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# Physiology of Ageing

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**Abstract**
Gerontology studies the elderly. Gerontologists say ageing is four-dimensional. Ageing theories attempt to explain ageing over a 120-year lifespan. The ageing theory can be traced back to Dr. August Weismann's 18th-century theorem that metabolism and lifespan are inversely related. Free radicals from basic metabolic processes damage cells and organs.
Studies showed that pituitary-deficient mice lived longer and aged later. Joint, bone, fat, and muscle changes with age affect our physical and mental development. Presbyopia occurs when the lens loses flexibility and thickens, making close-up vision difficult. Brain mass decreases by 30% by age 80. Early learning and short-term memory are affected.
Kidney thickening and permeability decrease with age. These are major risk factors for arterial fibrillation, hypertension, and stroke. Leakage, urine retention, and UTIs increase as bladder muscles weaken. Malnutrition, postprandial hypotension, dysphagia, constipation, and faecal incontinence are common in older people. Several types of calcium and iron are malabsorbable in achlorhydria. Vitamin D malabsorption worsens elderly hypovitaminosis.

**Keywords:** Ageing, biological, theory, programmed, effects of ageing

## Introduction
The physiological alterations in the human body that take place from reaching adulthood till death are referred to as "ageing. Any person who is 60 years of age or older is considered to be an "elder [1]." Aging is a biological phenomenon that begins at conception and concludes with death, according to the World Health Organization. At the biological level, ageing is brought on by the build-up of a variety of molecular and cellular damage over time, which results in a gradual loss of physical and mental function, an elevated risk of disease, and, ultimately, death.
Gerontology is the study of ageing and elderly people. According to gerontologists, ageing has at least four dimensions [2].

1. Chronological ageing is calculated using the years since birth.
2. "Biological aging" is the term used to describe the bodily changes that result in our physical decline as we age.
3. Psychological aging describes the psychological alterations that take place as we age, such as those that affect our personalities and mental abilities.
4. Social ageing describes changes in a person's duties and connections in formal organisations like the workplace and workplace homes, as well as in their networks of family and friends.

## Ageing theories
Theories of ageing make an effort to explain the phenomenon of ageing as it manifests itself during the life span, which is generally believed to be 120 years at the most. According to conventional ideas about ageing, growing older is neither a genetic predisposition nor an adaptation. Programmed and damage-or-error theories are the two primary subcategories of contemporary biological explanations for human ageing [3].
Programming philosophies say that bodies follow a biological timeline and that the human body is made to age.
Three subcategories comprise the programmed theory:

### 1. Endocrine hypothesis
Hormones work with the biological clock to regulate how quickly we age. Recent research supports the hormonal control of ageing and the central role of the evolutionarily conserved insulin/IGF-1 signalling (IIS) pathway in this control.

**2. Programmed durability**

The sequential turning on and off of particular genes is what causes senescence, which is the stage at which age-related deficiencies become apparent.

**3. Theorizing immunology**

The immune system is designed to deteriorate over time, which makes people more susceptible to infectious diseases, ageing and death. Cancer, Alzheimer's disease, inflammatory bowel disease and cardiovascular disease have all been inadvertently connected to dysregulated immune responses.

**The theories of damage or error**

Ageing is primarily caused by environmental assaults on living things that create accumulative harm at various levels. Include.

**1. Theory of Wear and Tear**

Vital components of cells and tissues wear off over time, which causes aging. German biologist Dr. August Weismann first proposed this notion in 1882. Even now, many people find this theory to be completely logical.

**2. Rate of living theory**

According to this notion, an organism's lifespan is inversely correlated with the rate of basal oxygen metabolism. Based on the observation that larger animals typically outlive smaller species, Max Rubner proposed this theory in 1908 and suggested that a slower metabolism may be related to longevity. Although useful, this idea falls short in describing the maximum life span.

