. Bumblebees, wasps, and some termite species have one queen in the community. Such communities are phylogenetically primary. They exist while the queen is alive. When it ceases to lay eggs due to old age, the death of working individuals becomes uncompensated and communities gradually disappear [190,191].

Thus, the formation of the property of aging in the community of social insects arose as a result of natural selection along the path of growth of specialization of its constituent individuals, that is, along the path of increasing the complexity of its structure and integrity. Separating community functions between its elements is a useful process for it. He improved resource efficiency. But the inevitable companions of beneficial processes are harmful processes. Aging is a bad sign for the community. The community is given the property of aging by the presence in it of an important, but non-renewable element, the queen. Communities of social insects have an analogue of the parametabolic reactions of the body - the inability of working individuals to replace the queen in case of her aging and death. The property of a community to grow old is its payment for the advantages it receives in the struggle for existence due to the high specialization of its members. The property of aging in them arose as a by-product of natural selection, aimed at complicating their structure and integrity.

Let us extend the idea of the double development of biological systems — individual and historical [189], to the community of social insects. Its individual development is a chain of events, the beginning of which is the mating flight of a male and a female, and the end is the extinction of the community due to the death from the old age of the queen, the founder of the community. The historical development of a community is its evolution along the path of adaptation to a changing abiotic and biotic environment. The property of aging in communities was formed during the historical development of the community, but it is realized, like the property of aging in an individual, in the course of its individual development. After the mating season, the fertilized female, the future queen of the anthill, having thrown off her wings, builds a nest and lays eggs. She herself takes care of them and of developing larvae - future working individuals. But when the working individuals are born, they take on most of the functions that ensure the existence of the community. Now the queen’s only function is to lay eggs, and her aging will be aging and a community that will die out soon after her death. The property of a community to age, like this property of an individual, is a consequence of the complexity of its structure, its high integrity, a consequence of the processes of specialization of elements that occur during its individual and historical development.

The formation of the property of aging in human societies

Human society has all the properties of biological systems - genetic uniqueness, integrity, hierarchical organization, the ability to self-regulation, development, reproduction and adaptation. It arose as a result of biological evolution as an integral part of the biosphere and consists of elements that have all the characteristics of a biological species. Functions in society, as in other biological systems, are divided between its elements. Society, like other biological systems, exchanges matter with the environment. Through it, just as through other biological systems, a stream of energy flows. Therefore, although the main reason for the aging of society is social processes, it is possible and necessary to discuss from a biological point of view, why it is aging. According to V.V. Jerichina [169], the processes that took place in the course of history in human societies have much in common with the processes that took place during evolution in multi-species systems.

The growth in the course of evolution of the degree of integrity of the system is the gradual transformation of its updated elements into hard-to-update, and then into non-renewable specialized elements. The presence of non-renewable elements makes the system age. Therefore, the higher the degree of integrity of the system, the greater the likelihood that it will cease to exist due to internal reasons. And, conversely, the lower the degree of its integrity, the lower this probability. Low holistic systems do not age. The degree of integrity of the system is measured, as mentioned above, by its ability to retain its specific features in spite of external influences seeking to break it [68]. In human societies, the ability to retain their specific characteristics in spite of external influences seeking to disrupt them is less pronounced than in communities of social insects. In a short time (from a geological point of view), a person moves from a tribal lifestyle to life in the state. The state is changing its specific features - it is moving, for example, from paganism to Christianity, from Christianity to atheism and to the building of communism, from its building to the restoration of churches and to liberal reforms. The lifestyle of community insect communities is more conservative. They have the ability to retain their specific characteristics in spite of external influences is more pronounced.

The degree of system integrity is also measured by the interdependence or, on the contrary, by the autonomy of parts, by a greater or lesser subordination of parts to the whole [40]. The interdependence between elements of human society is lower than between elements of communities of social insects. A cell of a human society a family can leave society and move to live in another society, or it can settle outside of society, in a forest or on a desert island. Social insects cannot live outside their community. This means that the integrity of human societies is lower than the integrity of communities of social insects.

