OLEKSANDR BOGOMOLETS IS A VISIONARY OF ANTI-AGING IN UKRAINE

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Abstract

Anti-aging is a relatively new term in the professional vocabulary of Ukrainian physicians. It has begun to develop in our country, to a large extent, in recent decades. However, a significant number of practitioners do not pay proper attention to or distrust this field of medicine even now. Most of them are convinced that this industry came to us from abroad and does not fit right into our realities. This article attempts to refute this baseless claim. It presents information about the developments and achievements of the outstanding Ukrainian scientist O.O. Bogomolets in the field of anti-aging. This article overviews the main hypothesis and discoveries made by Bogomolets and discusses his great legacy in the struggle for a long healthy, and happy life.

Keywords: Healthy aging, Geriatrics, Ukraine, History

Introduction

Nowadays, global medicine is working on the problem of human life span prolongation and its quality improvement. One of the key postulates of the World Health Organisation (WHO) is that “every person in every country in the world should have the opportunity to live a long and healthy life”. The WHO prioritizes the need to elaborate new evidence-based strategies for healthy aging. Moreover, The United Nations declared a global collaboration called Decade of Healthy Ageing (2021-2030). Why do we suddenly pay such close attention to the problem of healthy aging? Statistics show the inevitable. In 2019, the population of the earth numbered 1 billion people aged 60 years and older. By 2030 their number will rise to 1.4, and by 2050 will reach 2.1 billion [1]. Furthermore, the number of people at their 60 and older outstrips children under five years.

The inhibition of the aging process has already become a unifying component for different areas of medical science. This field combines traditional and alternative medicine and uses a wide range of scientific knowledge and practical achievements, unifying therapy, preventive medicine, gerontology, endocrinology, neurology, nutrition, physiology, and many other branches of medicine. It is called anti-aging medicine. The fundamental difference between anti-aging medicine and gerontology is that the latter treats and prolongs the life of the elderly. However, anti-aging is aimed at disease prevention and uses techniques that slow down aging. Thus, a person stays young as long as possible and may live their best life in old age.

Although anti-aging medicine has not achieved significant spread and development in Ukraine and is mistakenly considered as the acquisition of
the 21st century only, a few individuals in our medical history were true pioneers in this field. Herein, we would like to elucidate the figure of the famous Ukrainian scientist O.O. Bogomolets as a founder of longevity research in Ukraine.

**O.O. Bogomolets as a pioneer of anti-aging in Ukraine**

O.O. Bogomolets was one of the foremost leaders in Ukrainian medicine (Fig.1). It is difficult to list all his achievements and merits. O.O. Bogomolets launched the field of pathophysiology. Moreover, he is widely remembered as the creator of numerous scientific discoveries and concepts that have opened a new page in many areas of experimental medicine, such as reactivity, immunity, connective tissue, endocrinology, blood transfusion, and oncology [2]. However, the public is usually unaware that scientist have always been interested in the search for longevity.

In 1941, O.O. Bogomolets established the world’s first dispensary for combating premature aging in Kyiv [3]. Later, the Institute of Gerontology was established on its basis. Two years earlier, in 1939, the academician wrote a comprehensive work entitled “Continuing Life” (Fig.2), in which he put forward his theory of aging. The scientist asked the question: “what is the normal life expectancy of the human body?” In this work, Bogomolets substantiated the reality of prolonging human life to 100-150 years or more. But why did the author come to such numbers?

**The ideal length of our life**

O.O. Bogomolets used the Buffon coefficient to determine the probable duration of human life. Notably, this coefficient was tested and formulated by observing different species of mammals. According to Buffon, the possible life expectancy of animals is 5-7 times longer than the period of its growth. The growth of the organism was considered complete when bones will stop growing in length.

**Figure 1. Portrait of O.O. Bogomolets.**

Considering that human growth stops approximately at 25 years, our hidden potential for longevity is impressive. However, even Bogomolets himself did not claim this formula to be the ultimate truth. He realized that the life expectancy of the organism depends not only on the greater or lesser ability of the cellular elements of different animal species to reproduce. Observations on the average life expectancy of various species show that it is determined by some other internal and external factors.

**The attentive gaze inside the cell**

O.O. Bogomolets and his scientific team paid considerable attention to the state of cellular plasma as a living colloidal suspension. The academician was convinced that loss of the ability of plasma to biochemical regeneration is the cause of aging and death. He tends to represent the aging process as a gradual weakening of cell reactivity, which is based on biophysical and biochemical changes in cellular structure, the gradual loss of the ability to reproduce and renew its biochemical structural elements, clogging of cells with enlarged cytoplasmic particles.

**Figure 2. The cover of O.O. Bogomolets’ work “Continuation of life”**
According to Bogomolets, from the physicochemical point of view cell aging is a process of consolidation and condensation of cellular colloids, reduction of their dispersion, and depletion of water. The scientist used the term “hysteresis of protoplasm”. It expresses a decrease in the physicochemical and at the same time biological activity of the cell. Bogomolets described a consecutive line of events: nutrition of cells is disturbed; thus, occurs starvation, vital functions are reduced, so aging and death occur. Even though the scientist did not formulate a clear theory of certain changes in the molecular structure of cells leading to aging, he was right about the subcellular level of the aging process. Nowadays, we can analyze different molecular mechanisms and networks proven to be involved in aging, which helps develop effective concepts to combat cell aging [4-6].

