UNIT-1 : Ageing Theories

Structure:

1.1 INTRODUCTION TO THEORIES OF AGEING

Human aging is influenced by a composite of biologic, psychologic, social, functional, and spiritual factors. Aging may be viewed as a continuum of events that occur from conception to death (Ignatavicius, Workman, Mishler,1999). Biologic, social, and psychologic theories of aging attempt to explain and explore the- various dimensions of aging. This chapter explores the *prominent theories* of aging as a guide for developing a holistic gerontologic nursing theory for practice application. No single gerontologic nursing theory has been accepted by *this* specialty, which requires nurses to use an eclectic approach from other disciplines as the basis of clinical decision making (Comfort's.,1970).

Theories of aging attempt to explain this phenomenon of aging as it occurs over the lifespan, which is thought to be a maximum of approximately 120 years (Cetron, Owen, 1998). Several basic assumptions and concepts have been accepted over the years as guiding research and clinical practice related to this phenomenon of aging. Human aging is viewed as a total process that begins -at conception. Because individuals have uniquely different genetic, social, psychologic, and economic factors intertwined in their lives, the course of ageing varies from individual to individual. *Senescence*, defined as a change in the behavior of an organism with age, leading to a decreased power of survival and adjustment, occurs as well. It is the recognition of the universal truths that we attempt to discover through the theories of aging.

1.2 THEORIES OF AGEING

1. Biologic theory

Concerned with answering basic questions regarding physiologic processes that occur in all living organisms over time (Hay flick, 1996).

2. Sociologic theory

Focused on roles & relationship with in which individuals engage in later life (Hogstel, 1995)

3. Psychologic theory

Influenced by both biology& sociology and address how a person responds to the tasks of their age.

1.3 BIOLOGIC THEORIES OF AGEING

Biologic theories are concerned with answering basic questions regarding the physiologic processes that occur in all living organisms as they chronologically age. These ages 'related changes occur independently of any external or pathologic influence.

The foci of biologic theories include explanations of the following:

(1) Deleterious effects leading to decreasing function of the organism

(2) Gradually occurring age-related changes that are progressive over time
(3) Intrinsic changes that can affect all members of species because of chronologic

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The decreasing function of an organism may lead to a complete failure of either an organ or an entire system. (Hay flick, 1996).

The biologic theories can be subdivided into two main divisions, stochastic and non-stochastic. Stochastic theories explain aging as events that occur randomly and accumulate over time, while non-stochastic theories view aging as certain predetermined, timed phenomena.

1.3.1 Stochastic Theories

- **Error Theory**

As a cell ages, various changes occur naturally in its deoxyribonucleic acid (DNA) and ribonucleic acid (RNA),the building blocks of the cell. DNA, found in the nucleus of the cell, contains the fundamental genetic code and forms the genes on all 46 human chromosomes .In 1963, Orgel proposed the Error Theory, sometimes called the Error Catastrophe Theory. The hypothesis of this theory is based on the idea that errors can occur in the transcription in any step of protein synthesis of DNA, and this eventually leads to either the aging or the actual death of a cell. The error would cause the reproduction of an enzyme or protein that was not an exact copy of the original. The next transcription would again contain an error. As the effect continued through several generations of proteins, the end product would not even resemble the original cell and its functional ability would be diminished. In recent years, the theory has not been supported by research. Although changes do occur in the activity of various enzymes with aging, studies have not found that all aged cells contain altered or misspecified proteins, nor is aging automatically or necessarily accelerated if specified proteins or enzymes are introduced to a cell.

- **Free Radical Theory**

Free radicals are byproducts of fundamental metabolic activities within the body. Free radical production can increase as a result of environmental pollutants such as ozone, pesticides, and radiation. Normally, they are neutralized by enzymatic activity or natural antioxidants. If, however, they are not neutralized, they may attach to other molecules. These highly reactive free radicals react with molecules

in cell membranes, in particular cell membranes of unsaturated lipids such as mitochondria, lysosomes, and nuclear membranes. This action monopolizes the receptor sites on the membrane, thereby inhibiting the interaction with other substances that normally use this site; this chemical reaction is called lipid peroxidation. Therefore the mitochondria, for example, can no longer function as efficiently, and their cell membranes may become damaged, resulting in increased permeability. If excessive fluid is either lost or gained, the internal homeostasis is disrupted and cell death may result. There are other deleterious results related to free radical molecules in the body. Although these molecules do not contain DNA themselves, they can cause mutations to occur in the DNA-RNA transcription, thereby producing mutations of the original protein. In nervous and muscle tissue, to which free radicals have a high affinity, a substance called lipofuscin has been found and is thought to be indicative of chronologic age. Lipofuscin, a lipid- and protein-enriched pigmented material, has been found to accumulate in older adults' tissues, and is commonly referred to as "age spots." As the lipofuscin's presence increases, healthy tissue is slowly being deprived of oxygen and nutrient supply. Further degeneration of surrounding tissue eventually leads to the actual death of the tissue. The body does have naturally occurring antioxidants or protective mechanisms. Vitamins C and E are two of these substances that can inhibit the functioning of the free radicals or possibly decrease their production in the body.

Harman (1956) was the first to suggest that the administration of chemicals terminating the propagation of free radicals would extend the lifespan or delay the aging process. Animal research has demonstrated that administration of antioxidants did increase the average length of life, possibly due to the delayed appearance of diseases that may have eventually killed the animals studied. It appears that administration of antioxidants postpones the appearance of diseases such as cardiovascular disease and cancer, two of the most common causes of death. It appears that antioxidants also have an effect on the decline of the immune system and on degenerative neurologic diseases, both of which affect morbidity and mortality (Hay flick, 1996; Yu, 1998, 1993).

- **Cross-Linkage Theory**

The cross-link theory of aging hypothesizes that with age some proteins become increasingly cross-linked or enmeshed and may impede metabolic processes by obstructing the passage of nutrients and wastes between the intracellular and extracellular compartments. According to this theory, normally separated molecular structures are bound together through chemical reactions. Primarily this involves collagen, which is a relatively inert long-chain macromolecule produced by fibroblasts. As new fibers are created, they become enmeshed with old fibers and form an actual chemical cross-link. The end result of this cross-linkage process is an increase in density of the collagen molecule but a decrease in the

capacity to transport nutrients 'to, and to remove waste products to the cells. Eventually, this results in a decrease in the function of the structure. An example of this would be the changes associated with aging skin. The skin of a baby is very soft and pliable, whereas the aging skin losses much of its suppleness and elasticity. This aging process is similar to the process of tanning leather, which purposefully creates cross-links (Bjorkstein, 1976; Hay flick, 1996).

Cross-linkage agents have been found in unsaturated fats; in polyvalent metal ions like aluminum, zinc, and magnesium; and in association with excessive radiation exposure. Many of the medications ingested by the older population contain aluminum (antacids and coagulants), as does the common cooking ingredient baking powder. Some research supports a combination of exercise and dietary restrictions in helping to inhibit the cross-linkage process, as well as the use of vitamin C prophylactically as an antioxidant agent (Bjorkstein, 1976).Cerani has shown that blood sugar reacts with bodily proteins to form cross-links. He has found that the crystal is of the lens of the eye, membranes of the kidney, and blood vessels are especially susceptible to cross-linking under the conditions of increased glucose. Cerani suggests increased levels of blood glucose because increased amounts of cross-linking which accelerate lens, kidney, and blood vessel diseases (Schneider, 1992).