The idea of the dual development of a complex biological system - individual and historical [189], applies to human society. The individual development of the community of public insects with aging is nearing completion. His ability to age is easily explained by the complexity of his structure, the high degree of its integrity and the presence in it of an non-renewable element - the queen. The individual development of human society is a chain of events from its occurrence to the cessation of existence, for example, from the founding of Rome to the fall of the Roman Empire. In human society there are no non-renewable elements, but there are only hard-to-update elements - highly qualified specialists. Based on the fact that human society is less holistic than the community of social insects, and the fact that there are no non-renewable elements in it, one could assume that the individual development of human society does not have to end with its aging. But history testifies that human societies are temporary formations. Ancient and ancient societies, if external influences did not destroy them at the very beginning of formation, having existed for some time (according to K.N. The property of aging in them arose, like this property in an individual and in the community of social insects, due to natural selection. Its units were human societies. The survival of a society competing for resources with other societies was facilitated by the more efficient use of environmental resources than among other societies. Those societies that used them more efficiently than others and, therefore, spent less on adaptation to the environment, won the competition. And the efficient use of resources was facilitated by the division of labor between citizens, that is, their specialization. Specialization of citizens is a complication of the structure of society and the growth of its integrity. Natural selection, contributed to the formation in societies of the social layer, consisting of specialists, masters of their craft. Thanks to them, wealthy societies won victories, and science and art flourished in them. Those societies that did not care about the growth of qualifications of their citizens were eliminated. Having achieved prosperity, ancient and ancient societies, as history testifies, fell into decay and ceased to exist. Their death was usually caused by external influences or internal shocks that occurred in them. But neither external influences nor internal shocks were its cause, but an endogenous decrease in homeostatic properties. And this decrease was associated with an increase in the specialization of citizens, that is, with a high integrity of society. The property of human society to grow old is a by-product of natural selection, aimed at complicating society and increasing its integrity.

The history of the development of Western European civilization, which began after the fall of the Roman Empire, is the history of the natural selection of societies that appeared and disappeared on the geographical map of Western Europe. Natural selection, the units of which were societies, contributed to the growth of the qualifications of specialists, the complexity of the structure of societies, and the growth of their integrity. At first, this led to an increase in the reliability of the existence of Western European civilization, but then there were signs of a weakening of its homeostasis. This was noticed by K.N. Leontiev [192] and O. Spengler [193].

Article K.N. Leontyev's "Byzantism and Slavism" was published in 1875 and published as a separate book in our time [192]. In it, he considered the history of Western European civilization as a special case of biological development, that is, a gradual ascent from the simplest to the most complex. Development by K.N. Leont'ev begins with initial simplicity, then blooming complexity ensues, followed by a secondary mixing simplification, ending with the cessation of society. In Western European States, according to K.N. Leontief stage of initial simplicity was the middle Ages. Since the Renaissance, the integrity of states began to grow and their intra-state diversity increased (legal, religious, regional, estate, ethnographic, philosophical and artistic). From the XV century the stage of blooming complexity has come. At this time, Western European civilization spread beyond Western Europe. In the middle of the XVIII century. Its secondary mixing simplification began, which, according to K.N. Leontiev to its destruction.

O. Spengler in his book Der Untergang des Abendlandes: Umrisse einer Morphologie der Weltgeschichte, published in 1918-1922 and translated into Russian under the title Sunset of Europe [193], also predicted the destruction of Western European states. Spengler society goes through two stages in its development - the stage of culture and the stage of civilization. The stage of culture is childhood, youth and the maturity of society, the stage of civilization is its old age. Modern Spangler (that is, the beginning of the 20th century), the inhabitants of Western Europe lived, in his opinion, at the stage of civilization, after which the collapse of society would follow.

