Theories of Aging

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ABSTRACT

Aging is the progressive decline in the function and performance, which accompanies advancing years. It is the process of growing old, resulting in part from the failure of body cells to function normally or to produce new body cells to replace those that are dead or malfunctioning. There are bio-medical and philosophical views about aging. Aging has been viewed differently by different people. Whereas to some it means power, authority, wisdom and respect, others consider it as a forced retirement leading to a state of dependency, loss of charm and of physical strength. To most, aging implies physiological and psychosocial changes that are reflected in their reduced income, lesser activities, and consequential loss of status, both in the family and in the society. The status of the aged person in contemporary times seem to have changed perceptively. Industrialization and urbanization have given rise to migration and emergence of nuclear families with increasing stress on individuality. Here examine different theories of aging.

Keywords: Theories of Aging, Types of aging

Aging is the progressive decline in the function and performance, which accompanies advancing years. It is the process of growing old, resulting in part from the failure of body cells to function normally or to produce new body cells to replace those that are dead or malfunctioning. There are bio-medical and philosophical views about aging. Aging has been viewed differently by different people. Whereas to some it means power, authority, wisdom and respect, others consider it as a forced retirement leading to a state of dependency, loss of charm and of physical strength. To most, aging implies physiological and psychosocial changes that are reflected in their reduced income, lesser activities, and consequential loss of status, both in the family and in the society. The status of the aged person in contemporary times seem to have changed perceptively. Industrialization and urbanization have given rise to migration and emergence of nuclear families with increasing stress on individuality.

The phenomenon of large aging population has become one of the most dramatic and influential developments in the 20th century. This situation has profound significance for the

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society in both the 'developed' and 'developing' nations. As per the Global Population Profile: 2002 by U.S. Census Bureau, the estimated population of the world was 6.2 billion. Of this, about seven percent people could be classified as elderly, that is, those who were 65 year old and above.

Old age has been defined variously in different societies and cross culturally. It is a relative concept and different meanings have been attributed in different contexts. A still more specific definition of aging was offered by Handler, "Aging is the deterioration of a mature organism resulting from time dependent, essentially irreversible changes intrinsic to all members of a species, such that, with the passage of time, they become increasingly unable to cope with the stresses of the environment, thereby increasing the probability of death" (Handler, 1960, p.200). Aging refers to the regular change that occurs in mature genetically representative organism living under representative environmental conditions as they advance in chronological age.

The term 'aged' not only describes individuals but is also used as collective noun, and once individuals are identified as 'old', they are perceived exclusively as such. Hazan (1994, p.16) observes that there are several ways of defining aged, "one way is seemingly unproblematic self-definition: an 'old person' is someone who regards him or herself as such… Another definition of 'aged' is socially constructed, composed of an infinite number of overlapping points of view with regard to a given person. Changing circumstances and the dynamics of social relationships make it difficult if not impossible to use such a definition vigorously".

1. TYPES OF AGING:

There are four types of Aging

(a) The biological age of an individual can be defined as an estimate of the individual's present position with respect to his potential life span. (b) Psychological age, by definition, refers to the adaptive capacities of individuals, that is, how well they can adapt to changing environmental demands in comparison with the average (c) Functional age is closely related to psychological age. Functional age is an individual's level of capacities relative to others of his age for functioning in a given human society. (d) Social age refers to the roles and social habits of an individual with respect to other members of a society.

All individuals age, young children age, as do older adults. Aging is a universal experience for human with diversity in meaning and interpretation. Aging includes under its rubric, individual aging and population aging. First, individual aging refers not only to a person's interactions and inter-relationships but also involves performance in a sequence of socially prescribed roles, accumulation of experiences and changes in the physiological systems as well as in perceptual, cognitive, emotional and other psychological process: we age biologically, psychologically, and sociologically. The nature of aging among human beings as members of society is markedly affected by psychological, social and biological factors. These factors continue to differentiate individuals of any one chronological age within the life span. It is a normative process and not a fixed dimension of the life cycle. As individuals
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grow older changes are witnessed in the physical, cognitive and social realms. The 'aging experience' is determined by the unique interactions between the various clocks. Aging is not a homogeneous experience that affects every individual within the same society in the same way. It is generally viewed as bringing physical decline, emotional instability, mental deterioration, forced retirement, and financial dependency. All society attaches great significance to various stages of life cycle.