Bogomolets and Mechnikov: points of agreement and dispute

O.O. Bogomolets agreed with the views of another famous scientist Mechnikov, who did not consider the aging process as physiological. He stated: “Because everyone is getting older, old age can only be considered normal to the extent that pain during childbirth can be considered normal... But during labor pain, it is enough to use an anesthetic, while old age is a chronic evil against which it is much harder to find a cure." The scientist also supported Mechnikov's views on the importance of balancing the intestinal microflora to preserve longevity. As practice shows, scientists have proved to be right in their beliefs [7].

On the other hand, scientists differed in the interpretation of other features of the aging process. Bogomolets believed that Mechnikov’s "excited phagocytes" were a consequence, not a cause, of the death of aged cells. After all, phagocytes consume already dying, aged, and non-viable cells.

Its majesty a connective tissue

In addition, Bogomolets believed that the importance of a healthy state of connective tissue is undeservedly underestimated. The scientist was convinced that the physiological system of connective tissue performs extremely important trophic functions in the body. He considered connective tissue a kind of the root of the body, which state largely determines the state of other cellular elements of the organism. According to him, longevity is achieved through the health of connective tissue.

In his work, Bogomolets adopts the saying of French doctors that a person is the age of his arteries. However, he tends to look at this problem more globally. Since arteriosclerosis as a manifestation of vascular wall damage is only one of the manifestations of general connective tissue sclerosis, he proposed to paraphrase the proverb with the statement: "a man has the age of his connective tissue." That is why, in his opinion, the struggle for longevity should be largely a struggle for healthy connective tissue, which is in line with many current research and assertions [8].

Scientist classified people into four main types according to the structure and functioning of connective tissue of the body:

- lipomatous,
- pasty (lymphatic),
- asthenic,
- fibrous-

Depending on which of these types a person belongs to, the reactivity of his body and susceptibility to certain diseases and finally longevity is determined.

Continuation of life: hypotheses and facts

However, not only connective tissue came into the scientist’s field of vision in the focus of aging. The academician argued that the state of the nervous system, especially its autonomic part is of utmost importance for the preservation of health. In his work, he dwelled in detail on the capability of the sympathetic nervous system to maintain the longevity of the body. As the vegetative nerve system directly regulates the functions of internal organs - rhythm and strength of heart rate, tone of blood vessels, biochemical processes of assimilation and dissimilation in various organs and tissues of the body, it is one of the possible keys to the prolongation of life expectancy. Moreover, Bogomolets paid tribute to the bidirectional influences between the function of the autonomic nervous system and mental experiences. The scientist also attached great importance to moderate physical activity and maintaining healthy sleep.

The studies of O.O. Bogomolets and his scientific team in the field of blood transfusion formed the theory of colloidoclastic shock. Colloidoclasia may be explained as damage to colloids. In the case of blood transfusions, colloids are protein particles being part of the blood and cell plasma. In experimental studies, colloidoclasia of cellular proteins was observed even in transfusion of...
compatible blood. Protein particles became less stable and precipitated. Subsequent studies have confirmed that this sediment consisted of the oldest, physiologically least active particles and disintegrated over time. This allowed Bogomolets to develop the hypothesis that colloidalastic shock caused by blood transfusion allows cells to get rid of old elements of the cytoplasm and even enhance metabolic processes and functional activity of cells.

In conclusion, based on the considered hypotheses and observations, we can see for ourselves that O.O. Bogomolets in the first half of the 20th century prophetically looked at the present. However, despite the many hypotheses suggested by scientists in the search for effective methods of aging control, the final choice is always up to each of us. That is why the saying of O.O. Bogomolets seems especially relevant and instructive: "The struggle for the prolongation of human life should not be based on attempts to rejuvenate an already aged organism. It is difficult to turn back the river. Although, you can slow down the aging process by managing your life wisely."

**AUTHOR CONTRIBUTIONS STATEMENT:**
The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

**COMPLIANCE WITH ETHICAL STANDARDS:**
No human participants/animals were evaluated. These data are public. Therefore, there was no requirement for ethics committee approval.

**CONFLICT OF INTEREST:**
The author declares no conflicts of interest.

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Резюме
«Анти старіння» – відносно новий термін у професійному словнику українських медиків. У нашій країні він почав розвиватися, значною мірою, в останні десятиліття. Проте значна кількість практикуючих лікарів навіть зараз не прищільнують належної уваги цій галузі медицини або не довіряють їй. Більшість з них впевнені, що ця галузь прийшла до розвитку, значною мірою, в останні десятиліття. Проте, не маємо сумніву в тому, що ця галузь прийшла до розвитку, значною мірою, в останні десятиліття.

Ключові слова: здорове старіння, геріатрія, Україна, історія