Cross-linkage theory proposes that as a person ages and the immune system begins to decrease in its efficiency, the body's defense mechanism cannot remove the cross-linking agent before it becomes securely established. Cross linkage has been proposed as a primary cause of arteriosclerosis, a decrease in efficiency of the immune system with age, and the loss of elasticity often seen in older adult skin. The cross-link theory has emerged from deductive reasoning and other than the previous examples, there is little: empirical evidence to support its claims (Hay flick, 1996).

- **Wear and Tear Theory**

This theory proposed that cells wear out over time because of continued use. When this theory was first proposed in1882 by Weisman, death was seen as a result of tissues being worn out because they could not rejuvenate themselves in an endless manner (Hay flick, 1988). Essentially, the theory reflects a belief that organs and tissues have a preprogrammed amount of energy available to them and eventually wear out when the allotted energy is expended. Eventually, this leads to the death of the entire organism.

Under this theory, aging is viewed as almost a preprogrammed process-a process thought to be vulnerable to stress, or an accumulation of injuries or trauma, which may actually accelerate it. "Death," said Weisman, "occurs because a worn out tissue cannot forever renew itself"(Hayflick, 1996).Proponents of this theory cite microscopic signs of wear and tear that have been found in striated and smooth

muscle tissue and in nerve cells. Researchers question this theory with research demonstrating increased functional abilities in individuals that participate in daily exercise. This effect occurs even in persons with chronic limiting states such as rheumatoid arthritis. If exercise has been found to increase a person's level of functioning rather than decrease it, critics challenge, how can the wear and tear hypothesis be correct? The time frame for the development of this theory was during the Industrial Revolution, when people were attempting to explain and make sense of events in their world. These people were trying to equate men with the marvelous machines they were producing. It eventually became clearly evident just how different man was from these machines.

1.3.2 Nonstochastic Theories

- **Programmed Theory or Hay flick Limit Theory**

One of the first proposed biologic theories is based on a study completed In 1961 by Hay flick and Moore head. This particular study included an experiment on fetal fibroblastic cells and their reproductive capabilities. The results of this landmark study changed the way scientists viewed the biologic aging process. Hay flick and Moore head's study showed that there are functional changes that do occur within cells and are responsible for the aging of the cells and the organism.

The study further supported the hypothesis that a cumulative effect of improper functioning of cells and eventual loss of cells in organs and tissues is therefore responsible for the "aging phenomenon." This study contradicted earlier studies by Carrel and Ebeling in which chick embryo cells were able to be kept alive indefinitely in a laboratory setting; the conclusion from this 1912 experiment was that cells do not wear out, but continue to function normally forever. An interesting aspect of the 1961 study was that freezing was found to halt the biologic cellular clock (Hay flick, Moore head, 1961).

Based on this 1961 study, unlimited cell division was not found to occur; the immortality of individual cells was found to be more an abnormal than a normal occurrence. Therefore this study seemed to support the HayfIick limit Theory. Life expectancy was generally seen as preprogrammed, within a species-specific range; this biologic clock for humans was estimated at 110 to 120 years (Gerhard, Cristofalo, 1992; Hay flick, 1996). Based on the conclusions of this experiment, the Hayflick Limit Theory is sometimes called the "Biological Clock," "Cellular aging," or "Genetic Theory."

- **Immunity Theory**

The immune system is a network of specialized cells, tissues, and organs that provide the body with protection against invading organisms. Its primary role is to differentiate self from non-self, thereby protecting the organism from attack by pathogens. It has been found that as a personages, the immune system functions less effectively. The term *immune senescence* has been given to this age-related decrease in function. Essential components of the immune system are T cells,

which are responsible for cell-mediated immunity, and B cells, the antibodies responsible for humoral immunity. Both T and B cells may respond to an invasion of the organism, though one may provide more protection in certain situations. The changes that occur with aging are most apparent in the T-lymphocytes, although changes also occur in the functioning capabilities of B-lymphocytes.

Accompanying these changes is a decrease in the body's defense against foreign pathogens, which manifests itself as an increased incidence of infectious diseases and an increase in the production of autoantibodies, which lead to a propensity to develop autoimmune-related diseases (Hay flick, 1996) .The changes occurring in the immune system cannot precisely be explained by an exact cause-and-effect relationship, but they do seem to increase with advancing age. These changes include a decrease in humoral immune response, often predisposing older adults to: (1) a decreased resistance to a tumor cell challenge and the development of cancer, (2) a decreased ability to initiate the immune process and mobilize the body's defenses in aggressively attacking pathogens, and (3) a heightened production of autoantigens, often leading to an increase in autoimmune-related diseases. Immune deficient conditions, such as the human immunodeficiency virus (HIV) and the immune suppression of organ transplant recipients, have demonstrated a relationship between immune competence and cancer development. HIV has been associated with several forms of cancer, such as Kaposi's sarcoma. Recipients of organ transplants are 80 times more likely to contract cancer than the rest of the population (Black, Matarassian-Iacobs, 1997)

1.4 SOCIOLOGIC THEORIES OF AGING

Sociologic theories focus on changing roles and relationships, in some respects, sociologic theories relate to our social adaptations in the lives of older adults. One of the easiest ways to view the sociologic theories is to view them within the context of the societal values at the time in which they were developed. The early research was also carried out largely on institutionalized and ill older persons, skewing the information obtained. Contemporary research is being conducted in a variety of more naturalistic environments, reflecting more accurately the diversity of the aging population. During the 1960s, sociologists focused on the losses of old age and the manner in which individuals adjusted to these losses in the context of their roles and reference groups. A decade later, society began to have a broader view of aging as reflected in the aging theories proposed during this period. These theories focused on more global, societal, and structural factors that influenced the Jives of aging persons. The 1980s and 1990s again brought another change in focus from society. At this point, sociologist's began to explore interrelationships, especially those between older adults and the physical, political, environmental, and even socioeconomic milieu in which they lived.

1.4.1 Disengagement Theory

When the disengagement theory was introduced by Cumming and Henry in 1961, the theory sparked immediate controversy. These two theorists viewed aging' as a developmental task in and of itself, with its .own norms and appropriate patterns of behavior. The identified appropriate patterns of behavior were conceptualized as a mutual agreement between older adults and society on a reciprocal withdrawal. Individuals would change from being centered on society and interacting in the community to being self-centered persons withdrawing from society, by virtue of becoming “old." Therefore social equilibrium would be achieved as the end result {Cumming, Henry, 1961}.The idea that older adults preferred to withdraw from society and to voluntarily decrease their interactions with others was not readily accepted by the general public, much less the older population. Although the theory oversimplified the aging process, the lasting benefit of the theory relates to the controversy it created. The theory itself is no longer supported, but the discussion and the research stemming from its premise continue today.

