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Aging, Health, Disease, and Adaptation: A Unified Concept of Preventive Medicine

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Abstract

Modern medicine has achieved remarkable success in diagnosing and treating individual diseases; however, a significant portion of chronic human pathology arises and progresses against the background of age-related changes in the organism. Cardiovascular diseases, cancer, neurodegenerative disorders, diabetes, tissue frailty, and functional decline occur much more frequently with increasing age. This creates the prerequisites for shifting from a predominantly nosological approach toward a more systemic understanding of health and disease. This article proposes an author's concept in which health, disease, aging, and recovery should be viewed not as fully isolated states but as different modes of functioning of a single adaptive-homeostatic system of the organism. The central element of this concept is the ability of

the organism to maintain and restore functional equilibrium under constant internal and external influences. Preventive medicine is proposed to be understood not only as the prevention of specific diseases but also as a science of mechanisms that preserve, restore, and enhance the functional resilience of the organism. Special attention is given to adaptive reactions: dosed stress, physical activity, inflammation, regeneration, thermoregulation, immune surveillance, and other physiological mechanisms that, under pathological conditions, may become excessive or insufficiently controlled. The author's hypothesis is that the effectiveness of preventing age-related diseases can be increased by shifting from targeting individual end manifestations of disease toward influencing the general mechanisms that determine the organism's resistance to damage and its ability to restore functional norm.

Keywords: aging, health, disease, preventive medicine, adaptation, homeostasis, stress, eustress, inflammation, regeneration, geroscience, healthspan, age-associated diseases.

The question of what human aging represents remains one of the fundamental questions of modern biology and medicine. Traditional clinical medicine is organized primarily around individual diseases and medical specialties: cardiology studies cardiovascular pathology, oncology studies tumor diseases, neurology studies disorders of the nervous system, endocrinology studies metabolic disturbances, etc. This approach is extremely effective for solving specific clinical tasks. However, age-related pathology has a fundamental feature: with increasing age, the likelihood of developing a large number of diseases rises simultaneously. Age is one of the strongest risk factors for cardiovascular diseases, cancer, dementia, diabetes, frailty, and other chronic conditions. For this reason, modern geroscience views aging as a general biological context that significantly influences the emergence and course of many diseases. This leads to a key question: can preventive effectiveness be improved by studying not only individual diseases but also the general mechanisms that increase the organism's vulnerability to a whole complex of age-related pathologies? This approach has already begun to develop within modern geroscience. The contemporary concept of the *hallmarks of aging* integrates several interconnected mechanisms of aging: genomic instability, telomere attrition, epigenetic alterations, impaired proteostasis, changes in autophagy, nutrient-sensing dysregulation, mitochondrial dysfunction, cellular senescence, stem-cell exhaustion, altered intercellular communication, chronic inflammation, and dysbiosis. Thus, modern science is gradually moving toward viewing aging as a complex systemic process rather than a simple sum of individual diseases. If aging is considered a general biological context of age-related pathology, an important clarification is needed. The statement "aging is a disease" is a conceptual position, but not an accepted medical definition. The U.S. National Institute on Aging explicitly notes that aging itself is not considered a disease, although it is

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the most important risk factor for many chronic conditions. Therefore, a more scientifically accurate formulation is: aging should be viewed as a systemic biological process that gradually alters the functional reserve and resilience of the organism, thereby significantly increasing the risk of numerous diseases. From the standpoint of geroscience, it is especially important that many age-related diseases share common biological prerequisites. For example, impaired proteostasis, mitochondrial dysfunction, chronic inflammation, cellular senescence, and disrupted intercellular communication may simultaneously contribute to the pathogenesis of several different diseases. Consequently, there arises an opportunity to fundamentally change preventive strategy: from treating multiple consequences to influencing the general mechanisms that increase the likelihood of these consequences, and to limiting the exclusively nosological approach.

Modern medicine is built primarily around diagnostic categories. This is necessary for clinical practice but insufficient for understanding complex age-related states.

One of the most illustrative examples is Alzheimer's disease. For decades, a large number of pharmaceutical agents have failed to achieve clinically meaningful results. A 2022 analysis of clinical programs revealed numerous unsuccessful phase II and III trials and pointed to possible causes such as incorrect target selection, insufficient understanding of complex pathophysiology, and problems in clinical-trial design. At the same time, it would be incorrect to conclude that modern pharmacology is "useless." On the contrary, therapeutic approaches capable of slowing clinical progression under certain conditions have now emerged. However, the magnitude of effect, safety, patient-selection criteria, and long-term clinical significance continue to be actively studied. Thus, the experience with Alzheimer's disease demonstrates a broader problem: a complex systemic disease may not respond adequately when attempts are made to explain it primarily through a single molecular target. This principle has broader significance for age-related medicine, where health is viewed as a dynamic state.

Health as a dynamic adaptive-homeostatic state In the proposed concept, health should not be understood as the absence of symptoms or diagnosed diseases. The human organism is constantly exposed to physical, chemical, biological, social, and psycho-emotional factors. Within the organism, processes of damage, removal of damaged structures, inflammation, regeneration, tissue remodeling, and adaptation are constantly occurring. Therefore, health is best defined as: a dynamic state of interaction between homeostatic and adaptive mechanisms that ensure preservation of the organism's functional integrity, its ability to adjust to environmental changes, recover after damage, and maintain functional activity. This definition aligns the concept with modern ideas of *resilience* — the ability of the organism to maintain or restore function after stressor exposure. Health and disease cannot be viewed as two fully independent states. Between them lies a wide spectrum of transitional states in which compensatory mechanisms still maintain functional resilience, but their reserve is already declining. Physiological mechanisms are always present — even during disease.

