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What is the priority in the problem of ageing?

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Abstract. What should we do to help solve the problem of postponing ageing? What is the priority? Let us define human ageing as accumulation of damage in the human organism that increases the probability of death. There are various problems of ageing: psychological ageing, biological ageing, etc. The central problem is biological ageing. If biological ageing is postponed, diminishing and postponing of diseases and increase in the older workers' ability to work are possible. People can stay healthy longer and countries save on social expenses. The problem of biological ageing is complex due to many different subproblems and adhering problems. Research in biological ageing is relatively poorly funded. Its funding and research depend on gaining public attention to this research. Many scientists think that there are no solutions for postponing ageing. Factually, no problem will be solved if we proceed from the assumption that the problem is not solvable. Researchers need popular support for the concept that ageing is a solvable problem. Higher public interest in biological ageing research compared to the present is possible through research of the causes of the average life expectancies of big contingents (countries, big population groups) and also interventions based on the risk factors of all-cause mortality. Studies of different causes of mortality in various countries may point to new risk factors to health and ageing. Interventions according to the known risk factors to age-related diseases can postpone these diseases and ageing markedly, by 10–20 years, and also increase the public interest in research in biological ageing.

Key words: biological ageing, biomedical gerontology, health, life expectancy, research priority, risk factors.

INTRODUCTION

Almost all organisms are ageing. Researchers have only not found ageing processes in a few animals: the sea anemone, hydra, etc. There was no need for the evolutionary process to develop organisms that will live forever. Long life of an animal has little species advantage.

Most people (excluding young, less than 15–18 years) do not want to be old. Many women use skin rejuvenation that can be achieved in a number of ways, ranging from laser, light and other energy-based treatments to chemical peels and other non-ablative methods. People older than 30–40 years sometimes dream about being young. At present, many ageing problems become increasingly important for governments of developed European countries in connection to population ageing.

People do not want to simply disappear. In spite of the small proportion of people who are uninterested in their health and therefore create problems for the medical industry, most people's activities are aimed at maintaining their health through better

living and working conditions, better food and medical services. People want to use better homes, cars, clothes. Therefore, prolonging the period of healthy years (and life) is of the greatest importance (Kristjuhan, 2013).

At present, the percentage of older people in population is increasing and creating more problems for medicine. Most diseases of elderly people (cardiovascular diseases, Type 2 diabetes, cancer, arthritis, osteoporosis, dementia, Alzheimer, macular degeneration, glaucoma) depend, first of all, on the age of the subjects. Sarcopenia and general ageing-related muscle weakness are important limiting factors for the so-called successful ageing (McPhee et al., 2013). The percentage of pensioners also increases in population as countries have a fixed pension age, mostly 65 years, though in some countries this pension age has been increased during the recent years. Financial and social problems are topical in connection with funding of pension systems in developed countries: saving the previous level of the pension is difficult and often this level will be lower in the future. Nowadays, older people are working in enterprises more often than before and retire later. They are experienced specialists, but physically weaker compared to the young. Sometimes they need new knowledge and sometimes (depending on occupation and health) they need specific working conditions. The question of in what age their productivity is highest and when it begins to fall is important. The age of maximum productivity is quite high in the case of highly qualified specialists in intellectual work. University professors have maximum productivity in their fifties and sixties (Kristjuhan & Taidre, 2013).

The problem of ageing is a complex of many different subproblems and adhering problems and therefore solving some of them is a priority. The central scientific field is biomedical gerontology that is engaged in the biological processes of ageing. One of the world's pioneering researchers in the science of biological ageing, Tom Kirkwood (1999), says that ageing is one of the last great mysteries of the living world. Biogerontologists are interested in many problems of the biology of ageing, but first of all ways of slowing down biological ageing. Unfortunately, biomedical gerontology is badly funded. Professor Judith Campisi (2011, in interview by V. Glaser), a pioneer in researching controlling of cellular senescence, said: 'We need to gain more popular support for the concept that aging is a solvable problem.'

What is the priority in the problem of ageing? What should we do to help solve the problem of postponing ageing?