1.4.2 Activity Theory or Developmental Task Theory

With one group of theorists proposing the concept that older adults need to disengage from society, other sociologists proposed that people needed to stay active if they are to age successfully. In 1953, Havighurst and Albrecht first proposed the idea that aging successfully meant staying active. It was not until 10 years later that the phrase "activity theory" was actually coined by Havighurst and his associates (Havighurst, Neugarten, Tobin, 1963).Activity is viewed by this theory as necessary to maintain a person's life satisfaction and a positive self-concept. By remaining active, the older person stays young and alive and does not withdraw from society because of an age parameter. Essentially, the person actively participates in a continuous struggle to remain "middle-aged." This theory is based on three assumptions: (1) it is better to be active than inactive, (2) it is better to be happy than unhappy, and (3) an older individual is the best judge of his or her own success in achieving the first two assumptions (Havighurst, 1972). Within the context of this theory, activity can be viewed very broadly as physical or intellectual. Therefore, even with illness or advancing age, the older person can remain "active" and achieve a sense of life satisfaction {Havighurst, Neugarten, Tobin, 1963}.

1.4.3 Continuity Theory

The continuity theory dispels the premises of both the disengagement and activity theories. According to this theory, being active, trying to maintain a sense of being middle aged, or willingly withdrawing from society does not necessarily bring happiness. Instead, the continuity theory proposes that how a person has

been throughout life is how that person will continue through the remainder of life(Havighurst, Neugarten, Tobin, 1963).Old age is not viewed as a terminal or final part of life separated from the rest of life. According to this theory, the latter part of life is a continuation of the earlier part and therefore an integral component of the entire lifecycle. When viewed from this perspective, the theory can be seen as a developmental theory. Simply stated, the theory proposes that as person's age, they try to maintain or continue previous habits, preferences, commitments, values, beliefs, and all the factors that have contributed to their personalities {Havighurst, Neugarten, Tobin, 1963}.

1.4.4 Age Stratification Theory

Beginning in the 1970s, theorists on aging began to focus more broadly on societal and structural factors that influenced how the older population was being viewed. The age stratification theory is only one example of a theory addressing societal values. The key societal issue being addressed in this theory is the concept of interdependence between the aging person and society at large (Riley,Johnson, Foner, 1972).This theory views the aging person as an individual element of society and also as a member, with peers, interacting in a social process. The theory attempts to explain the interdependence between older adults and society and how they are constantly influencing each other in a variety of ways. Riley (1985) identifies the five major concepts of this theory: (1) each individual progresses through society in groups of cohorts that are collectively aging socially, biologically, and psychologically; (2) new cohorts are continually being born, and each of them experiences their own unique sense of history; (3) society itself can be divided into various strata according to the parameters of age and roles; (4) not only are people and roles within every stratum continuously changing, but so is society at large; and(5) the interaction between individual aging people and the entire society is not stagnant but remains dynamic.

Person-Environment Fit Theory

One of the newer aging theories relates to the individual's personal competence within the environment in which he or she interacts. This theory was proposed by Lawton(1982) and examines the concept of interrelationships among the competencies of a group of persons, older adults, and their society or environment. Everyone, including older persons, has certain personal competencies that help mold and shape them throughout life. Lawton (1982) identified these personal competencies as including ego strength; level of motor skills, individual biologic health, and cognitive and sensory-perceptual capacities. All of these help a person deal with the environment in which one lives. As a person ages, there may be changes or even decreases in some of these personal competencies. These changes influence the individual's abilities to interrelate with the environment. If a person develops one or more chronic diseases, such as

rheumatoid arthritis or cardiovascular disease, then competencies may be impaired and the level of interrelatedness may be limited. The theory further proposes that, as a person ages, the environment becomes more threatening and one may feel incompetent dealing with it. In a society constantly making rapid technologic advances, this theory helps explain why an older person might feel inhibited and may retreat from society

1.5. PSYCHOLOGIC THEORIES OF AGING

The basic assumption of the psychologic theories of aging is that development does not end when a person reaches adulthood, but remains a dynamic process that occurs over the lifespan. As a person passes from the middle to the later life roles, abilities, perspectives, and belief systems enter a stage of transition. The health care professional, by providing holistic care, seeks to employ strategies to enhance clients' quality of life (Hogstel, 1995). The psychologic theories of aging are much broader in scope than the previous theories because they are influenced by both biology and sociology.

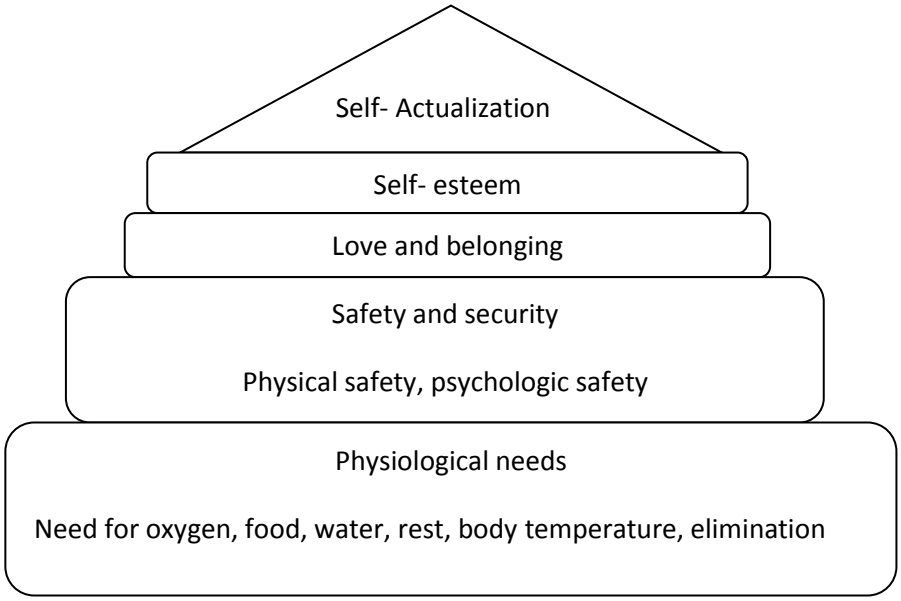
Therefore psychologic aging cannot readily be separated from biologic and sociologic influences. As a person ages, various adaptive changes occur that assist the person to cope with or accept some of the biologic changes. Some of the adaptive mechanisms include memory, learning capacity, feelings, intellectual functioning, and motivations to perform or not perform particular activities (Birren, Cunningham, 1985). Psychologic aging, therefore, includes not only behavioral changes but also developmental aspects related to the lives of older adults. How does behavior change in relation to advancing age? Are these behavioral changes consistent in pattern from one individual to another? Theorists are searching for answers to questions such as these.

1.5.1 Maslow's Hierarchy theory

Maslow's Hierarchy of Human Needs Theory According to this theory, each individual has an innate internal hierarchy of needs that motivates all human behaviors (Maslow, 1954). These human needs have different orders of priority. When people achieve fulfillment of their elemental needs, they strive to meet those needs on the next level, continuing on until the highest order of needs is reached. These human needs are often depicted as a pyramid, with the most elemental needs at the base. The initial human needs each person must meet relate to physiologic needs, needs for basic survival. Initially, a starving person worries about obtaining food to survive. Once this need is met, the next concern is about safety and security. These needs must be met, at least to some extent, before the needs for love, acceptance, and a feeling of belonging become concerns.

