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ANTI-AGING PHARMACOLOGY: PROMISES AND PITFALLS

Introduction. Life expectancy has grown dramatically in modern times. This increase, however, is not accompanied by the same increase in healthspan. Efforts to extend healthspan through pharmacological agents targeting aging-related pathological changes are now in the spotlight of geroscience, the main idea of which is that delaying of aging is far more effective than preventing the particular chronic disorders. Currently, anti-aging pharmacology is a rapidly developing discipline. It is a preventive field of health care, as opposed to conventional medicine which focuses on treating symptoms rather than root causes of illness. [1, p.3].

Aim. This review is focused on current advances and perspectives in the field of anti-aging pharmacology.

Few decades ago, it was generally believed that damage induced by free radicals is a primary cause of aging and, thereby, that antioxidants may protect against this damage, consequently slowing the aging process and improving health. Currently, it is becoming apparent that a single cause could not properly explain the health- and lifespan-promoting effects of different pharmacological classes. It is increasingly clear that pro-longevity effects of many prospective antiaging agents are complex and could be attributable to numerous interacting signaling pathways. Taking into account the exceptional complexity of mechanistic pathways underlying aging, the

identification of these pathways and development of relevant anti-aging interventions seems to be a challenging task. Considerable progress, however, has been made in this research field throughout the past years. A large number of pharmacological substances having the potential to target molecular pathways underlying aging and to induce protective responses against aging-associated diseases including, e.g., mTOR inhibitors such as rapamycin, senolytics, etc, are presently under investigation.

One important issue in the study of potential geroprotective agents is that their pro-longevity effects might be mediated by the prevention and/or delay of onset of age-associated, life-shortening diseases, rather than through inhibiting the aging processes itself. For example, Neff et al. (2013) and Ehninger et al. (2014) based on a large-scale assessment of more than 150 cellular, molecular, histopathological, and functional traits, which typically change during the course of aging, in rapamycin-treated mice, concluded that rapamycin can extend longevity, but it has only limited effect on the aging process per se. Another promising anti-aging drug candidate, resveratrol, was found to be able to extend life span in mice fed with high-fat diet by reversing the initial steps of particular age-related diseases induced by that diet, but had no effect on animals fed with healthy diet.

Thus, all known pro-longevity drugs can be divided in three categories in accordance with the suggested mode of action:

- those demonstrating anti-aging effects, but without any evidence yet of their ability to prolong life;

- those that are suggested to extend longevity primarily because they can prevent or postpone the progression of particular age-related disease, such as cancer, but which are not proven to delay the aging process(es) per se;

- those that extend longevity because they are actually suggested to reverse the aging process itself, at least in certain environments [2, p.221].

Based on these considerations, the most promising agents with suspected anti-aging properties are categorized into three main groups in the Table 1. Since the fundamental purpose of anti-aging medicine is ultimately an extension of the healthy human life, only evidence for life extension obtained in mammalian models are

shown in the table. Certainly, the classification presented in this table is quite conditional since only relatively few research findings have been reported until now in this area of investigation, thus any new data can move a particular substance from one category to another.

In summarizing it may be suggested that targeting aging per se may be more efficient approach to prevent or postpone age-related diseases than treatments targeted to particular pathological conditions. Because of the aging population, this therapeutic strategy undoubtedly can be an area of increasing relevance for the pharmaceutical industry and public health organizations. It is currently assumed that great socio-economic benefits can be obtained from the approach based on the longevity dividend paradigm in comparison with modern public health strategy aimed on the prevention of particular diseases. Presently, the consensus is among medical and health professionals that the optimization of physiological and mental functioning through the life course should be a main focus of public health policy addressing the problem of global aging. A healthy lifestyle including a balanced diet, regular exercise and smoking cessation is the first-line strategy. Using the pharmacological substances, both potential and existing, may serve as a prospective additional approach [1, p.41-43]

Table 1. Summary and categorization of the most promising anti-aging agents

Preparation	Effects observed									
	AO	DR	AI	AC	AP	NP	AA	GHS	TA	LE
Agents with no observed demographic effects until now										
2-deoxy-D-glucose		+		+	+					
Pegvisomant	+			+				+		
Agents suggesting to promote longevity mainly by inhibiting particular disease(s)										
Statins			+	+	+	+	+			+
Rapamycin	+	+	+	+			+	+		+

Agents with both anti-aging and pro-longevity effects										
Aspirin		+	+				+			+
Coenzyme Q10	+	+	+			+	+			+
Spermidine	+	+	+		+			+		+
Vitamin E				+						+
Sodium butyrate	+		+	+	+	+				+
Suberoylanilide hydroxamic acid	+		+	+	+	+				+
Melatonin	+		+	+	+	+		+		+

AO: antioxidant; DR: dietary restriction; AI: anti-inflammatory; AC: anti-cancerous; AP: autophagy; NP: neuroprotective; AA: anti-atherogenic; GHS: growth hormone suppression; TA: telomerase activation; LE: life extension [1, p.89].

Conclusions. The great expectations related to further development of anti-aging interventions, however, must certainly be critically discussed and explored in the light of their economic, social and ethical implications. The implementation of these approaches in clinical practice will be possible only after in-depth examination and further comprehensive discussion. To meet the needs caused by the rapid population aging across the globe, a novel emphasis in physiological geroscience is needed which will require the joint efforts of interdisciplinary investigators working throughout the continuum of translational medicine from basic research to clinical applications [1, p.43]

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ECONOMIC FREEDOM AS AN IMPORTANT PRECONDITION OF BUSINESS FUNCTIONING

The purpose of this study is the consideration of the concept and components of economic freedom and its importance. Accordingly, the subject of the study is economic freedom as the ability of members of a society to undertake economic actions [1]. The components of economic liberty are private property, freedom of entrepreneurship, freedom of custom choice, the optimal level of state regulation [2].

During the writing the study the theoretical and empirical research methods were used.

The role of economic freedom is extremely high. It provides «a formula for economic progress and success». The actuality of my report lies in the fact that there are many incipient economic changes in the Ukraine that impact on the material well-being of each member of our society. That is why we need to know in which direction to implement these economic changes and decisions, what should guide us in the development of the national economy and what should be categorically abolished. Thus, large economic losses can be avoided and economic benefits can be maximized.

The result of the study was as follows. The most important component of economic freedom is availability of private property. The private property is a right to dispose, use and control certain resources by individuals or their groups. A private