Age is as culturally constructed and personally negotiated as any other attribute. Given that age, as opposed to physical capability, has no necessary characteristics, such attributes as age are granted culturally. Society differentiates people on the basis of age. Age is universally applied as major yardstick to judge the timing of behavior and to classify situations and life events in some temporal order. It is understandable that every society will have some form of stratification and differentiation based on age. As such age is a key dimension in the organization of the structure of society. Different age groups experience different life situations that are further shaped by people's race, class and gender. There are unique social experiences and different life chances for different age groups in society. Chronological age is not a determinant of individual behavior. It is not the intrinsic meaning of age itself that brings certain specific life course patterns. Age is not an explanation of behavior or a course of change; it is, in fact, nothing more than the passage of time and a marker of stages in a sequence.

Every society has had a concept of old age. Older people in various nations and cultures experience aging quite differently. The age at which old age is thought to start varies in different cultures. In Samoa, old age is usually defined as starting at 50; at 60 in Japan and Thailand, at 65 to 70 years in most western industrial countries. Whilst the term old or elderly appears a near universal social category recognized throughout recorded history, the twentieth century has seen a radical rethinking of what being old means. The pension and retirement policies that emerged during the first decades of the last century provided a new indicator of what it was to become an old person. Demographic change, state retirement policies and the emergence of Gerontology and Geriatrics as empirical disciplines studying old age produced a revolutionary shift in thinking about old age throughout most of the developed world rendering the physical determinacy of aging problematic. Being old is something that happens on an individual basis, the criteria for old age tend to be flexible, and transition may occur over a long period of time. People age differently within their personal life contexts according to individual characteristics and histories that bring to the older adulthood.

2. THEORIES OF AGING
Many different views about the causes of aging have been proposed. Important among them are as follows.

**Stochastic Theories**

Stochastic theories: "Growing old is the result of living". The first group, Stochastic theories, also known as wear-and-tear theories of aging, suggest that we grow old because of
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Cumulative damage to our bodies from both external and internal sources. Because such damage is completely not repaired, we simply "wear out" over time. One such theory emphasizes the role of free radicals—atoms that are unstable because they have lost electrons. According to this theory, these highly unstable particles are continuously produced by body metabolism; once formed, they react violently with other molecules in cell, thus producing damage. When this damage affects DNA, free radicals can interfere with basic aspects of cell maintenance and repair. The theory proposes that this damage cumulates over time, thus producing the decline associated with aging.

Another stochastic theory stresses the effects of damage to our DNA—damage produced either because cell division somehow "goes wrong", or by external causes such as viruses or toxins in the environment. As the number of cell damage DNA deterioration increases, we age and our internal systems gradually decline.

Indirect evidence for wear-and-tear theories of aging is provided by individuals who repeatedly expose their bodies to harmful conditions or substances, for instance, large doses of alcohol, various drugs, or harsh environments. Such persons often show premature signs of aging, presumably because they have over loaded their bodies capacities for internal repairs.

Programmed Theories

A second group of theories attributes physical aging primarily to genetic programming. According to these programmed theories of aging, every living organism contains a kind of built-in biological clock that regulates the aging process. Very recent findings suggest that it may involve, at least in part, strips of DNA that cap the ends of our chromosomes—telomeres (Gladwell, 1996). Each time a cell divides, the telomere become shorter; when this shortening reaches some critical point, the cell can no longer divide, and this may contribute to the aging process.

Other programmed theories stress the fact that our immune system seems to "wind down" over time and that our endocrine system and the neural areas that control it, declines with increasing age. These systems regulate many basic processes (e.g., our metabolism); so, as they decline, our vitality drops too. Support for programmed theories is provided by several observations. First, each species has a characteristic maximum life span; this suggests that length of life is somehow built into different species genetic code. Second, longevity appears to be an inherited trait. One rough indicator of how long you will live is the lifespan of your parents and grandparents. This, too, suggest an important role of genetic factors in the aging process. Third, age-related changes in our bodies show a regularity that is hard to explain without reference to genetic factors. Finally some findings suggest that certain cells do indeed divide only a set number of times before dying. Moreover, no environmental conditions seem capable of altering this set number.
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The Neuroendocrine Theory
First proposed by Professor Vladimir Dilman & Ward Dean MD, this theory elaborates on wear and tear by focusing on the neuroendocrine system. This system is a complicated network of biochemicals that govern the release of hormones, which are altered by the walnut sized gland called the hypothalamus located in the brain.