According to Maslow(1968), as each succeeding layer of needs is addressed, the individual is motivated to look to the needs at the next higher step; Maslow’s fully developed, self-actualized person displays high levels of all of the following

characteristics: perception of reality; acceptance of self, others, and nature; spontaneity; problem-solving ability; self-direction; detachment and the desire for privacy; freshness of peak experiences; identification with other human beings; satisfying and changing relationships with other people; a democratic character structure; creativity; and a sense of values (Maslow, 1968). Maslow's ideal self-actualized person is probably only attained by about 1% of the population (Thomas, Chess, 1977). Although limited actual achievement of this final level may be true, the person developing in a healthy way is always moving toward more self-fulfilling levels. (Fig-2.1).



2.1 Maslow's Hierarchy of needs

1.5.2 Jung's Theory of Individualism

The Swiss psychologist Carl Jung (1960) proposed a theory of personality development throughout life: childhood, youth and young adulthood, middle age, and old age. An individual's personality is composed of the ego, the personal unconsciousness, and the collective unconsciousness. According to this theory, a person's personality is visualized as oriented either toward the external world (extroverted) or toward subjective, inner experiences (introverted). A balance between these two forces, which are present in every individual, is essential for mental health. Applying Jung's theory to individuals as they progress through life, it is at the onset of middle age that the person begins to question values, beliefs, and possible dreams left undone. The phrase "midlife crisis" became popular based on this theory and refers to a period of emotional, and sometimes behavioral, turmoil that heralds the onset of middle age. This period may last for several years, with the exact time and duration varying from person to person. During this period, the individual often searches for answers about reaching

goals-questioning whether a part of their personality or "true self" has been neglected and whether time is running out for the completion of these quests. This may be the first time that the individual becomes aware of the effects of the aging process and the fact that the first part of the adult life is over. This realization does not necessarily signal a time of trauma. For many people, it is just another "rite of passage. "As the person ages chronologically, the personality often begins to change from being outwardly focused, concerned about-establishing oneself in society, to becoming more inward, as the individual begins to search for answers from within. Successful aging, when viewed from Jung's theory, is when a person looks inward and values oneself for more than just current physical limitations or losses.

1.5.3 Eight stages of life theory

Eight Stages of life Theory Erikson (1993) proposed a theory of psychology development that reflects cultural and societal influences. The major focus of development in this theory is with an individual's ego structure, or sense of self, especially in response to the ways in which society shapes its development. In each of the eight stages identified by Erikson, a "Crisis" occurs that impacts the development of the person's ego. The manner in which a person masters any particular stage influences future success or lack of success in mastering the next stage of development.

When considering older adults, attention needs to be focused on the developmental tasks of both middle and older adulthood. The task of middle adulthood is resolving the conflict between generatively and stagnation. During older adulthood, the developmental task needing resolution is balancing the search for integrity and wholeness with a sense of despair.

1.5.4 Peck expansion of Erikson's theory

In 1968, Peck expanded Erikson's original theory regarding the eighth stage of older adulthood. Erikson grouped all individuals together into" old age" beginning at age 65 and did not anticipate that a person may potentially live for another 30 to 40 years beyond this identified milestone. Since people were living longer, there became an obvious need to identify additional stages for older adults. Peck (1968) expanded the eighth stage, ego integrity versus despair, into three stages: ego differentiation versus workrole preoccupation, body transcendence versus body preoccupation, and ego transcendence versus ego preoccupation (Ignatavicius, Workman, Mishler, 1999).

During the stage of ego differentiation versus work role preoccupation, the task for older adults is to achieve identity and feelings of worth from sources other than the workrole. The onset of retirement and termination of the work role may reduce feelings of self-worth. In contrast, a person with a well-differentiated ego,

who is defined by many dimensions, can replace the work role as the major defining source for self-esteem.

The second stage of body transcendence versus body preoccupation refers to the older person's view of the physical changes that occur as a result of the aging process. The task is to adjust to or transcend the declines that may occur-in order to maintain feelings of well-being. This task can be successfully resolved by focusing on the satisfaction obtained from interpersonal interactions and psychosocial related activities.

The third and final task of ego transcendence versus ego preoccupation involves acceptance of the individual's eventual death without dwelling on the prospect of it. Remaining actively involved with a future that extends beyond a person's mortality *is* the adjustment that must be made to achieve ego transcendence.

1.5.5 Selective Optimization with Compensation

Selective Optimization with Compensation Baltes (1987) has conducted a series of studies on the psychological processes of development and aging from a lifespan perspective and formulated a psychologic model of successful aging. The central focus of this theory individual develops certain strategies to manage the losses of function that occur over time. This general process of adoption consists of three Interacting elements. First, there is the element of selection, which refers to an Increasing restriction in one's life to fewer domain of functioning because an age-related loss. The second element optimization reflects the view that people engage in behaviors to enrich their lives. The third element, compensation, older adults to literally "compensate" for any losses by developing, suitable, alternative adaptations (Schroots, 1996).The lifelong process of selective optimization with compensation allows people to age successfully.

1.6 Evaluate Your Progress

- **LONG QUESTION**

1. Define aging from a biologic, sociologic, and psychologic framework.
2. Analyze the prominent biologic, sociologic, and psychologic theories of aging.
3.Develop nursing interventions based on the psychosocial issues and biologic changes associated with older adulthood.
4. Discuss several nursing implications for each of the major biologic, sociologic, and psychologic theories of aging.

- **SHORT NOTES**

1. Maslow's Hierarchy theory
2. Wear and Tear theory
3. Disengagement theory

- **MULTIPLE CHOICE QUESTIONS**

1. The sociologic theories include the following except:
   a. Disengagement theory b. Activity theory
   c. Continuity d. Immunity theory
2. Ageing can be explained by which of the following theories:
   a. Biological b. psychosocial
   c. Immunity theory d. All of the above

Answer

1. D 2. D

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UNIT-2 : AGEING PROCESS

Structure :

AGEING PROCESS

2.1 Introduction of Ageing

The word “ageing” and “old” are highly subjective.
“Ageing “is defined at the time from birth to the present for a living individual, as measured in specific units.
“Old” is defined as having lived for a long time and is often synonymous with negative terms, such as “ancient” “antiquated” & time worn”.
Geriatric is defined as “the branch of medicine concerned with medical problems and care of Geriatric. It is the branch of medicine dealing with the physiological, psychological aspects of ageing and with diagnosis and treatment of diseases affecting older people.

Aging is a multidimensional process and refers to the process of "…accruing maturity with the passage of time." It begins with conception and continues throughout life until death occurs. Aging is progressive, ubiquitous and inevitable to all living things.
Normal aging and diseases associated with aging are two separate entities. Normal aging refers to those normal deteriorative processes that all human beings will experience if they live long enough, such as decreased bone mass, osteoarthritis, and lens cataracts. Diseases that are associated with aging, but not caused by aging and do not occur in all persons (i.e. probabilistic aging) include dementia, hypothyroidism, stroke, and congestive heart failure; while they are common they are not inevitable to all persons, and not all seniors will have them.

Ageing is a normal part of human development. The pattern of ageing- what happens, how and when-vary greatly among older people. Ageing is a normal, universal, progressive, irreversible process.

The changes and decline with advancing age. As the ageing process progress mental capability such as memory physical abilities further deteriorate.