Reconsidering processes traditionally viewed as pathological Inflammation, fever, hypoxia, tissue damage, edema, regeneration, and immune activation are physiological functions. Inflammatory response is part of the organism's defense, participating in removal of damaged structures, recruitment of immune cells, and subsequent tissue restoration. However, it is essential to distinguish between a physiological process and pathological dysregulation. Inflammation is not automatically beneficial or harmful; its significance depends on intensity, duration, localization, and the organism's ability to complete the reaction.

Thus, a more accurate concept is: a pathological process may represent a quantitative, temporal, or spatial dysregulation of a physiological mechanism. This avoids the false dichotomy of "physiology versus pathology."

Dosed stress as a factor of adaptation Life is continuous interaction with the environment. Complete absence of stressors is impossible and likely undesirable. In this context, the concept of dosed stressor exposure becomes especially important — an exposure that triggers an adaptive response without exceeding the organism's recovery capacity. Examples include:

1. daily cold-water exposure,
2. optimal physical activity running, walking, etc.,
3. weekly intermittent fasting for 36–44 hours,
4. inhalation of cold air (an original invention),
5. sauna and steam bath.

Physical activity is the most obvious example. It induces temporary changes in energy metabolism, mechanical load on tissues, hormonal and inflammatory signaling, followed by adaptation. WHO recommendations confirm the fundamental importance of physical activity for preventing chronic diseases and reducing mortality risk

In the proposed concept, this is formulated as the principle of adaptive exposure: an adequate stressor can not only temporarily disrupt homeostasis but also stimulate mechanisms that enhance the organism's ability to withstand subsequent challenges. The term *eustress* should not be used as a universal justification for any stress. Biological effect depends on intensity, duration, frequency, the organism's condition, and recovery capacity. Thus: beneficial is not stress itself, but an adequate stressor corresponding to the organism's functional reserves.

Damage and recovery as continuous physiological processes The organism constantly undergoes microdamage and restoration. Physical activity, fasting, and other stressors may induce microdamage of various structures and activate recovery and adaptation processes, including at molecular and cellular levels. Hence an important principle of preventive medicine: the organism's ability to repair damage may be no less important a characteristic of health than the absence of damage itself**.** This requires further experimental study. Of particular interest is how the balance between damage and recovery changes with age. If damage persists while repair capacity declines, functional impairments accumulate. The transition from reversible damage to persistent dysfunction may represent a key target for preventive interventions.

Aging as a decline in adaptive reserve

Aging is viewed primarily through changes in the organism's ability to maintain dynamic equilibrium. With age, many systems change: repair mechanisms, mitochondrial function, immune regulation, proteostasis, regenerative potential, neuroendocrine regulation, and intercellular communication. In this concept: aging is the gradual alteration of the structure and regulation of adaptive-homeostatic systems, accompanied by reduced ability to maintain optimal function under load and restore it after damage. This definition does not require treating every age-related change as pathology. It allows aging to be seen as a process of declining resilience.

The "third state" a dynamic continuum

Between physiological norm and overt pathology lies a dynamic continuum. The organism is rarely static; its parameters constantly fluctuate in response to load, nutrition, physical activity, infection,

temperature, sleep, psycho-emotional influences, and many other factors. Health should be viewed not as a fixed point but as a dynamic range in which regulatory mechanisms can return the system to a functionally stable state.

Disease arises when: reaction becomes excessive or insufficient; its temporal regulation is disrupted; the ability to complete the reaction disappears; damage exceeds repair capacity;compensatory mechanisms are exhausted; a temporary disturbance becomes a persistent structural-functional change.

Thus, transitions "health → disease" and "disease → recovery" are dynamic processes. Preventive medicine at any age is medicine of functional resilience.

References

1. López-Otín C, Blasco MA, Partridge L, Serrano M, Kroemer G (2023). **The Hallmarks of Aging: An Expanding Universe.** *Cell*. 186(2):243–278.
2. National Institute on Aging. **Geroscience: The Intersection of Basic Aging Biology, Chronic Disease, and Health.**
3. National Institute on Aging. **Trans-NIH Geroscience Interest Group.**
4. Kritchevsky SB, Cummings SR (2025). **Geroscience: A Translational Review.** *JAMA*. 334(12):1094–1102.
5. Forman DE, et al (2023). **Impact of Geroscience on Therapeutic Strategies for Older Adults With Cardiovascular Disease: JACC Scientific Statement.** *Journal of the American College of Cardiology*.
6. Kim CK, Lee YR, Ong L, et al (2022). **Alzheimer's Disease: Key Insights from Two Decades of Clinical Trial Failures.** *Journal of Alzheimer's Disease*. 87(1):83–100.
7. Cummings J, et al (2022). **Alzheimer's disease drug development pipeline: 2022.** *Alzheimer's & Dementia: Translational Research & Clinical Interventions*.
8. World Health Organization (2020). **WHO Guidelines on Physical Activity and Sedentary Behaviour.**
9. World Health Organization. **Physical Activity.**
10. World Health Organization. **Promoting Physical Activity for Older People: A Toolkit for Action.** 2023.
11. Tel L.Z (1992). *Human Physiology*. Kazakhstan.
12. Tel L.Z (1994). *Human Physiology and General Mechanisms of Diseases*. Almaty.
13. Tel L.Z (1994). *Aging. Physiology, evolution, therapy*. Kazakhstan.
14. Tel L.Z (1997). The Truth of *Health*. Akmola.
15. Tel L.Z (1999). *Human Valeology — Philosophy of Life*. Astana.
16. Tel L.Z (2001). *Health Code*. Moscow: AST.
17. Tel L.Z (2001). *The Doctrine of Health, Illness, and Recovery*. Moscow: AST.