DISCUSSION

Fundamental problems at present

Biological ageing in humans, increasing mortality, begins from youth, but probably not with the birth. Mortality rate is often lowest in the age group 5–9 years in developed countries.

Factually, there are no widely accepted definitions for biological ageing. In experiments, the life expectancy of laboratory animals is widely used as a criterion of biological ageing, but the criterion of life expectancy is less used for ageing in human beings. Many other factors (e.g. diseases) are known which human life expectancy depends on.

There is also no widely accepted definition for diseases. It is not clear whether we should study biological ageing separately from diseases or as one continuum

(Blumenthal, 2003; Advances, 2013). There are thousands of centenarians and they are still dying of diseases, not of old age. Autopsies which have been performed on the very old always show a pathological cause of death. Disease prevention uses knowledge to decrease the morbidity associated with ageing. Distinction of ageing from diseases is difficult; it is separating undefinable from undefined (Evans, 1988). Kennedy and Minkler (1998) argue for a dialectical vision of ageing, wherein both able-bodied and disabled bodies are all parts of ageing. According to Ladiges et al. (2013), pathology assessment is essential to help define the progression of lesions associated with ageing; the real challenge is including it in ageing studies, because there is currently a lack of specialized expertise and resources. In the last few years, a new science geroscience has began to develop. The aim of geroscience is to examine how ageing contributes to disease (Advances, 2013).

Some scientists think that the first rate problem is how to measure ageing. However, the biomarkers of the pace of ageing are debatable despite many studies.

Many gerontologists think they need to know far more about the biology of ageing to slow down the ageing process. Other scientists think that there is no need for finding ways to slow down ageing. Maybe they are right. In the history of medicine, prevention of infectious diseases required different knowledge from the knowledge of disease mechanisms.

Most gerontologists think that modern biological theories of ageing in humans are falling into two main categories: the programmed and damage or error theories (Jin, 2010). Both groups of theories have pros and cons. The increasing number of centenarians is not simply due to an increase of the human life span as a consequence of improved economic, cultural conditions, and social/health care, but also the consequence of interaction of these factors with the genetic variability present in human populations, and environmental factors (Vasto et al., 2012). There is need a for balancing life-style and genomics research for disease prevention. Genetic and environmental factors, including diet and life-style, both contribute to cardiovascular disease, cancers, and other major causes of mortality, but various lines of evidence indicate that environmental factors are most important (Willett, 2002).

Speculative recommendations for postponing human ageing without any theoretical or experimental confirmation are very widespread. On the Internet, we can find a high number of anti-ageing remedies (herbs, adaptogens, antioxidants, hormones, vitamins, minerals, a lot of water, apple cider vinegar, etc.) but scientific confirmations of their efficiency can be found rarely.

Several modern biomedical fields have directly originated from rejuvenation and life extension research: 1) Hormone Replacement Therapy was born in Charles-Edouard Brown-Séquard's rejuvenation experiments with animal gland extracts (1889); 2) Probiotic diets originated in Elie Metchnikoff's conception of radically prolonged ’orthobiosis’ (c. 1900); 3) The development of clinical endocrinology owed much to Eugen Steinach's ’endocrine rejuvenation’ operations (c. 1910s–1920s); 4) Tissue transplantations in humans (allografts and xenografts) were first widely performed in Serge Voronoff's ’rejuvenation by grafting’ experiments (c. 1910s–1920s); 5) Tissue engineering was pioneered during Alexis Carrel's work on cell and tissue immortalization (c. 1900–1920); 6) Cell therapy (and particularly human embryonic cell therapy) was first widely conducted by Paul Niehans for the purposes of rejuvenation as early as in the 1930s (Stambler, 2014).

However, many scientists agree with Tosato et al. (2007) that no convincing evidence showing that administration of the existing 'anti-ageing' remedies can slow down ageing or increase longevity in humans is available. Biological ageing is studied mainly in laboratory animals (translational biogerontology), but data of these studies are not easily usable in humans.

Are the practical problems of ageing financial?