**3. Free Radicals theory**

According to this idea, superoxide and other free radicals harm the macromolecular parts of cells, leading to cumulative damage that eventually prevents cells and organs from functioning. Free radicals are a by-product of the body's basic metabolic processes. Dr. Gerschman first proposed this theory in 1954, but Dr. Denham Harman later developed it. Harman [4] proposed in 1956 that administering substances that reduce the amount of free radicals could extend life or slow the ageing process. Experiments showing longer mean lifespans for animals fed antioxidants have supported this notion. According to Igor Afanas'ev's review, reactive oxygen species (ROS) signalling is currently thought to be the most important enzyme/gene route responsible for cell senescence and organismal ageing, and it may be viewed as a further evolution of the free radical theory of ageing.

**4. The glycation hypothesis of AGEs and the cross-linking theory**

Johan Bjorksten put forth this theory in 1942. This hypothesis is supported by the evidence that proteins, DNA, and other structural molecules form unsuitable cross-links or attachments as we get older. Glycation, also known as glycosylation, is one of the key mechanisms by which cross-linking takes place. Proteins can bind to glucose molecules, which can then change into brown molecules known as "advanced glycosylation end products" or AGEs [5]. A persistent cross-link is created between two nearby proteins by the sticky ends of AGEs, which prevents the proteins from performing their normal roles. The senile cataract, arteriosclerosis and elasticity loss frequently observed in older adult skin are known cross-linking disorders.

**5. Theorem of somatic DNA damage**

In the cells of living things, DNA is constantly being damaged. While the majority of these damages are fixed, restoration procedures are unable to eliminate flaws as quickly as they appear to be created. As people age, genetic mutations develop and multiply, leading cells to degenerate and malfunction. Damage to mitochondrial DNA, in particular, may result in mitochondrial dysfunction. Therefore, cellular genomic integrity is compromised as we age.

**Age-related neuroendocrine theory**

Professor Vladimir Dilman made the initial suggestion. According to this idea, the body's ability to maintain homeostasis decreases with age, which results in the failure of adaptive systems, ageing, and death. The pacemaker theory and the ageing clock theory are other names for this hypothesis. As people age, the principal regulatory system maintaining human homeostasis-the hypothalamus-pituitary axis-begins to function less effectively. The hypothalamus loses its capacity for precise regulation, and the hormone receptors that take them up lose some of their sensitivity. As a result of receptor downgrading, both the secretion and efficacy of numerous hormones decrease. Despite the possibility that some late-life functional changes are related to decreased hormone levels, experimental data from mice suggests that hormone reduction can actually lengthen life. According to studies, mice with their pituitary glands removed lived longer and experienced age-related changes later.

**Ageing and the Telomere Theory**

The ends of the DNA molecule that makes up our chromosomes are protected by tiny caps called telomers. They guard against chromosome instability and end-to-end fusions. Experimental evidence suggests that telomers get shorter with each subsequent cell division [6]. According to Dr. Hayflick's 1961 idea, human cells can only divide 50 times before ceasing to divide (the Hayflick limit theory of ageing). While most adult cells lack this ability, some cells, like egg or sperm cells, use telomerase to restore telomeres to the ends of their chromosomes. The cells stop replicating at a meaningful pace when the telomers reach a critical length, and they die off. This finally results in the death of the entire organism.

**Ageing and calorie restriction**

The reduction of energy consumption without malnutrition is referred to as "calorie restriction". It is a non-genetic technique that guards against age-related illnesses and lengthens life. Laboratory mice with calorie restrictions appeared to live twice as long as mice with regular diet [7]. It has been established that consuming more calories after the age of 40 speeds up ageing. The following consequences have been linked to caloric restriction of roughly 30% of total intake:

a) Extension of the average life expectancy and maximum life span.
b) Impact on protein turnover, gene expression and cross-linking.
c) Postponement of the onset of age-related diseases.

d) Reduction in the deterioration of physiological functions like immune responsiveness, glucose metabolism, muscle atrophy, etc.