2.2 Physiology of Aging

Aging is a process that begins at conception and continues for as long as we live. At any given time throughout our lifespan, the body reflects:

- Its genetic component and
- Its environmental experience.

In other words, our bodies reflect our genetic capacity to adapt and repair, as well as the cumulative damage from disease processes. Aging highlights our strengths and our weaknesses.

In our society we currently think of the "young old" as being around 65 to 74 years of age, the "middle old" 75 to 84 and the "old old" 85 years +. With advancing age, all of the body systems eventually demonstrate reduced efficiency, slowed building & replacement and actual loss of tissue. While an individual's aging experience is unique, there are generalizations which can be observed for each of the body systems.

2.2.1 Skin

The primary function of the skin is to protect the organism from the environment. It accomplishes this by providing a barrier that regulates temperature, retains fluid and absorbs shock and ultraviolet radiation, among other things. As we age, the dermis decreases in thickness by about 20%. As, it thins it loses vascularity, cellularity and sensitivity. Its ability to exchange or retain internal heat is diminished. The skin becomes thin, fragile and slow to heal. Sweat and sebaceous glands are reduced both in number and effectiveness. Sensory neurons are decreased by 30% from the age of 10 years to 90 years old.

Subcutaneous fat deposition is altered in the elderly. Muscle, blood vessels and bone become more visible beneath the skin due to thinning of subcutaneous fat in the extremities. Fat deposition occurs mainly on the abdomen and thighs.

2.2.2 Musculoskeletal

Muscle mass is a primary source of metabolic heat. When muscles contract, heat will be generated. The heat generated by muscle contraction maintains body temperature in the range required for normal function of its various chemical processes.

As early as the third decade of life there is a general reduction in the size, elasticity and strength of all muscle tissue. The loss of muscle mass continues throughout the years in elderly. Muscle fibers continue to become smaller in diameter due to a decrease in reserves of ATP, glycogen, myoglobin and the number of myofibrils. As a result, as the body ages, muscular activity becomes less efficient and requires more effort to accomplish a given task. The elderly are less efficient at creating the heat necessary to drive the important biochemical reactions necessary for life.

2.2.3 Respiratory function

Lung function diminishes with age. The major contributing factors are the progressive loss of elastic recoil within lung tissue, the chest wall becomes stiff, and there is a decrease in alveolar surface area. These changes diminish the efficiency of gas exchange and make it more difficult to exercise.

2.2.4 Cardiovascular System

Despite cardiovascular disease, often combined with a slowdown in the autonomic nervous response, the cardiovascular function of a resting healthy elder is usually adequate to meet the body's needs. Cardiac output of healthy exercising elders can usually be maintained, allowing moderate continued physical activity throughout their lives.

2.2.5 Endocrine System

Old age is accompanied by a generalized reduction in hormone production and activity. This reduction affects most metabolic functions of the body. Water, mineral, electrolyte, carbohydrate, protein, lipid and vitamin disorders are all more common in the elderly. Nutrition and the ability to use food for energy are seriously affected in the elder population.

Diabetes is common in the elderly. There are many causes but a primary mechanism involves the inability of skeletal muscle to absorb glucose. Over time skeletal muscle becomes less responsive to insulin.

Recent research indicates that the elderly are at risk for nutritional deficiencies due to anorexia. Age related anorexia has been linked to a lower satiety threshold. Elders feel "full" sooner which may be due to changes in hormone receptor or trigger mechanisms.

2.2.6 Neuro sensory

Like other systems, the nervous system changes with age. There is loss of neurons in both the brain and spinal cord. There is loss of neuronal dendrites which

reduces the amount of synaptic transmission. The sense of smell, taste, sight, touch and hearing are all diminished over time. Depression can be the result of impaired synaptic activity. Research indicates that as many as 25% of nursing home residents are clinically depressed. Depression is one of the most common reversible causes of weight loss.

2.3 Factors Affecting Ageing Process

Whereas much is scientifically known about the aging process, there is widespread misunderstanding on this subject. What follows is an attempt to clarify the basic ideas about aging.

The word *aging* implies change as a result of the passage of time. It is a common mistake to disregard the mechanisms of aging and to place the main emphasis on the factor of time alone. The aging process does not result solely from chronological age. Instead, the critical factor is the length of time during which events occur that are injurious to the body and its cells. Whereas there are many mechanisms by which aging occurs (some of which are not fully understood), scientists have a basic understanding of the general categories of factors that initiate cell damage resulting in aging. Let us examine these factors, some of which are impossible to prevent, but others of which can be prevented with a bit of knowledge and effort.

Various hereditary and environmental factors affect ageing.

2.3.1. Hereditary Factors

Some families live longer than others, given the same environmental circumstance. This is related with genetic factors.

2.3.2. Environmental Factors

Bourlier has given three categories of environmental factors which can influence the rate of ageing in man. They are

2.3.2.1 Abiotic factors: these are the physical and chemical components of the environment such as climatic influences, pollutants and radiation.

Example-

High-Frequency Radiation

Radiation in this context refers to the emanations of particles or electromagnetic energy from radioactive decay or from man-made processes such as x-ray photography of the human body.

In non-massive amounts, such radiation damages individual cells. Damaged cells may be impaired in their function (such as a muscle cells losing their ability to contract). As time passes and the number of impaired cells increases, the entire muscle (in this example), which is composed of a very large number of individual cells, becomes impaired in its general functioning. If the cells in question are that of an organ, as time passes, that organ will become decreasingly able to perform its function, and other organs will, in turn, be affected. Eventually, when the proportion of these damaged cells throughout the body reaches a certain degree, the organs cannot fulfill their functions. The individual cannot survive the resulting avalanche effect and dies.

The damaging effects of radiation occur cell by cell and are a substantial part of the aging process.

Ways in Which We Are Exposed to Radiation

Some radiation is unavoidable because it comes from outer space and from natural objects such as rocks. Other radiation resulted from nuclear explosions or from the venting of radioactive materials into the air; and which occur either accidentally or routinely in nuclear power plants. Still other radiation is received from medical x-rays. By eliminating all medical radiation other than that which is crucial (e.g., x-rays for a broken bone), we can cut the harmful effects of radiation approximately in half. It should be noted that dental x-rays constitute a very low exposure compared to chest x-rays. Also, x-rays to the extremities are not as bad as those to the trunk of the body, where in lie the organs. X-rays to the genital area are especially to be avoided if one expects to conceive offspring. There is reason to suspect that chest x-rays may contribute to breast cancer.

Low-Frequency Radiation

Presently there is a growing concern among scientists that the electromagnetic radiation from power lines, television sets, computer monitors, electric stoves and heaters, etc. causes damage to cells.

2.3.2.2 Biotic Factors: These result from the influences of the thousands of living organisms which share man's environment. Ageing processes are affected by such things as pathogens, parasites and the availability of food products.

Example-

Free Radicals

Free radicals are molecules that are ingested or produced within the body that combine haphazardly with the molecules of living cells. Free radicals damage the cells of all the bodily organs —especially the heart and arteries.