A widespread opinion is that postponing human ageing and increasing the average life expectancy are very expensive, but factual data do not confirm that.

Most people are worried about their own longevity. They think much less about life expectancy in their country. It seems that it is far from their everyday problems.

A study comparing different life expectancies and Gross National Products (GDP, purchasing power parity, PPP) shows that sometimes the average life expectancy in poor nations is as long as in rich countries. According to World Factbook (2014), the average life expectancy in Jordan is 80.3 years, better than in the United States (78.6 years), but Jordan has much lower GDP (6.1 thousand USD per year) per person than the United States (50.7 thousand USD per year). Life expectancy in Kyrgyzstan is 69.75 years, nearly the same as in Russia (69.85 years), but Kyrgyzstan has much lower GDP (2,400 USD per year) than Russia (17.5 thousand USD per year). Economic recessions (extended declines in general business activity) despite the shortage of money often boost life expectancy (Kristjuhan & Taidre, 2012). Single factors (economy) probably have some role, but complexes of risk factors are more important. Complexes of health risk factors have been studied rarely as their study is difficult.

Studies of the causes of different life expectancies in various countries are rare. We know more about individual longevities and life expectancies of small groups of people rather than have a strong genetic aspect. Much attention is paid to the issues of the longevity of centenarians.

At present, national economies consider improving life expectancy to be a mere by-product of economic development, without any intrinsic value. The measures used to avoid deaths are mostly considered to be expenses (Kristjuhan, 2012).

Although human life is declared to be of high value everywhere, there is no intensive activity in research and practice for slowing down human biological ageing due to the complexity of the research and the difficulties with financing such projects. A part of this problem is misunderstanding of the effect of postponing ageing. Many people think of extended lives as extended illnesses and suffering. Factually, in countries where people have longer lives, people of the same age are healthier than in countries where life expectancy is short. The effect of prolonging life is very positive: more years in youthful condition, better health, longer health, lower morbidity, higher ability to work of the some age groups, better economy in countries, etc.

Postponing ageing in reality

Factually, at present, life expectancy and health expectancy increase together in most countries. At present, older people of the same age have better health than many years ago. The trends are towards less cardiovascular diseases and less disability (Khaw, 1997). The living and working conditions are better today compared to dozens of years ago. Khalyavkin and Yashin (2007) suggest that nonpathological senescence

arises from unsuitable external influences, inadequate interaction of the organism with the environment. When biological ageing in humans is defined as accumulation of changes that increase the probability of death, many ways open for its postponing in reality.

Physicians sometimes think that life expectancy increases, but health deteriorates and diseases are even found in younger persons. They find infarctions in the myocardium and in the brain of younger persons than before. The main cause is that methods for diagnostics are becoming more sensitive. Using magnetic resonance imaging discovers many small infarctions and lacunar infarctions in brains that would not have become known before.

Practice of diminishing the risks of age-related diseases

Specialists in epidemiology and occupational health see a huge number of risk factors developing in highly developed countries as well. There are a great number of various risk factors for age-related diseases. Examples of the risk factors are obesity, big waist circumference, high body mass index (BMI), high blood pressure, low vitamin C content in food, tobacco consumption, binge drinking, sedentary lifestyle, high cholesterol, and diabetes. Many effects of these factors and their prevention are not clear. For example, there are different values of blood pressure: at home and in clinic. In a study of 438 patients (random selection), 170 (38%) normotension, 190 (43%) white coat hypertension, 10 (2%) masked hypertension (detected in at home measurements, but not in the clinical setting), and 68 (15%) sustained hypertension cases were detected (Helvaci & Seyhanli, 2006). White coat hypertension occurred more often than sustained hypertension. Avoiding and prevention of white coat hypertension is complicated. It depends very much on different psychological factors.

There are striking reserves to increase the average life expectancy and postponing ageing in highly developed countries. For example, 40% of men in Japan smoke and the Japanese use nearly two times more salt than the upper daily limit (6 g) recommended by the World Health Organization.