**Age-related physiological effects on various body organs and systems**

All systems undergo physiological changes as we age. The musculoskeletal system is frequently the first to exhibit age-related symptoms. The eyes and ears first begin to alter around midlife. Most bodily processes peak before the age of 30, after which they gradually but steadily begin to decline.

**Effects of ageing on the joints and bones**

Osteoporosis and fractures are caused by a decline in bone density. The end of the femur at the hip, the wrist's radius and ulna, and the spine's bones are the bones most commonly affected. The tissue cushions between the vertebrae thin out and lose fluid, making the spine less thick and shorter. Osteoarthritis is caused by cartilage damage through wear and tear or recurrent injury. Joints feel tight or stiff as ligaments and tendons lose their elastic properties.

**Effects of ageing on body fat and muscles**

Beginning at about the age of 30, the muscular mass and strength tend to decline and last the rest of one's life. Furthermore, because more fast-twitch (fast-contracting) muscle fibres are destroyed than slow-twitch (slow-contracting) muscle fibres, muscles cannot contract quickly. By the age of 75, the percentage of body fat often doubles from what it was in adolescence. A high body fat percentage can make conditions like diabetes more likely. Additionally, the distribution of fat alters, affecting the torso's form.

**Effects of ageing on the eyes**

Presbyopia is a disorder that develops in middle age when the eye's lens loses flexibility and the ability to thicken, making it harder for the eye to focus on close objects. Age-related changes to the eye's lens can also result in visual haze. The lens gets denser, making it harder to see in low light. As the lens turns yellow, so does the perception of colour. The decline in nerve cells that carry visual signals from the eyes to the brain affects how well people perceive depth. Less tears are produced, causing the eyes to feel dry. Floaters, which are very little black spots, are sometimes observed darting across the field of view. On the surface of the eye, an arcus senilis [8], a gray-white ring, may emerge.

**Effects of ageing on the throat, nose and ears**

Presbycusis or a progressive loss of hearing, is frequent, especially for high-pitched sounds. Older persons frequently have hearing loss, and the prevalence of hearing loss rises with age. This could potentially affect a person's capacity for verbal comprehension. Ringing in the ears and vestibular imbalance are common complaints among the elderly. With age, the sense of smell may deteriorate. Foods may occasionally not taste the same due to this possible impact on the sense of taste. With age, the voice also changes. The larynx's tissues could stiffen, which would damage the voice's pitch and quality as well as lead to hoarseness.

**Effects of ageing on the nervous system**

As we age, the brain's size, vasculature, and cognitive abilities all change. By the age of 80, people undergo a 30% decrease in brain mass, especially grey matter. There can be a decline in brain activity. The ability to learn new material and short-term memory are typically impacted quite early. Neurotransmitter synthesis will decrease. Nerve conduction becomes sluggish.

**Effects of ageing on the cardiovascular system**

Ageing of the vasculature results in increased arterial thickness, loss of flexibility and stiffness, and defective endothelium. Clinically, these alterations lead to an increase in systolic pressure and are significant risk factors for the development of arterial fibrillation, hypertension, and stroke. Reduction occurs in the sympathetic modulation of heart rate, response to beta-adrenergic receptor activation, left ventricular contractility, and ejection fraction. The heart's ability to pump lessens, and cardiac output declines [9].

**Effects of ageing on the respiratory system**

As people age, their lung function gradually declines. weakening of respiratory muscles Lung compliance declines, and the thoracic cage becomes stiffer due to rib cage calcification, age-related kyphosis and osteoporosis, which limits the capacity of the cage to expand [10]. Alveoli and bronchial tubes both lose flexibility. The lungs can't recoil as well as they used to. Environmental exposures put the lungs at greater risk and increase their propensity to infection and inflammation. Reflexes to coughing become less sensitive.

**Effects of ageing on the urinary system**

Age-related changes in the kidney include Bowman's capsule thickening and decreased permeability, degenerative changes in the tubules, atrophy, and a reduction in the number of nephrons, as well as vascular abnormalities at all vessel levels. Maximum excretory capacity and glomerular filtration rate decrease. As the muscles controlling the bladder deteriorate, problems with leakage, incontinence, or urine retention may arise. Increased chance of urinary tract infections. Urinary incontinence is more likely to occur in women due to changes in the urethra, which may be brought on by a drop in oestrogen levels during menopause.