Free radicals are formed in foods during processing, storage, or cooking. Fats, especially unsaturated ones, are subject to free-radical formation when they are exposed to heat, light, or oxygen. To avoid the introduction of free radicals into the body, you should avoid damaged fats. Damaged fats include not only foods fried in vegetable oil but bottled oils, most of which have been exposed to processing, heat, light, and oxygen. Since fats are essential to health, one should eat a moderate amount of fats that occur in raw, whole seeds and nuts or in steamed or baked cold-water fish. Such foods are rich in undamaged "essential fatty acids." The undesirable fats should be avoided.

Once free radicals have been introduced into the body, they are removed and their damaging effect is offset by substances called anti-oxidants. Vitamin C, vitamin E, zinc, and selenium are examples of anti-oxidants. It is ironic that the very oils which produce the free radicals have had the vitamin E removed in the refining process. Moreover, white flour, the staple of the American diet, has had all of the zinc and vitamin E removed, as well as other vital nutrients. When the natural anti-oxidants are unavailable, the body utilizes cholesterol to clean out the free radicals. To attempt to reduce blood cholesterol levels by removing cholesterol from the diet does not address the problem of free radicals and may place an additional burden on the body to manufacture its own cholesterol. The answer is to lower intake of free radicals and increase the intake of antioxidants.

2.3.3. Socio-economic factors: Adverse living and working conditions can increase the 'wear and tear 'tissues to which the individual is exposed. Stressful conditions of living are considered likely to accelerate the process of ageing. Stress factors, income and poverty, nutrition, chronic health problems also affect ageing process.

Example

Nutrition

Another manner in which cells are damaged is by not receiving the nutrients required for their functioning, repair, or reproduction. Every cell in our body requires a supply of oxygen, vitamins, minerals, amino acids, sugar, etc. Every cell also requires that waste products such as carbon dioxide be eliminated from it. It is not sufficient to eat a "well-balanced diet." The food must be digested, absorbed into the bloodstream, and routed to the appropriate cells. Optimal digestion and absorption are unlikely when foodstuffs are haphazardly consumed without regard to their mode of digestion and the effect of one upon the digestion of the other. Full discussion of this topic is beyond the scope of this book but can be found in Herbert Shelton's excellent book on combining foods.[4]

Unfortunately, most foods lack essential vitamins and minerals. This results from forcing foods to grow in impoverished soil, which will lose vitamins and minerals

during processing, or purposely removing nutrients. For example, wheat products such as bread, pasta, cake, cookies, crackers, and cereals are made almost exclusively from white flour rather than whole-wheat flour.

Repeated Cellular Reproductive Demand

Widespread or repeated damage to cells requires many cell divisions for the repair of the damage. The greater the number of reproductions that occurs, the greater the probability that errors will be made. Such errors can result in (a) tissue that is unable to perform its specialized function, (b) an inability to reproduce past a certain point, and (c) cancerous growth.

Insufficient Sleep

There are many important restorative effects that occur during sleep. During the day, our body is under the constant pull of gravity in a vertical direction. Gravity compresses the spine and requires the heart and vascular system to pump blood against its pull. When sleeping, which is usually done lying down, the heart and vascular system can rest, and the spine can regenerate. Of course, merely lying down will give similar benefits, but there are other benefits that only occur during sleep. For example, certain hormones such as growth hormone and cortisol are secreted only during sleep. Also, the brain and nervous system go into a state that does not occur while awake. Many of the benefits of sleep occur during meditation, and those who meditate regularly often require much less sleep.

Stimulants such as coffee, tea, and chocolate cause difficulty in falling asleep, and then, the minimal sleep that occurs are not deep. Stimulants also lead to "overdrawing one's energy account," which is never adequately paid back. Also, work schedules and alarm clocks also cause many people to incur a sleep deficit.

Excessive Sexual Activity

For the male, excess sexual activity is not without a cost. Sperm requires energy and nutrients for its production, and engaging in excessive sexual activity tends to stimulate a larger than normal production of sperm. Moreover, the production of seminal fluid requires nutrients that are lacking in the diets of many. For example, the secretion of the prostate contains relatively large amounts of zinc, and unless one eats a diet primarily consisting of natural foods or takes mineral supplements, that mineral is not easy to get. The main staple diet, white flour, has had essentially all of its vitamins and minerals removed in the refining process. Whole-wheat flour, from which white flour is made, is rich in many nutrients, especially zinc.

Poisons

A poison is any substance that has an adverse physiological relationship to the growth and nutrition of the cells of the body. There are a multitude of poisons that harm us and are, consequently, to be avoided. Among these poisons are artificial flavors, artificial colors, preservatives, polluted air, polluted water, damaged fats, alcohol, caffeine, mercury-amalgam dental fillings, inoculations, most pharmaceuticals, and products of putrefaction in the gut. Whenever a poison enters the body, it is transported to all of the cells of the body via the blood. Cells that are bathed in these poisons are altered deleteriously in function

Insufficient, Improper, or Excessive Exercise

Here is a case where the aging process is not so much a result of age but, rather, the number of years of lack of proper use of the body. For example, flexibility continually decreases with lack of movement that involves regularly using muscles through their full range, and increases with proper "stretching." The word *stretching* is in quotes because that word implies lengthening a muscle by applying an outward force on each of its ends, and much of the way people stretch in exercise class tends to be done that way, namely by pitting one set of muscles against another.

The benefits of proper stretching are toning and strengthening of muscles, tendons, blood vessels, nerves and acupuncture meridians; strengthening of bones; and massaging organs and glands. Aerobic exercises such as running, bicycling, swimming are valuable for the cardiovascular system, lungs, and weight stabilization.

2.4 Prevention As A Primary Step To Delay Ageing

We all know that ageing is a result of accumulated redundancies over time caused due to sub-optimal functioning of old cells. These cells which lose their functional power due to oxidation or lack of specific resource hinder optimal performance as they create a toxic environment. Tracking these inefficiencies and administering a solution quickly is the best possible way to prevent this accumulation and hence slow down the rapid ageing processes.

It is the inability to know and instantly address the body's functional errors that gives us no control over the ageing process. In our current day practices, the unaware patient consults a doctor when there is a repetitive sign of discomfort (symptom). The symptom could be a resultant of a certain failed process that has occurred over a few days/months prior. Though the body's repair system is on the job, there might be scenarios where the repair system has been overpowered due to the latency in administering a solution.

Hence it becomes extremely important to track and monitor processes that help us stay informed and take preventive measures to quickly solve redundancies. A periodic check-up can help us keep abreast of the current performance and also help us analyze by comparing with past metrics, which can hint at processes that underperformed from the last time period and hence a quick measure can be taken.

In order to stay informed, we need to quickly develop and adapt to medical devices and wearables, capable of tracking data. Everyday check on pressure, temperature, urine, blood and flow analysis, can reveal a lot of information, regarding the current state of affairs.