Some physicians think that they know almost everything about health risk factors. Factually, a very small percentage of risk factors have been studied in detail. For example, over 99% of the chemicals (cleaning products, cosmetics, clothing, etc.) in the market have undergone no comprehensive human and environmental risk assessment (REACH, 2005).

At present, we are only beginning to know the need for many components in our food and the actual situation – trace chemicals, antinutrients, etc. Small amounts of potentially harmful substances are found at some level in almost all foods. We are only just starting to understand nutritional patterns and their interaction with genetic and other forms of environmental exposure.

Several longitudinal studies have shown that taking into account some health risk factors and using interventions enable to postpone age-related diseases for 10-20 years. This saves social expenses significantly.

Ford et al. (2011) examined the relationship between four lifestyle behaviours (never smoked; healthy diet; adequate physical activity; and moderate alcohol consumption) and all-cause mortality in a national sample in the United States. They used the data from 16,958 participants aged 17+ in the National Health and

Nutrition Examination Survey III Mortality Study from 1988–2006. The rate of advancement periods representing the equivalent risk in the form of a certain number of years of chronological age for participants who exhibited all four high risk behaviours compared to those who had none were 11.1 years for all-cause mortality, 14.4 years for malignant neoplasms, 9.9 years for major cardiovascular diseases, and 10.6 years for other causes.

Khaw et al. (2008) examined the relationship between lifestyle and mortality in a prospective population study of 20,244 men and women aged 45–79 living in the general community in the United Kingdom with no known cardiovascular disease or cancer in a baseline survey from 1993–1997 and followed up in 2006. Participants scored one point for each health behaviour: currently not smoking; not physically inactive; moderate alcohol intake (1–14 units per week); and plasma vitamin C >50 mmol/l indicating fruit and vegetable intake of at least five servings a day, for a total score ranging from 0-4. The mortality risk for those with four compared to zero health behaviours was equivalent to being 14 years younger in chronological age.

Clarke et al. (2009) examined 18,863 men from 1967–70 and followed them for 38 years. Compared with the men in the lowest 5% of the risk score based on smoking, diabetes, employment grade, continuous levels of blood pressure, cholesterol concentration, and BMI, the men in the highest 5% had a 15-year shorter life expectancy from the age of 50 (20.2 *vs* 35.4 years).

Kopes-Kerr (2010) highlighted ten major studies on the effects of primary prevention. These studies demonstrate significant correlations between specific healthy lifestyle behaviours and decreases in major chronic diseases (e.g. diabetes mellitus, heart disease, stroke, and cancer) and all-cause mortality.

Studies showed that positive lifestyles (avoiding stress, blood pressure control, exercising, healthy food, etc.) do not entail much expenses and can have an impressive effect on health and life expectancy.

There are also many biogerontologists' suggestions on how to postpone ageing and increase human life expectancy. Rattan (2008) recommends applying hormesis in ageing research and a therapy which is based on the principle of stimulation of maintenance and repair pathways through repeated exposure to mild stress. A shortcoming of this method is that the value of the optimum level of mild stress is debatable. Kristjuhan (2006) recommended avoiding the risk factors of all-cause mortality from age-associated diseases and keeping away from sensations of discomfort.

Over 30 years, we have conducted ergonomic studies (we understand ergonomics as a scientific discipline concerned with understanding of interactions among humans and other elements in the human-machine-environment system) in industry workers. Data on ageing were a by-product of these studies. Comparing the data of the ability to work and health of the workers in optimal conditions with data of the workers who did not follow our physiological and ergonomics guidelines showed that it was already possible to postpone age-related diseases up to 20 years (Kristjuhan, 2010).

CONCLUSIONS

It is important to increase public interest in research of biological ageing. More public interest compared to the present is possible through research of the causes of the average life expectancies of big contingents (countries, big population groups) and also interventions based on the risk factors of all-cause mortality. Studies of the causes of different mortalities in various countries may point to new mechanisms and risk factors of health and ageing. Comparing the data of ability to work and health of workers in optimal conditions with data of workers who did not follow physiological and ergonomics recommendations showed that it was already possible to postpone age-related diseases up to 20 years.

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