The contribution of Western European civilization to world civilization, wrote K.N. Leontiev, great. Indeed, inventions of Western Europeans (a microscope, a telescope, a mechanical watch, a bicycle, a car, the Internet, railways, metro, airplanes, helicopters, power plants, etc.) are used all over the world. Nowadays, Western European civilization, contrary to the prediction of K.N. Leontiev, although mixed, but not simplified. The complexity of its structure continues to grow. However, in accordance with his and Spengler's prediction, according to many [172-178], collapse threatens her. The discussion in the press about the possibility of its collapse is evidence that K.N. Leontiev and O. Spengler are not without foundation. The homeostatic properties of Western European civilization are declining, and the reliability of its existence is declining.

The existence of Western European civilization is ensured by the work of very narrow specialists, much narrower than ever before and elsewhere. Thanks to the deepening social division of labor, environmental resources are used much more efficiently than before. And much more strongly than ever before and elsewhere, there are analogues of parametabolic reactions, that is, uncontrolled by society harmful processes associated with useful processes for it - the growth of the genetic burden in populations, environmental pollution, near exhaustion planet resources, etc. The fertility of women has decreased. This is due to the fulfillment by them of functions requiring qualification, that is, with their specialization. The slowdown in population reproduction also weakens the homeostatic properties of Western European civilization, since it will make it difficult to recover in case of damage. The damage caused by analogues of parametabolic reactions is the payment of Western European civilization for the benefits acquired by them as a result of the activities of highly qualified specialists.

Hopes are also laid on specialists for the development of means to combat the negative consequences of scientific and technological progress. However, their solution of some problems gives rise to others requiring their new efforts. The problems accumulating in Western European civilization reduce the reliability of its existence. In the event of its collapse, if it occurs, highly qualified specialists will be the first to disappear from it. They, as well as highly specialized cells of a unitary individual, are a target for harmful processes uncontrolled by the system that accompany processes useful for the system.

Thus, the aging of human society, as well as the aging of an individual and community of social insects, is caused by the harmful effects of the processes of specialization of the elements that it consists of, useful to it. Aging of human society is a by-product of selection, which goes in the direction of complicating society and increasing its integrity. Useful for human society processes of the division of labor between citizens and a further narrowing of their specialization, which first helped society to win the struggle for existence with other societies, become harmful to it.

Is it possible to prevent the collapse of Western European Civilization?

When considering from a biological point of view the future of Western European civilization, it should be borne in mind that social processes are not crucial for its fate. Therefore, discussing from a biological point of view the question posed in the heading, one has to step on unreliable ground of assumptions, and draw conclusions based on far from incomplete knowledge. The discussion of the question from the biological point of view, which is carried out here, can only answer whether there is a fundamental possibility to prevent its collapse or whether there is no such possibility, as there is no way to rejuvenate an aging unitary individual.

Many types of public insects have found ways to prevent the aging of their communities. Here's how they did it. Communities of social insects in which only one queen, as mentioned above, is phylogenetically primary. New communities of social insects are created after the mating flight of sexual individuals. The period of solitary life of the fertilized founding female is the most dangerous in the life of the community. Most potential female founders die from predators. Therefore, independently of different species of ants, fertilized females began to return to their native anthill and lay eggs under its protection. And different types of termites began to be grown in termite mounds of additional females and males capable of reproduction. Now the life of these communities has ceased to depend on the life expectancy of the female founder. Communities of honey bees got rid of the ability to age differently. There is one uterus in the hive. When she grows old and her fecundity decreases, worker bees grow another and kill the old one. Some wasp species in communities have female breeding species capable of breeding. While the queen is alive, they do not use this ability, but in the event of her death they begin to lay their eggs and the life of the community is not interrupted [191,192]. Thus, many types of public insects found a way to rejuvenate their communities. Therefore, biological patterns allow rejuvenation of supraorganismic complex systems allow. From a biological point of view, rejuvenation of Western European civilization is possible. Of course, it is impossible to borrow the mechanism of rejuvenation from social insects to prevent its collapse, since the organization of their communities is fundamentally different from the organization of human society.

