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Is It Possible to Rejuvenate the Aging Global Civilization?[1]

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Abstract—Society is not only a social, but also a biological, system. The growing complexity of biological systems inevitably leads to the loss of their potential immortality and to the emergence of the aging. The aging of the present-day civilization is evidenced by the problems that have accumulated in it. The question of whether its collapse can be stopped depends on the answer to a more general question of whether this supraorganismal system, which, due to growth of structural complexity, has acquired the property of aging, can, without losing the complexity that has been achieved, return to its ancestral potential immortality. A positive response is given to this question. There are supraorganismal systems that have been liberated from the necessity of aging. These are communities of social insects. Some of them were initially moral, but, in the course of evolution, have lost the aging attribute. Therefore, complex supraorganismal systems, including present-day civilization, can return to their ancestral potential immortality without losing their achieved structural complexity. The main obstacle to rejuvenating civilization is not the nature of things, but the mindset of human beings.

Keywords: aging of civilizations, parametabolic theory of aging, social insects
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INTRODUCTION

The scope of gerontology is wider than the study of aging in humans and other species. The aging of an individual is a particular case of a more general phenomenon—an endogenous decrease in the homeostatic properties of biosystems. The homeostatic properties of ancient civilizations also decreased, and again for endogenous reasons; they also aged, and, therefore, may also be objects of gerontological research. The problem of the aging of civilizations from a point of view close to gerontological was discussed by K.N. Leontiev and O. Spengler. Leontiev's article "Byzantinism and Slavdom" was published in 1875 and published as a separate book in our time [5]. There, he considered the history of states as a special case of development, that is, a gradual ascent from the simplest to the most complex states. According to Leontiev, development begins initial simplicity, followed by the appearance of explosive complexity and, then, secondary simplification, which ends with termination of the existence of the system. In Western European states, according to [5], the Middle Ages were the stage of primitive simplicity. Since the Renaissance, the integrity of states began to grow and their internal diversity (legal, religious, regional, class, ethnographic, philosophical, and artistic) to increase. The stage of explosive complexity started in the 15th century. In the middle of the 18th century, secondary simplification began, which will lead Western European civilization to destruction.

In the book *Der Untergang des Abendlandes: Umrisse einer Morphologie der Weltgeschichte*, published in 1918–1922 and translated into Russian [7], Spengler also predicted the death of Western European states. According to Spengler, the development of society consists of two stages: the stage of culture and the stage of civilization. The stage of culture is the childhood, adolescence, and maturity of society, and the stage of civilization is its old age. The modern (early 20th century) inhabitants of Western Europe, according to Spengler, live in the old age of society.

The inventions of Western Europeans (watches, telephones, the telegraph, radio, television, computers, bicycles, railways, airplanes, helicopters, cars, subways, and power stations) became the general property of humanity. As a result, a global planetary civilization arose that is based on Western European civilization. Contrary to Leontiev, it is not becoming simpler. Its diversity is continuing to grow. However, according to the predictions of Leontiev, Spengler, and many other authors [4, 8, 9, 12], it awaits a collapse. Leontiev and Spengler saw the reason for this in social problems. Modern authors, however, consider environmental problems to be the main threat. The discussion in the literature of the possibility of collapse of global civilization testify to a decline in the reliabil-

[1] This article is open to discussion.

ity of its continued existence, that is, its aging. Has humanity gone so far that it is no longer able to change its future, or can this collapse be prevented? The purpose of this article is to discuss this issue. For this, the processes of the emergence of the aging attribute in *Metazoa*, in communities of social insects, and in society are compared.

EMERGENCE OF THE AGING ATTRIBUTE IN *Metazoa*

Potential immortality is an ancestral property of *Metazoa*. The body does not age in individuals of the species, which are in the early stages of evolution. They die only from external effects. Species the individuals of which are potentially immortal include sedentary colonial invertebrates: sponges, hydroids and coral polyps, bryozoans, Kamptozoa, Pterobranchia, and colonial ascidians [11]. They do not age, because their cells are little differentiated. Thanks to this, they retain the ability to divide and rediffuse throughout ontogenesis, which provides individuals with high regenerative abilities and allows them to not grow old.