The hypothalamus controls various chain-reactions to instruct other organs and glands to release their hormones etc. The hypothalamus also responds to the body hormone levels as a guide to the overall hormonal activity. But as we grow older the hypothalamus loses its precision regulatory ability and the receptors which uptake individual hormones become less sensitive to them. Accordingly, as we age the secretion of many hormones declines and their effectiveness (compared unit to unit) is also reduced due to the receptors down-grading.

One theory for the hypothalamus loss of regulation is that it is damaged by the hormone cortisol. Cortisol is produced from the adrenal glands (located in the kidneys) and cortisol is considered to be a dark-hormone responsible for stress. It is known to be one of the few hormones that increases with age. If cortisol damages the hypothalamus, then over time it becomes a vicious cycle of continued hypothalamic damage, leading to an ever increasing degree of cortisol production and thus more hypothalamic damage. A catch-22 situation. This damage could then lead to hormonal imbalance as the hypothalamus loses its ability to control the system. Such an argument demands the use of cortisol adjusters (such as DHEA, Gerovital-H3® or Phenytoin) to help slow down the cortisol accumulation.

Dr. Dean also believes that the next-generation of hormone replacement therapy is the hypothalamus hormones (expected to be commercially available in the next few years). These types of natural supplements could present a whole new approach and concept to endocrine balance, control and improvement.

The Membrane Theory of Aging
The membrane theory of aging was first described by Professor ImreZs-Nagy of Debrechen University, Hungary. According to this theory it is the age-related changes of the cells ability to transfer chemicals, heat and electrical processes that impair it.

As we grow older the cell membrane becomes less lipid (less watery and more solid). This impedes its efficiency to conduct normal function and in particular there is a toxic accumulation. This cellular toxin is referred to as lipofuscin and as we grow older lipofuscin deposits become more present in the brain, heart and lungs and also in the skin. Indeed some of the skin age-pigments referred to as liver or age-spots are composed of lipofuscin. It is known that Alzheimer Disease patients have much higher levels of lipofuscin deposits than compared to their healthy controls. The cells declining efficiency also means that the essential and regular transfer of sodium and potassium is impaired, thus reducing communication. It is also believed that electrical and heat transfer is also impaired.
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Professor Zs-Nagy himself became involved in research to find substances that could aid in the removal of lipofuscin deposits and improve cellular lipidity and communication. The development was Centrophenoxine (Lucidril®) which is perhaps the most efficient substance currently available; (interestingly, Professor Zs-Nagy is currently working on an analogue). Other substances that have shown an ability to remove lipofuscin include DMAE and the amino acids Acetyl-L-Carnitine and Carnosine.

The Hayflick Limit Theory
The Hayflick Limit Theory of Aging (so called after its discoverer Dr. Leonard Hayflick) suggests that the human cell is limited in the number of times it can divide. Part of this theory may be affected by cell waste accumulation (which is described in the Membrane Theory of Aging). Working with Dr. Moorehead in 1961, Dr. Hayflick theorized that the human cells ability to divide is limited to approximately 50-times, after which they simply stop dividing (and hence die).

He showed that nutrition has an effect on cells, with overfed cells dividing much faster than underfed cells. As cells divide to help repair and regenerate themselves we may consider that the DNA & Genetic Theory of Aging may play a role here. Maybe each time a cell divides it loses some blueprint information. Eventually (after 50-odd times of division) there is simply not enough DNA information available to complete any sort of division.

We also know that calorie restriction in animals significantly increases their life span. In essence less fed animals live longer. Is this because they are subject to less free radical activity and therefore less cellular damage? Or is it that insulin and glucose damage is less prevalent in them than in overfed animals?