Since the integrity of human societies is lower than the integrity of social insect communities, it is easier to rejuvenate them than insect communities. But will social patterns allow rejuvenation of Western European civilization? E.V. Balatsky [194] writes that there are laws that automatically presuppose the self-destruction of any social formation. The biggest problem in preventing the collapse of Western European civilization, according to Ehrlich and Ehrlich [174], is the difficulty of convincing politicians and economists of the need for fundamental changes in society. Everyone does not like the consequences of continuing the development of society along the chosen path, writes Rull [195], but no one wants to make the necessary sacrifices to solve the problem. The human mind is still insufficient to ensure appropriate behavior on a global scale, writes M.M. Kamshilov [196]. Species of public insects, whose communities have become potentially immortal, have benefited existing communities. But the future is not for them, but for those species whose communities have preserved the property of aging. Aging communities of social insects evolve faster than potentially immortal ones. Therefore, it will be easier for them to adapt to future changes in the environment. And these changes will undoubtedly be. The death from the old age of human societies increases the reliability of the existence of a higher system - humanity. Maybe because Homo sapiens and the flourishing species, because in Antiquity and Antiquity it was represented not by potentially immortal societies, but by societies that had the property of aging?

Formation of the property of aging in multi-species systems

The evolution of the property of aging in multi-species systems is examined by the theory of phylocenogenesis created by paleontologists [169,190,197-199]. Phylocenogenesis is the evolution of multi-species systems. The evolution of multi-species systems ends with an endogenous decrease in their homeostatic properties, that is, their aging. According to this theory, multi-species systems of past geological epochs have evolved in the direction of increasing biological diversity, but to a certain limit. Having reached it, they, because of limited resources or because of the impossibility of their use due to a certain structure of organisms, stopped to become more complicated. At this stage, when biological diversity was maximally possible with a given structure and physiology of the constituent multi-species systems of species, the effectiveness of their homeostatic mechanisms was greatly reduced. External influences and internal shocks at this time could easily destroy them and really destroyed them. This led to global environmental crises, as a result of which multi-species systems ceased to exist. But neither external influences nor internal shocks were the cause of their death. They were only an impetus to her. The prerequisites for their disappearance from the face of the Earth were formed in the course of their previous evolution, which followed the path of growth of biological diversity. Let us consider why a very high biological diversity reduced the homeostatic properties of multi-species systems and caused their death.

But first you need to retreat. A multispecies system can be a community, a group, or possess properties that are intermediate between them. A community is a multi-species system whose species composition is rich and relatively constant. It is composed of coenophiles - highly specialized species adapted to live together. Coenophiles are members of the biota of the final stages of succession. As a rule, they do not occur outside of communities in nature. Grouping is a multi-species system that occurs in habitats that have been destroyed or re-emerged as a result of geological processes that have not yet been captured by communities or unsuitable for their life. Groupings are made up of coenophobes, non-specialized, unpretentious and eurytopic species that do not have adaptations for coexistence. They are members of biota in the initial stages of succession. The species composition of the groups is poor, unstable and depends on the case [190,200].