The first *Metazoa* on Earth were colonial species [6]. They probably, like modern sedentary colonial invertebrates, did not age. Their intraorganism diversity, that is, the number of cell types that performed different functions of the body, was very low. Natural selection encouraged an increase in the number of cell types in these ancient animals. This increased the integrity of the body and, therefore, provided an advantage in the struggle for existence. Therefore, in the course of evolution, the cells of the body became increasingly differentiated and its number of cell types increased. The higher the degree of their differentiation became, the lower their ability to propagate was. Some types of cells completely lost this ability and, therefore, became nonrenewable. Such cells, according to the parametrabic theory of aging proposed by A.G. Golubev [10], are a target for the damaging effects of products of parametabolic reactions.

Parametabolic reactions are chemical reactions occurring in the body that are not catalyzed by enzymes. They are the inevitable accompaniments of biochemical reactions that are useful for an individual. Products of parametabolic reactions accumulate in nonrenewable cells. The concentration of these products in these cells increases with the age of the individual. Because of this, nonrenewable cells decrease their activity and die off [10]. Their death is a senile involution, that is, aging. It is irreversible for *Metazoa*. Cells in sedentary colonial invertebrates are specialized very little, and, therefore, there are no renewable cells. In these organisms, the concentration of products of parametabolic reactions in the cells does not reach a level sufficient for senile involution.

EMERGENCE OF PROPERTIES OF AGING AND REJUVENATION IN COMMUNITIES OF SOCIAL INSECTS

In communities of social insects (bees, bumblebees, wasps, ants, and termites), the aging process arose when their ancestors transitioned from solitary to social life, that is, also in the course of evolution and due to the functional differentiation of the elements of the system—individuals. Communities of these insects consist of infertile workers and an egg-laying queen or, in the case of termites, a queen and king. Reproduction is only one of the specializations in the community. Workers are also functionally differentiated. In bumblebees, wasps, and some species of termites, there is only one queen in the community. Their communities exist as long as the queen is alive. When she, having aged, ceases to lay eggs, the dying off of infertile workers becomes uncompensated and the community gradually fades away [2, 3], thus dying due to old age. Division of the functions of the community between its members is a process that is useful for it. However, the inevitable accompanying processes of processes that are useful for biosystems are harmful. They are analogues of the parametabolic reactions of an organism. In communities of social insects, the analogue of the parametabolic reaction is the extinction of the community after the death of the only female that lays eggs. The parametabolic theory of aging that has been proposed to explain the mechanism of aging of an individual [10] also explains the aging of supraorganismal systems.

The populations of the ancestors of social insects consisted of individuals that were not functionally differentiated and lived apart. In their populations, there were no aging supraorganismal structures. The community, which includes only one egg-laying female, is evolutionarily primary. New communities are created after the mating flight of sexual individuals. The period of solitary life of a fertilized female founder is the most dangerous in the life of the community. Most of potential community founders die from predators. Therefore, independently in different species of ants, fertilized females began to return to their native anthill and lay eggs under its protection. Different types of termites began to grow additional breeding females and males in the termitary. The life of these communities has ceased to depend on the lifespan of the female founder. Communities of honey bees have eliminated the property of aging differently. There is one queen bee in the hive. When she grows old and her fertility declines, worker bees raise another and kill the former one. The communities of some species of wasps have working females capable of breeding. While the queen is alive, they do not use this ability, but in the case of her death they start laying eggs and the life of the community is not interrupted [2, 3]. Thus, communities of social insects can rejuvenate.

Their aging, unlike the aging of the individual, is reversible.