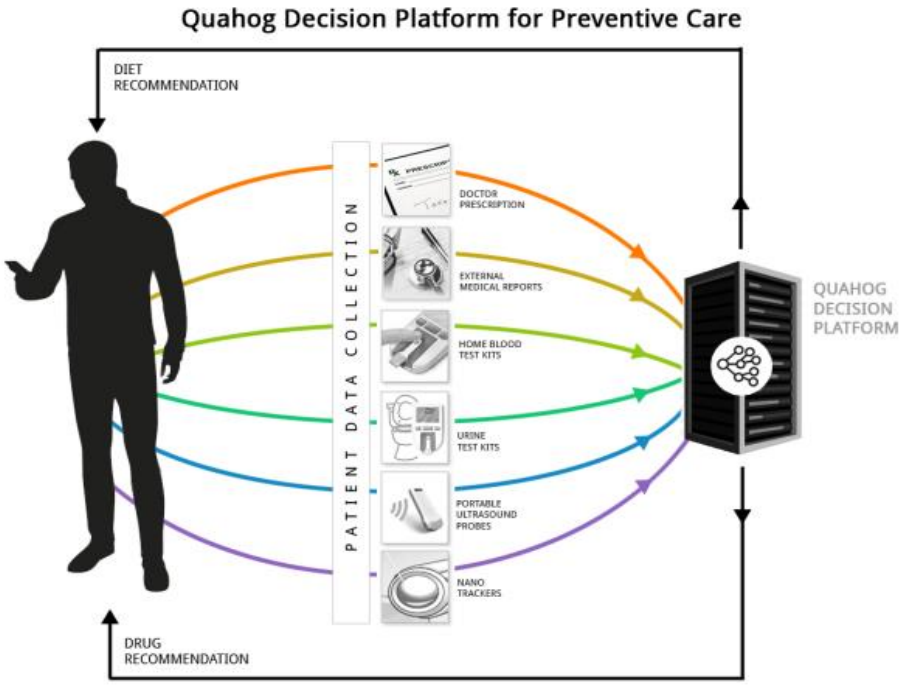
For instance, A simple urine test home kit can reveal abnormalities in urinary systems, kidney functions, liver and pancreatic functions, bacterial infections, acidosis/sepsis, advanced kidney, bladder or prostate cancer, nutrition conditions, dehydration and more or a handheld or a wireless ultrasound probe can help understand the causes of pain, swelling and infection or diagnose heart conditions or even flow obstructions.

Even better would be to see everyday use of nano medical concepts like VCSN (Vascular Cartographic Scanning Nano device) or the Gastro-intestinal micro scanning devices can help us understand processes and failures at molecular level and administer solution for base processes. Nano sensor embedded wearables are being developed to detect pathogens in the environment and help us take measures to avoid harmful pathogens.

In order to enable individuals to stay informed about their body condition, it would require tracking and collecting from these various devices and synthesize data over combination of parameters to arrive at easy intelligence for a regular individual to interpret.

For instance; An urine device reports data that determines ketone test positive and the blood test device sends data reporting as blood glucose levels are high, then you would want to quickly recommend to drink plenty of water and fluids containing no calories to “wash out” the ketones. Since untreated high blood glucose with positive ketones can lead to a life-threatening condition called diabetic ketoacidosis, it is important to test blood glucose every 4 hours and share data in real-time with your assisting doctor to make sure that the individual is free from complications

To manage and streamline this barrage of data, Quahog Life Sciences are building a decision platform that allows users to connect devices and get informed decisions on their mobile phones, keeping them informed at all times.



About Quahog Decision Platform

Quahog Decision Platform is an analytical framework that serves synthesized patient data (Patient Stack), which helps patients to measure, and monitors health periodically and help doctors in diagnosis and predictions of diseases with possible prescriptive measures.

The data architecture is the unique feature of the engine. It uses the concepts of system biology to map events at the molecular level in order to draw a relationship across various attributes of the human body facilitating full blown body investigations.

The Patient Stack will find applications in the following areas

- Risk Mitigation measures for Invasive Repair
- Drug Personalization
- Diet Personalization

- Provide deep insights for cell culture and analysis.

The Patient Stack contains the complete history, prescriptions, results and predictions of a particular patient, which can be accessed by external applications using API methods.

2.5 Prevention According To National Institute Of Ageing

People are living longer. In 1970, the average life expectancy at birth in the United States was 70.8 years; in 2008, it was 78.0 years; and by 2020, the U.S. Census Bureau projects life expectancy will reach 79.5 years.

Views on aging are also changing. Disease and disability were once considered an inevitable part of growing older, but that is no longer true. While aging does put us at greater risk for health issues, many older adults can be healthy and active well into their advancing years.
The National Institute on Aging (NIA), part of the Federal Government's National Institutes of Health (NIH), investigates ways to support healthy aging and prevent or delay the onset of age-related disease and decline. We already know, for example, that healthy eating and exercise and physical activity help to promote healthy aging. Other interventions that can help? NIA-supported and other studies are taking a look at the possible benefits and risks of a number of approaches, including antioxidants, calorie restriction, and hormone supplements.

Antioxidants
Antioxidants protect the body from the harmful effects of by-products known as free radicals, made normally when the body changes oxygen and food into energy. The discovery of antioxidants raised hopes that people could slow aging simply by adding them to the diet. So far, studies of antioxidant-laden foods and supplements in humans have yielded little support for this conclusion.
Calorie Restriction
Scientists are discovering that what you eat, how frequently, and how much may have an effect on quality and years of life. Of particular interest has been calorie restriction, a diet that is lower by a specific percent of calories than the normal diet but includes all needed nutrients. Research in some animals has shown calorie restriction of up to 40 percent fewer calories than normal to have an impressive positive effect on disease, markers of aging, and, perhaps, life span.
Findings of the Comprehensive Assessment of Long-term Effects of Reducing Intake of Energy in humans showed that overweight adults who cut their calorie consumption by 20 to 30 percent lowered their fasting insulin levels and core body temperature. The lower calorie intake also reduced their risk for major causes of mortality such as heart disease and diabetes.

Hormones

Hormones are chemical messengers that set in motion different processes to keep our bodies working properly. For example, they are involved in regulating our metabolism, immune function, sexual reproduction, and growth. Hormones are made by specialized groups of cells within the body's glands. The glands—such as the pituitary, thyroid, adrenals, ovaries, and testes—release hormones into the body as needed to stimulate, regulate, and control the function of other tissues and organs involved in biological processes. Most hormones are typically found in very low concentrations in the bloodstream. But a hormone's concentration will fluctuate depending on the body's activity or time of day.

We cannot survive without hormones. As children, hormones help us grow up. In our teenage years, they drive puberty. As we get older, some hormone levels naturally decline.

In order to learn more, NIA is investigating how the administration of hormones to older people affects frailty and function. Many of these studies focus on hormones that naturally decline with age, including:

- Human growth hormone
- Testosterone
- Estrogen and progesterone (as part of menopausal hormone therapy)
- Dehydroepiandrosterone (DHEA)

How Hormones Work

A hormone acts upon a cell much like a key unlocking a door. After being released by a gland, a hormone molecule travels through the blood until it finds a cell with the right fit. The hormone latches onto a cell via the cell's receptor. When this happens a signal is sent into the cell. These signals may instruct the cell to multiply, make proteins or enzymes, or perform other vital tasks. Some hormones can even cause a cell to release other hormones.

A hormone may fit with many types of cells but may not affect all cells in the same way. For example, one hormone may stimulate one cell to perform a task, but it might also turn off a different cell. Additionally, how a cell responds to a hormone may change throughout life.