Now let’s move on to the issue. Global environmental crises have occurred many times in the history of the Earth. In the Paleozoic, they repeated after 37 million years, in the Mesozoic and Cenozoic - after 26 million years [201]. As a result of the crises, the coenophiles died out, only coenophobes remained and biodiversity on Earth sharply decreased. In place of communities, groupings arose. Between them began the struggle for resources. It was a natural selection, the units of which were groups. He led to the fact that those who survived more efficiently than others used the resources of the environment, that is, those who spent less on adapting to its changes, survived. And the effectiveness of their use was facilitated by the separation of the functions of groups between their constituent species. Therefore, there was a specialization of species and an increase in their number in groups. The specialization of species is the phased transformation of coenophobes into coenophiles, and groupings into communities. At first, this increase in biological diversity increased the reliability of the existence of multi-species systems. But the very narrow specialization of species and the increase in their number began to reduce it. First, they reduced the fecundity of species. Coenophiles (and they are K-strategists) are less prolific than coenophiles (r-strategists). Therefore, coenophiles are hard-renewing elements of the supraspecific system. The decrease in the fertility of species slowed down the elimination of the consequences of damage to the multispecies system, i.e., its homeostatic properties weakened. Secondly, in systems, as a result of an increase in the number of species, it became crowded. Since the resource used by the system is finite, the growth in the number of species decreased the amount of the resource that each of them got. Because of this, the availability of resources to species was deteriorating. This weakened their homeostatic properties and, consequently, the homeostatic properties of the entire multi-species system. Thirdly, with the increase in the specialization of species, the specialization of the entire multi-species system also increased. This tightened its requirements for the environment, and, therefore, also weakened the homeostatic properties of a multispecies system. At the final stages of the growth of biological diversity, the multi-species system became unstable. The crisis of the biosphere, consisting of such systems, could even cause a slight destabilizing external impact or internal shock [202,203,169,190]. As K.N. writes Leontiev [192], flowering complexity (that is, high biological diversity) is an inevitably temporary phenomenon. It is a harbinger of reducing the homeostatic properties of systems and the cessation of their existence. Thus, the growth of biological diversity, that is, the complexity of a multi-species system, the growth of its integrity led first to the strengthening of homeostatic properties, and then to an endogenous decrease in the ability to maintain one’s homeostasis. The selection of multi-species systems was aimed at increasing the specialization of the species that composed them, and at increasing biological diversity. The decrease in the homeostatic properties of multi-species systems, that is, their aging, occurred as a by-product of this selection, the units of which were multi-species systems.

It is believed that the mid-Cretaceous global environmental crisis, during which most of the terrestrial and marine species that existed then, was caused by the fall of a giant meteorite onto Earth. According to V.V. Jerichin [202,169], the main author of the theory of phylocenogenesis, the fall of the meteorite was not the cause of this crisis, but an impetus that launched the processes of destruction of the biosphere that had already matured by that time in the biosphere. By the time the meteorite fell, its homeostasis was weakened due to the processes occurring in it.

Can a global environmental crisis be prevented

As already mentioned, the higher the degree of integrity of the system, the greater the likelihood that it will cease to exist due to internal reasons. The degree of integrity of multi-species systems is much lower than the degree of integrity of the unitary Metazoa and community of social insects. And in multi-species systems there are no non-renewable elements, reasons for the temporary existence of an individual and community of social insects, but only difficultly updated elements (coenophiles). Therefore, one could assume that they are not threatened with the destruction of homeostasis due to internal reasons. But paleontology suggests that multi-species systems are temporary formations.

The internal causes causing a decrease in the homeostasis of multi-species systems during evolution are not equivalent. The main one is the appearance within them of a species or taxon of a higher rank that destroys the system from the inside [204,205]. The cause of the current global environmental crisis is man. We are a product of the biosphere, part of it. Therefore, it cannot be said that the biosphere is being destroyed in our time due to external causes. It is self-destructing. Human economic activity reduces the ability of multi-species systems to extract energy from the environment. Because of this, the energy-demanding connections between the species included in them are broken. The coenophiles, who depend on these connections more than others, are dying first.

Torn due to energy deficiency of multi-species systems and the connection between the sexes. Apomixis is now widespread - sexual reproduction without the participation of males. It has been described in macroalgae, fungi, char, lichens, mosses, ferns, gymnosperms and angiosperms, rotifers, crustaceans, insects, fish, amphibians and lizards. Many apomicts have not yet been identified [206-208]. Reproduction involving both sexes requires a higher expenditure of energy from the supraorganism system of the population than unisexual reproduction [209,210]. Apomixis reduces the number of intrapopulation interactions requiring energy costs. With apomixis, there is no expense in maintaining the structure and functioning of males, in meeting sexes, in courtship rituals, or in pollination. The transition to apomixis allowed populations in conditions when their metabolism is disturbed due to anthropogenic environmental degradation and they experience energy deficiency, reduce energy expenditures for their maintenance and thus maintain energy balance and avoid death from energy deficiency. Apomixis is evidence that the crisis of the biosphere has already come.