The Hayflick Limit indicates the need to slow down the rate of cell division if we want to live long lives. Cell division can be slowed down by diet and lifestyle etc., but it is also surmised that cell-division can be improved with many of the protocols of the other aging theories described herein.

The use of ribonucleic acids (RNAs, the building-blocks of DNA), improve cell repair processes, enhance cellular capabilities and increase the maximum number of cell divisions in animals and vitro tests. Human clinical studies with RNA supplements such as NeyGeront® and RN13® indicate that there are a number of biological, physiological and practical improvements for geriatric patients. If laboratory results prove true also for the individual, then Carnosine will be another potent Hayflick Limit extender.

The Mitochondrial Decline Theory
The mitochondria are the power producing organelles found in every cell of every organ. Their primary job is to create Adenosine Triphosphate (ATP) and they do so in the various energy cycles that involve nutrients such as Acetyl-L-Carnitine, CoQ10 (Idebenone), NADH and some B vitamins etc. ATP is literally the life-giving chemical because every movement,
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thought and action we make is generated from it. Yet very little ATP can be stored in the body. It is estimated that a 180 lb. man needs to generate an average of 80-90 lbs. of ATP daily. Under strenuous exercise the use of ATP may rise to as much as 1.1 lbs. per minute. But reserves of ATP are considered to be no more than 3-5 ounces, thus under those same strenuous exercise conditions that's approximately 8-seconds worth. Thus it becomes apparent that the mitochondria have to be very efficient and healthy, in order to produce a continuous supply of essential ATP for the necessary repair and regenerative process to occur.

Chemically speaking, under normal conditions the mitochondria are fiery furnaces and subject themselves to a lot of free radical damage. They also lack most of the defenses found in other parts of the body, so as we age the mitochondria become less efficient, fewer in number and larger. Accordingly, ATP production declines. As organs cannot borrow energy from one another, the efficiency of each organ’s mitochondria are essential to that particular organ’s repair processes and functions. If a particular organ’s mitochondria fail, then so does that organ (which of course can lead to death).

Enhancement and protection of the mitochondria is an essential part of preventing and slowing aging. Enhancement can be achieved with the nutrients, as well as ATP supplements themselves. Protection may be afforded by a broad spectrum of anti-oxidants substances, as well as substances such as Idebenone and Pregnenolone. Of particular use may be Acetyl-L-Carnitine and Hydergine, both of which have been proven in experiments to greatly improve the mitochondria condition of aged animals.

The Cross-Linking Theory

The Cross-Linking Theory of Aging is also referred to as the Glycosylation Theory of Aging. In this theory it is the binding of glucose (simple sugars) to protein, (a process that occurs under the presence of oxygen) that causes various problems. Once this binding has occurred the protein becomes impaired and is unable to perform as efficiently. Living a longer life is going to lead to the increased possibility of oxygen meeting glucose and protein and known cross-linking disorders include senile cataract and the appearance of tough, leathery and yellow skin.

Diabetes is often viewed as a form of accelerated aging and the age related imbalance of insulin and glucose tolerance leads to numerous problems; these have been called Syndrome X. In fact, diabetics have 2-3 times the numbers of cross-linked proteins when compared to their healthy counterparts. The cross-linking of proteins may also be responsible for cardiac enlargement and the hardening of collagen, which may then lead to the increased susceptibility of a cardiac arrest. Cross linked proteins have also been implicated in renal disorders.

It is also theorized that sugars binding to DNA may cause damage that leads to malformed cells and thus cancer. The modern diet is of course a very sweet one and we are bombarded
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with simple sugars from soft drinks and processed foods etc. One obvious example to reduce the risk of cross-linking is to reduce sugar (and also simple carbohydrates) in one’s diet. Some pharmacological interventions that could help reduce the carbohydrate/starch/glucose intake and affect, include Acarbose and Metformin.

But other supplements are also appearing that show great promise in the battle to prevent, slow and even break existing cross-links. Two of the most important at present are Aminoguanidine and the amino acid Carnosine.

No one theory is supported by sufficient evidence to be viewed as conclusive. The best scientific guess at present is that aging is caused by several different mechanisms and results from a complex interplay between environmental and genetic factors.

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