EMERGENCE OF THE AGING ATTRIBUTE IN CIVILIZATIONS

Civilizations grow old in the course of history, that is, also in the course of evolution, and due to the functional differentiation of the elements they consist of—individuals. There were no states in prehistory. People were united in tribes. There, the division of labor was just starting to emerge, and the tribal diversity was very low. The tribe, like the organism of a primitive invertebrate, could probably live forever. It was potentially immortal. The conditions for the functional differentiation of members of society improved in tribal associations, that is, states. At first, the intrastate diversity was low. However, natural selection occurring at the state level encouraged the division of labor among people, since it allowed them to be victorious in war. In the heyday of ancient civilizations, the functional differentiation of citizens was the greatest possible for that time. However, having reached the stage of explosive complexity, civilizations began to become simplified and decline due to the harmful processes that accompanied the activities of specialists that were useful to society [8], that is, analogues of the parametabolic reactions of the organism. After the collapse of civilizations, societies returned to the state of "original simplicity." Specialists did not have a place there. The reason for the aging of civilizations is the functional differentiation of citizens, their specialization.

In our time, the functional differentiation of citizens has reached an unprecedented level. Thanks to the deepening of the social division of labor, the resources of the environment are now used much more fully and efficiently than before—and, much more than before, there are the effects of analogues of parametabolic reactions: environmental pollution, reduced biodiversity and resources of the planet, an excessive increase in the number of people, climate change, increased genetic load in populations, and social problems. The analogues of parametabolic reactions indicate that further development of the world civilization along the chosen path will lead to a decrease in the stability of its existence and is fraught with the danger of its collapse [4, 8, 9, 12]. The decline in the stability of the existence of world civilization is endogenous in nature; that is, it is aging. The level of functional differentiation of members of society in our era has probably reached a limit and its increasing has ceased to improve the homeostatic properties of society, but rather has begun to reduce them.

THE POSSIBILITY OF REJUVENATING CIVILIZATIONS

Consideration of the process of appearance of aging in these three systems leads to the conclusion that this property arises as a result of evolution in the course of an increase in the functional differentiation of their elements, their specialization. The more the elements of the system are specialized, the more the parametabolic reactions or their analogues are harmful. With very high specialization of elements, the harm that they inflict is so great that it limits the lifespan of systems, depriving the system of potential immortality. The process of aging of the organism and society consists in reducing the number of their specialized elements. At a certain stage of this decrease, the homeostatic properties of the organism or society become so weak that they can cease to exist as a result of a minor external effect. The process of aging of the community of social insects is a consequence of the death of a single individual specialized in reproduction. The similarity of the processes of the emergence of aging in society and in the two biosystems examined shows that society is a system that is not only social, but also biological. The similarities of their aging processes shows the same thing. Consequently, the aging of society is governed not only by social, but also biological, patterns.

As shown by the example of communities of social insects [2, 3], biological patterns allow the rejuvenation of supraorganismal systems. However, of course, it is impossible to simply project the mechanism of rejuvenation of communities of social insects onto the rejuvenation of civilization, since the organization of their communities is radically different from the organization of society. The capacity for rejuvenation is probably not characteristic of only communities of insects. Some civilizations may have also become rejuvenated. This could have happened in Ancient Egypt and Ancient China. The life expectancy of most bygone civilizations is 1000–1200 years [5], but Egyptian civilization lasted 5000 years. China has existed for 5000 years and shows no signs of aging.

The decisive role in the aging of society is played not by biological, but social, patterns [5, 7]. These were not considered in this article. Will they allow civilization to become rejuvenated? According to P.R. Ehrlich and A.H. Ehrlich [9], the greatest problem in preventing the collapse of world civilization is the difficulty of convincing the politicians and economists of the need for making fundamental changes in the life of society. No one likes the consequences of continuing the development of society along its current path, writes R. Rull [12], but no one wants to make the sacrifices necessary to solve the problem. A.S. Akopyan et al. [1] are right in their belief that, if civilization dies prematurely, it will most likely not be because of limited resources and overpopulation, but because of the imperfections of human psychology and imperfection of the social and political organization of society.

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