Paleontologists can judge the consequences of the modern crisis for humans better than others. They know what previous global environmental crises have led to. That's what VV thinks about it. Jerichin [169]. If the destruction of existing multi-species systems goes deep enough, new stable multi-species systems will not arise either with our grandchildren or with our great-great-great-great-great-grandchildren. The process of establishing new multi-species systems will take tens of millions of years. Future generations will have to live in a world with an unstable nature, unsteady, uncertain, tomorrow is not the same as today. In such a world, it will be unusually difficult to plan your activities. Even the usual, just yesterday, reasonable actions will lead today to unexpected consequences.

The destruction of multi-species systems will lead to a sharp increase in the rate of evolution. There will be completely new organisms with unusual unexpected properties. It is likely, writes V.V. Jerichin [169] that as the ecological crisis develops, an increasing number of species will embark on the path of synanthropization and many of them will use the same resources as humans, that is, they will embark on the path of competition with humans or will cause new unknown diseases. These species will be resistant to environmental pollution and to control their abundance. They will destabilize the economy, divert forces and means to combat them and the diseases they cause.

Why did the reasonable in their intentions human activities on the biosphere scale turn out to be in the past and turned out to be unreasonable in our time? The answer, apparently, is this. When the mind came to the forefathers of man, thanks to this they gained a great advantage in the struggle for existence over other species. They took advantage of these opportunities and began to use them to the maximum. Cyanobacteria also behaved in the Proterozoic, using the energy of sunlight and saturating the anaerobic environment with oxygen, which destroyed most of the then existing anaerobic species and caused a global ecological crisis [211]. Angiosperms also behaved in the Cretaceous period, which, using their advantages over ferns and gymnosperms, supplanted them. And ferns and gymnosperms then lay at the base of the food pyramid on land. Their death also signified its collapse, that is, the global environmental crisis [169,202].

It is difficult to deal with a crisis when its signs are already evident [212]. And they are obvious. Point of no return passed. This happened when a person appeared in the biosphere that caused an internal shock to the biosphere. Its biological properties made another crisis of the biosphere inevitable. Stop the crisis is unlikely to succeed. The experience of environmental measures, which in most cases are unsuccessful, confirm this. Global environmental crises are inevitable and necessary components of evolution that cannot be stopped [170,213,214].Crises perform sanitary functions in the biosphere [215]. Crisis is a natural stage in the normal development of any system that is capable of changes. There can be no crisis development [216].

Humanity does not counteract the threat of environmental disaster. It directs its main efforts not at preventing the grave consequences of the global environmental crisis, but at the invention and improvement of increasingly sophisticated and effective means of mutual destruction. A broad declaration of interest in nature conservation is combined with a complete lack of interest in society [217]. Big business supports carriers of those views and schools in science that minimize its financial costs for nature conservation [218]. Humanity on a biosphere scale behaves like an ordinary biological species. Despite the presence of a person's mind, his role in the evolution of the biosphere does not differ from the role of other species that have caused global environmental crises in the past. With the advent of man, the biosphere continues to evolve along the same path that it evolved to before it. The role of man in the modern crisis of the biosphere does not differ from the role of species that caused the previous environmental crises. The biosphere is developing according to its own laws, which humanity, as part of it, must follow and, as we see, follows. The transformation of the biosphere into a noosphere in which mankind would manage to its advantage the processes occurring in it is not feasible, since the biosphere has much higher regulatory capabilities than humanity [219].

The possibility of influencing the course of events in the biosphere of mankind, although limited, still exists. Systems during crises are in an unstable state. Until the crisis is over, a person can turn the course of events in the biosphere in a less harmful direction [215]. The task of science is to indicate the ways of this impact on the biosphere.

