Global Journal of Arts Humanity and Social Sciences ISSN: 2583-2034

GSAR PUBLISHERS
GLOBAL SCIENTIFIC AND ACADEMIC RESEARCH

Glob. J.Arts.Humanit.Soc.Sci
ISSN: 2583-2034
Vol-3 Iss-10, page 1188-1191

The Biophysical Modelling of the Death

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Article History
Received: 26/09/2023
Accepted: 07/10/2023
Published: 09/10/2023

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Abstract
The fundamental study topic of biophysics is the life of the organism. Biophysics, which became a self-standing discipline, with specific objectives and research methods, opens wide perspectives in the most diverse fields of theoretical and applicative fields of medicine. In the explanation of the structure and function of the living orga¬nisms, the biophysicist selects and synthesises everything that the various fields of bio-medicine offer him. Death, the destruction of ancient organisms, allowed organic matter to return to the waters and new organisms to emerge. They live as organisms, and they live as part of those organisms. They can use it over a long lifetime of careful saving, or use it up in a short period of time with a stressful lifestyle. Then comes the only "extra-program": death, which is a tragic event in human society, but which is an indispensable condition for the development of the living world.

Keywords: biophysics, death, living, extra-program

INTRODUCTION

Biophysics is a borderline science between physics, biology, and psychology, which studies the laws and regulations of the complex system through mathematical methods: psychological-biological-physical. The fundamental study topic of biophysics is the life of the organism. The role of the biophysics consists of the study of the vital processes which take place in the living organisms, their correlations in the discovery of the causal relationships between the phenomena, establishing the underlying connections, and the quality differences of the processes which take place in the living organism. In any organism, there are biological processes taking place, whether it is monocellular or pluricellular.

Biophysics, which became a self-standing discipline, with specific objectives and research methods, opens wide perspectives in the most diverse fields of theoretical and applicative fields of medicine. [1] The means of biophysics are tightly connected with the development of science and technique, although modern medicine is a reflection of biophysics applicable to the human body.

In the contemporary times of explosive development of nature sciences, medical biophysics – a borderline science with interdisciplinary aspects – having as object the modelling of the human organism, becomes a basic discipline in the biomedical studies. Medical biophysics can be applied in all the fields of medicine. In order to understand the disturbances which take place in the pathological process in the body, we must know the normal evolution of the vital processes. The knowledge of biophysics is necessary for the diagnosis of the disease, for choosing and performing correctly the treatment; this is why no physician can work successfully without knowing biophysics. [2] The efficient management and use of the very diverse data supplied by biophysics request a new way of processing and interpreting which is possible in today's computer era. It is difficult to perform an exhaustive list of all the users of biophysics in the bio-medical scientific research, but one must not forget that at the origins, biophysics was created by scientists and for scientific needs.

The assiduous and passionate work of biophysicists in laboratories supplied the experimental results through which they revealed the intimate mechanisms of the living organisms. Hence the theoretical and experimental research in the field of biophysics supplied truly amazing results, which materialized in medical devices found in the endowment of all the modern clinics in the world (CT, MRI, PET, etc).

In the explanation of the structure and function of the living orga-nisms, the biophysicist selects and synthesises everything that the

various fields of bio-medicine offer him. This is why the text contains references from the field of these connected disciplines, which are not overlaps, but completions or elements necessary for the understanding of interpretative biophysical modelling. Under functional perspective, biophysics mentions limits between living and non living, normal and pathological; it also offers guiding principles on the correction of the parameters of the deviated characteristics during the disease, based on the knowledge of the modelling of normal functional mechanisms. Currently, we can say that the modern medicine starts and ends with biophysics.

Death

Fortunately, with life came death. It is unusual and perhaps strange to say "fortunately", but it is the truth. Death, the destruction of ancient organisms, allowed organic matter to return to the waters and new organisms to emerge. [3] Organisms thus created the possibility for the creation of new ones by their own destruction, and the material of the latter also entered the endless cycle of living and non-living nature that has been going on for billions of years.