**Effects of ageing on the digestive system**

Oesophageal, gastric, and colonic motility are particularly affected by changes in gut function with age. Malnutrition, postprandial hypotension, dysphagia, constipation, and faecal incontinence are all more common in the elderly. Age-related increases in the frequency and severity of infection are mainly attributed to the gut immune system's impairment. Achlorhydria is linked to the malabsorption of several types of calcium and iron. Hypovitaminosis, which is so prevalent in older people, is made worse by vitamin D malabsorption. Drug metabolism in the liver is delayed as people age.

**Effects of ageing on the endocrine system**

With age, various hormone levels decline. Hormone receptor sensitivity declines. Oestrogen and progesterone levels in women tend to decline, which causes menopause [11]. With age, testosterone levels also decrease. The thyroid gland gradually reduces the basal metabolic rate by producing fewer thyroid hormones. On the other side, when people age, their parathyroid levels increase, which may

cause osteoporosis. Due to poor glucose metabolism, blood glucose levels surge more quickly and take longer to return to normal. Age-related changes in melatonin levels may have a significant impact on the typical sleep-wake cycle.

## Summary and Conclusion

According to the physiology of aging, as humans age, a series of complex events results in the gradual loss of function in all organ systems. Although ageing is unavoidable, understanding the basic physiology of ageing processes can help to maintain quality of life in an ageing society. This stage of life must be experienced by each person at his or her own pace and location. These changes with age have important practical implications for the clinical care of older patients. In an effort to prevent or slow down some of these changes, rational preventative diet and exercise programmes are required.

## Conflict of Interest

Not available

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## References

1. Dyussenbayev A. Age Periods of Human Life. Adv. Soc. Sci. Res J [Internet]; c2017 Apr 1 [cited 2023 Feb 6]. Available from: https://journals.scholarpublishing.org/index.php/ASSRJ/article/view/2924
2. Jiang Y, Joseph Jachna T, Dong H. Understanding the Critical Needs of Older People: An Aging Perspective; c2016.
3. Jin K. Modern biological theories of aging. Aging Dis. 2010;1(2):72-4.
4. Beckman KB, Ames BN. The free radical theory of aging matures. Physiol. Rev. 1998;78(2):547-81.
5. Lv X, Lv GH, Dai GY, Sun HM, Xu HQ. Food-advanced glycation end products aggravate the diabetic vascular complications via modulating the AGEs/RAGE pathway. Chin J Nat Med. 2016 Nov;14(11):844-55.
6. Garber K. At Loose Ends: Telomere Theories of Aging and Cancer Begin to Converge. JNCI J Natl. Cancer Inst. [Internet]. 2012 Jun;104(11):803-6. [Cited 2023 Feb 6]. Available from: https://academic.oup.com/jnci/article/104/11/803/2581409
7. Weindruch R, Sohal RS. Caloric Intake and Aging. N Engl. J Med. 1997;337(14):986-94.
8. Salvi SM, Akhtar S. Ageing changes in the eye. Postgr Med J [Internet]. 2006;82:581-7. [cited 2023 Feb 6]. Available from: www.postgradmedj.com
9. Navaratnarajah A, Jackson SHD. The physiology of ageing. Med (United Kingdom) [Internet]. 2013;41(1):5-8. Available from: http://dx.doi.org/10.1016/j.mpmed.2012.10.009
10. Sharma G, Goodwin J. Clinical Interventions in Aging Effect of aging on respiratory system physiology and immunology. Clin. Interv. Aging [Internet]. 2006;1(3):253-60. [cited 2023 Feb 6]; Available from: https://doi.org/10.2147/ciia.2006.1.3.253
11. Chahal HS, Drake WM. The endocrine system and ageing. J Pathol. 2007 Jan;211(2):173-80.

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