Does extinction threaten humanity?

Some authors, for example, F. Kotsura and Z. Atarashvili [220], think that people can disappear from the face of the Earth due to changes in their environment that they caused and which they cannot adapt to. Assume the imminent extinction of man and due to another reason. It is believed that species are aging. According to it, the life of the species is predetermined. A species in the course of evolution, as an individual in ontogenesis, survives adolescence, maturity and old age, after which it dies out. The first to set out these views was Brocci. An overview of the works of his associates is contained in the book of L.Sh. Davitashvili [221]. Supporters of the views of Brocci are now. V.A. Kurdyum [222], writes that the species loses its ability to develop over time. Having appeared, he is already doomed. The more successful it is, the larger the cemetery of the remains will go to the future. By A.P. Akifiev and A.I. Potapenko [223]. The cause of extinction of a species may be aging in a series of generations of germ cells. These authors suggest that the aging of a species, like the aging of an individual, is caused by its hereditary program, and they ask whether the time for the extinction of humanity is predetermined. And according to V.F. Levchenko [224], the human race has already exhausted its adaptive and evolutionary potential and must “leave the stage”.

The view, contrary to like-minded Brocci, is able to change and adapt indefinitely. He dies out if the demands presented to him by the environment exceed his adaptive capabilities. Being an element of a multi-view system, the view is dependent on the processes occurring in it. Proponents of Brocci views do not take this into account. They discuss the causes of the extinction of a species outside of its environment. Coenophiles die out during global environmental crises. Their extinction is a consequence of a decrease in the level of homeostasis of the community into which they are members and cannot live outside of. Man is not a coenophile. He can live in different communities - in the tropics and in the tundra, in the rainforest and in the waterless desert. The modern extinction of species is not due to their aging, but because of the inability to withstand anthropogenic changes in the environment. Rights A.G. Ponomarenko [225-229], when he writes that humanity will always be an integral part of the biosphere. It coped with disasters that arose in the past. Modern problems will be solved. The fear that a person will not have a place in the biosphere changed by him is in vain. Cyanobacteria in the Proterozoic caused a global ecological crisis [211], but they themselves still exist. Angiosperms caused the mid-Cretaceous global ecological crisis [202], but nowadays they form the basis of land vegetation. Man will not disappear from the face of the Earth, the cause of the current global environmental crisis. Extinction during global environmental crises is the elimination by the biosphere of species that inhibit its development [214]. A man does not restrain him, but, on the contrary, accelerates due to the ability to find and use new materials and energy sources.

3 CONCLUSION

Considering the endogenous processes of reducing homeostatic properties during the evolution of multi-species systems, VV Jerichin [169], came to the conclusion that these processes occur in any system that 1) has a complex internal structure that combines hierarchical and network principles of organization; 2) capable of self-reproduction; 3) consists of self-reproducing elements; and 4) these elements are capable of adaptive evolution. Among the systems to which the theory of phylocenogenesis is applicable, he includes organisms, population-species, and socio-cultural systems. The aging of an individual, based on the theory of phylocenogenesis, is a special case of an endogenous decrease in the homeostatic properties of systems.

The formation of the property of aging in systems of different levels occurs similarly. For it to arise in the body, it is necessary that the number of functionally different cells that make up it increase. In order for the community of social insects and human society to have the property of aging, the number of functionally different individuals must increase in it. For a multi-species system to acquire the property of aging, it is necessary that the number of species performing different functions of the ecosystem increase in it. Thus, in order for the system to acquire the property of aging, it is necessary that the number of functionally different elements making up it reaches the maximum possible level for this stage of evolution.