In this *cycle*, the death of living individuals created the continuing possibility of new ones, but the new ones were not created in a comfortable, nutritious environment like the first ones. The faster one could survive, the slower one perished. The struggle for biological existence, which has been going on for about two billion years only among unicellular organisms, has begun.

This global competition has not been without impact on the environment. First of all, organic compounds that could have been used directly as nutrients by ancient organisms have disappeared from the Earth's atmosphere. They have disappeared not only from the atmosphere, but also from the water, and have become part of the living world.

Death in detail

As we have traced the broad outlines of the main events in the evolution of life on Earth, we have also slipped into our data the fact that there are single and double-living creatures. They also evolved independently, one about 4 billion years ago and the other 1.5–2 billion years ago.

What is single life and double life? If we say that death is the opposite of life, then there is single death and double death. [4] From the problem of death, let us try to understand the question of double life, based on humans.

It is well known that our body has vital and non-essential organs. The fibula is not a vital organ, nor are the tonsils and testicles. But the brain, the heart, the lungs, the liver, the kidneys are all things without which the human body cannot function, without which human life is not possible. It would follow that the removal of any of the vital organs would clearly result in the death of the human organism. But it is far from that simple. It is no longer uncommon in medical practice for an otherwise vital organ, such as a kidney or heart, to be temporarily or permanently removed from the body, or at least to have its function, i.e. its connection to the body, terminated. [5]

The emphasis is on the *coordinated system*: neither the heart, nor the liver, nor the kidneys live separately. The human lives as a unified whole, and also dies as a unified whole. This hardly needs explaining.

Double death

Today, however, we are confronted with contradictions on the questions of life and death. The "surviving" organs of a dead person are stored in "viable" condition in organ banks to replace, if necessary, similar organs of seriously ill patients that have become inoperable due to disease. The organ bank should therefore contain "living" organs. A transplantable heart can only be removed from a dead person immediately after death. First of all, it must be established beyond doubt by means of legally defined instrumental measurements that the donor is indeed dead, and only then can the heart be removed and transplanted. [5] A day or two after death attempts to remove and transplant the heart would be futile. The heart must be alive during the transplantation period.

And here is the big contradiction. The donor is clearly biologically, medically and legally dead. Yet their heart is alive. How is that possible?

If a piece of the heart is cut out, taking care not to contaminate it with bacteria, and placed in the right nutrient solution, it will be found to be alive. Not only does it grow, it feeds naturally, it can be stimulated and even moved. [6] So the death of the organism is not the same as the death of its parts. Higher organisms live doubly. They live as organisms, and they live as part of those organisms. The *two kinds of life* may cease separately since the death of a small part of the organism is far from being equivalent to the death of the whole organism, and after the death of the organism, parts of it continue to live separately.

So the cell – based on which all living organisms are built – has a separate independent life, but tissues and organs do not. A surviving heart is "alive" only because its cells are alive. It has a cell-specific life, but there is no life specific to the liver, heart, kidneys, or ears. However, when these parts work in a coordinated way in a larger unit, another, more complex characteristic form of life reappears the life of the organism. [7] So we say that life appeared on Earth in two waves. Two waves, two different times, two different lives. In the first, inanimate matter was organized into living systems, cells, and this form of life was the dominant form on Earth for about two billion years. Then, in the second, the living cells themselves became the building blocks, the building blocks of larger, more complex, different living systems, multicellular organisms.

Consequently, I could say that multicellular organisms live *two lives:* once as organisms, and when they die, their cells can live longer as cells under the right conditions. In nature, this survival does not usually occur; cells organized into organisms are so specialized that they cannot survive on their own under natural conditions. But under suitable artificial conditions, their life can be sustained after death and they can be induced to reproduce.

Living or dead

In our minds, the concept of death is shrouded in mystery and horror. So it is time to take a closer look at this concept, which is

as much a natural process as life itself. So much so, that many people include death among the phenomena of life, as a final, ultimate life phenomenon. Because not everything that is not alive is dead. The stone, the mountain, the water is not dead, but lifeless. Only what was alive before can be dead. [8] Death is the event in which the living ceases to be alive.