Individuals that accelerate evolution acquire the property of aging when, due to the increased complexity of the structure, they lose the ability to reproduce asexually. Communities of social insects acquire this property when workers, due to their high specialization, lose their ability to replace the queen in case of her aging. At what stage of its complication human societies and multi-species systems acquire the property of aging, the author does not know. The property of aging, that is, due to internal reasons to reduce their homeostatic properties, is possessed by complex systems of the organismic, supraorganismal, and multi-species level. This property is universal for them, the same as, for example, genetic uniqueness, integrity, hierarchy of organization, ability to self-regulation, development, reproduction and adaptation.

The property of aging in systems of the organismic, supraorganismal, and multi-species level arose through natural selection. Its units were systems that acquired this property. The selection was not aimed at its acquisition, but at complicating the systems, increasing the degree of their integrity. Having become complex and integral, systems lost potential immortality, became mortal, and the cessation of their existence became a matter of time, that is, inevitable. The aging property arose as a by-product of the development of a property useful for the system — high integrity. This property is a passive consequence of its complex structure.

The aging property, harmful to the system, is useful for the parent system of which it is a part. In order for it to be useful for her, it is necessary that the subordinate system be capable of reproduction. The considered systems possess this ability. The aging community of social insects, before disappearing, produce sexual individuals - capable of breeding males and females. Males (except termites) die after copulation. Overwintered fertilized females become the founders of new communities in the next season. Human societies that disappeared in Antiquity and Antiquity did not disappear without a trace. The surviving part of them became the ancestor of another or other societies. The multi-species systems that perished during global environmental crises did not disappear completely either. Avoiding extinction coenophobia formed a new multi-species system.

The usefulness for higher systems of the aging properties of lower-ranking systems lies in the fact that it accelerates their evolution and thereby facilitates adaptation to a changing environment. The aging of individuals guarantees the cessation of their existence, accelerates the change of generations, makes natural selection faster, and thereby facilitates adaptive genetic restructuring of a higher population system, increasing its adaptive capabilities. The aging of communities of social insects also guarantees the cessation of their existence, accelerates their change, makes natural selection faster, the units of which are communities, and thereby facilitates the genetic adaptive rearrangement of a higher population system necessary for its adaptation to a changing environment. The property of aging in human societies that disappeared in Antiquity and Antiquity guaranteed the cessation of their existence, shortened their lifespan, accelerated their change, and made natural selection faster, the units of which were societies. As a result of the acceleration of natural selection, that is, the acceleration of the replacement of some societies by others, the adaptive capabilities and reliability of the existence of a higher-ranking system — humanity — have increased. The aging of multi-species systems of the geological past guaranteed the cessation of their existence, accelerated their change and made natural selection faster, the units of which were multi-species systems. This ensured adaptive genetic rearrangement of the higher biosphere system. In the biosphere, due to the aging of multi-species systems, adaptive capabilities and the reliability of existence have increased. Biosphere crises, during which multi-species communities disappeared from the face of the Earth and were replaced by others, are a boon to the biosphere by analogy with the death of an individual, which increases the reliability of the population [214].

The age of the systems of different levels is different. In an individual, it can last for days, weeks, months, years or decades, in the community of social insects - weeks, months, in human societies - centuries, in multi-species systems - millions of years.

Only the most complex systems — individuals of unitary Metazoa — possess the property of being destroyed by oncogenesis. Evolution has not yet created supraorganismal and multi-species systems in terms of complexity equal to them. Therefore, in systems of a supraorganismal and multi-species level, processes similar to oncogenesis, unlike processes similar to aging of an individual, are impossible. Oncogenesis arose by natural selection, aimed at complicating the structure of the individual and at achieving high complexity and a high degree of integrity. Having reached a high complexity and a high degree of integrity and thereby gaining evolutionary advantages over modular species, unitary Metazoa have become susceptible not only to aging, but also to carcinogenesis. This property is a byproduct of natural selection. Oncogenesis, probably, like aging, increases the adaptive capabilities of the population. Death from cancer, as well as death from old age, is not the result of suicide of the body, as V.P. thinks. Skulachev [28] and a passive consequence of what happened during the evolution of the growth of the integrity of the individual.

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