To understand the meaning of death, we need to know exactly what life itself is. But determining this is not an easy task; it has been experimented with for thousands of years to no avail. There have been those who have defined life as the opposite of death, for example, in such a way that life is the totality of phenomena that resist death. We can easily admit that such artificial and forced definitions are no closer to life or death. Instead, let's say that living things are naturally reproductive systems that are characterized by the fact that they work, that is, that they have constantly coordinated processes that give them special abilities. One such ability is metabolism, by which food in a living system is transformed through a series of chemical and physical changes, partly into the living system's own internal materials and partly into the energy needed to run the system. [9,10] These include reproduction, the ability to grow, irritability and much more. The way to see if a living system is really alive is to check whether it has all these abilities, or at least some of the more fundamental ones, such as metabolism. If so, we can decide the question relatively easily. But if not, it does not mean death has occurred.

There is no life without water. The main life phenomenon, metabolism, which is the basis of all other life phenomena, can only take place in aqueous media through a series of chemical and physical changes. The specific transformations required for metabolism take place only in the presence of compounds dissolved in water. Drought is the enemy of wildlife. Yet if we put dry soil, roadside dust or hay in water and examine the liquid under a microscope after a few hours, we will find a mass of tiny organisms. How is that possible? Obviously, in the dust, in the dried straw, there were micro-organisms that were revived by the water. These, although they had no water and therefore showed no signs of life, could not be dead, because in the new medium, they could come to life, they had the capacity to live. So, the cessation of life is far from being equated with death. Sometimes, in order to preserve life, living organisms themselves cease their activity – temporarily (latent state): forming cocoons, burrowing, hibernating, etc.

The relationship between life and death

Death is therefore not the opposite of life, but of the *ability to live.* It is an irreversible process: the permanent, irreversible cessation of life. It is the breakdown of the order in which the parts in a living organism function. When freeze-drying, this order is not disrupted, only the processes stop, but under more favourable conditions they are able to work in harmony again. Even at death, it is not certain that these processes stop. [11] The parts can continue to function, but the harmony between them is broken, the order of cooperation is irreversibly, irredeemably disrupted. Every human comes into the world with a certain amount of inherited adaptive energy, inherited from ancestors, from parents. They can use it over a long lifetime of careful saving, or use it up in a short period of time with a stressful lifestyle. The amount of inherited energy is given, but we set the rate at which we use it.

Death is the last sign of life for all living organisms. It can be caused by an external effect (such as disease), but the organism can also die from internal causes without any external cause; this is natural death. The internal causes of death are to be found in the most basic life phenomenon itself, metabolism. Over time, the metabolism destroys more and more cells, and the remaining ones are adversely affected. Natural death is common in lower animals, while pathological death is predominant in higher animals. No natural deaths have been observed in humans. No one has ever died of old age. If someone were to die of old age, this would mean that all of their organs would be equally worn out from long service. But without exception, everyone dies with one organ wearing out out of proportion to the others. The life that holds our organs together can be compared to a link whose strength depends on the weakest link. [12] Regardless of how important this link is if it breaks, our organs can no longer come together as a living body.

Nothing can work forever, not even living systems. The final, irreversible cessation of these functions is death. In multicellular organisms, including our human bodies, a specific program controls the development of the organism from fertilized egg to adult and beyond. Individual development, the process of becoming an embryo in the womb and then an infant, child, or adult, follows an internal biological program, including the inexorable process of ageing. And this internal program will eventually come to an end. Then comes the only "extra-program": *death,* which is a tragic event in human society, but which is *an indispensable condition for the development of the living world.*

And life goes on: our descendants go through the same stages of development as ourselves. So life itself is a cycle, but not a perfectly self-perpetuating cycle. Imperceptibly small differences over countless regenerations – over four billion years – have led to the emergence of a HUMAN capable of going from a primitive cell to leaving the Earth.

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