Hormone Therapy

Levels of some hormones change naturally over the lifespan. Some hormones increase with age, like parathyroid hormone that helps regulate the amount of calcium in the blood and bone. Some tend to decrease over time, such as testosterone in men and estrogen in women. When the body fails to make enough of a hormone because of a disease or disorder, a doctor may prescribe hormone

supplements. These come in many forms such as pills, shots, topical (gels, creams, and sprays applied to the skin), and medicated skin patches.

Some Dangers of Hormone Therapy and "Anti-Aging" Supplements

Higher concentrations of hormones in your body are not necessarily better. And, a decrease in hormone concentration with age is not necessarily a bad thing. The body maintains a delicate balance between how much hormone it produces and how much it needs to function properly. Natural hormone production fluctuates throughout the day. That means that the amount of hormone in your blood when you wake up may be different 2, 12, or 20 hours later.

If an elderly take hormone supplements, especially without medical supervision, it can adversely affect this tightly controlled, regulated system. Replacement or supplemental hormones cannot replicate your body's natural variation. Because hormonal balance is so intricate, too much of a hormone in your system may actually cause the opposite of the intended effect. For example, taking a hormone supplement can cause your own hormone regulation to stop working. Or, your body may process the supplements differently than the naturally produced hormone, causing an alternate, undesired effect.

Growth Hormone

Growth hormone is important for normal growth and development, as well as for maintaining tissues and organs. It is made by the pituitary gland, a pea-sized structure located at the base of the brain.

Research supports supplemental use of growth hormoneGH) injections in certain circumstances. For instance, GH injections can help children who do not produce enough growth hormone. Sometimes GH injections may be prescribed for young adults whose obesity is the result of having had their pituitary gland surgically removed. These uses are different from taking GH as an "anti-aging" strategy. As with other hormones, growth hormone levels often decline with age, but this decrease is not necessarily bad.

Testosterone

Testosterone is a vital sex hormone that plays an important role in puberty. In men, testosterone not only regulates sex drive (libido), it also helps regulate bone mass, fat distribution, muscle mass and strength, and the production of red blood cells and sperm. Testosterone isn't exclusively a male hormone—women produce small amounts as well.

As men age, they often produce somewhat less testosterone, especially compared to years of peak testosterone production during adolescence and early adulthood. Normal testosterone production ranges widely, and it is unclear what amount of decline or how low a level of testosterone will cause adverse effects.

In recent years, the popular press has increasingly reported about "male menopause," conditions suppose to be caused by diminishing testosterone levels in aging men. There is very little scientific evidence that this condition, also known as andropause or viropause, exists. For instance, some men experiencing erectile difficulty (impotence) may be tempted to blame it on lowered testosterone, but many cases of erectile problems are due to circulatory problems.

Hormones in Women

Estrogen and progesterone are two hormones that play an important part in women's menstrual cycle and pregnancy. Estrogen also helps maintain bone strength and may reduce the risk of heart disease and memory problems before menopause. Both estrogen and progesterone are produced naturally by the ovaries. However, after menopause, the ovaries make much less of these hormones. For more than 60 years, millions of women have used estrogen to relieve their menopausal symptoms, especially hot flashes and vaginal dryness. Some women may also be prescribed estrogen to prevent or treat osteoporosis—loss of bone strength—that often happens after menopause. The use of estrogen (by a woman whose uterus has been removed) or estrogen with progesterone or a progestin, a synthetic form of progesterone (by a woman with a uterus), to treat the symptoms of menopause is called menopausal hormone therapy (MHT), formerly known as hormone replacement therapy (HRT).

There is a rich research base investigation on estrogen. Many large, reliable long-term studies of estrogen and its effects on the body have been conducted. Yet, much remains unknown. In fact, the history of estrogen research demonstrates why it is important to examine both the benefits and risks of any hormone therapy before it becomes widely used. Here's what scientists know:

- **Endometrial problems—** while estrogen helps some women with symptom management during and after menopause, it can raise the risk of certain problems. Estrogen may cause a thickening of the lining of the uterus (endometrium) and increase the risk of endometrial cancer. To lessen these risks, doctors now prescribe progesterone or a progestin, in combination with estrogen, to women with a uterus to protect the lining.
- **Heart disease—** the role of estrogen in heart disease is complex. Early studies suggested MHT could lower postmenopausal women's risk for heart disease—the number one killer of women in the United States. But results from the NIH Women's Health Initiative (WHI) suggest that using estrogen with or without a progestin after menopause does not protect women from heart disease and may even increase their risk.

In 2002, WHI scientists reported that using estrogen plus progestin actually elevates some postmenopausal women's chance of developing heart disease, stroke, blood clots, and breast cancer, but women also experienced fewer hip fractures and cases of colorectal cancer. In 2004, WHI scientists published

another report, this time on postmenopausal women who used estrogen alone, which had some similar findings: women had an increased risk of stroke and blood clots, but fewer hip fractures. Then, in 2007, a closer analysis of the WHI results indicated that younger women, ages 50 to 59 at the start of the trial, who used estrogen alone, had significantly less calcified plaque in their coronary arteries than women not using estrogen. Increased plaque in coronary arteries is a risk factor for heart attacks. Scientists also noted that the risk of heart attack increased in women who started MHT more than 10 years after menopause (especially if these women had menopausal symptoms). There was no evidence of increased risk of heart attack in women who began MHT within 10 years of going through menopause.

DHEA

De-hydroepiandrosterone, or DHEA, is made from cholesterol by the adrenal glands, which sit on top of each kidney. It is converted by the body into two other important hormones: testosterone and estrogen.

For most people, DHEA production peaks in the mid-20 and then gradually declines with age. The effects of this decline, including its role in the aging process, are unclear. Even so, some proponents claim that over-the-counter DHEA supplements can improve energy and strength and boost immunity. Claims are also made that supplements increase muscle and decrease fat.

The conversion of naturally produced DHEA into estrogen and testosterone is highly individualized. There is no way to predict who will make more or less of these hormones. Having an excess of testosterone or estrogen in your body could be risky.

2.6 Self assessment Question

Long type-

1. Define ageing, Explain physiology of ageing process.
2. Discuss about factors affecting ageing process.
3. Writes details about prevention of ageing process.

Multiple choice question-

1. People in the “middle- old” category of ageing range in age from ____ and _____.
   a. 65-74 b.85-100 c.75-84 d.57-67
2. People in the “young- old” category of ageing range in age from ____ and _____.

a. 65-74 b.85-100 c.75-84 d.57-67

3. Which one of the symptoms of menopause _____

a. Vaginal dryness b. Amenorrhea c. Dysmenorrhea d. pain

Answer –

1.c 2.a 3.a

2.7 Reference:

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UNIT- 3: Applied Anatomy and Physiology of Ageing and Age Related Changes

Structure :

3.1 INTRODUCTION

Aging begins as soon as adulthood is reached and is as much a part of human life as are infancy, childhood, and adolescence. Gerontology (the study of aging) is concerned primarily with the changes that occur between the attainment of maturity and the death of the individual. The goal of research in gerontology is to identify the factors that influence these changes.

The elderly population is increasing in size as people are living longer due to advances in medical science and improvements in standards of living. In the western world people over 65 years of age represent approximately 15% of the population and almost half of these individuals will present to hospital for a surgical procedure. Elderly patients have higher rates of hospital morbidity and mortality compared to younger patients. This increased risk is related to the normal physiological processes of ageing and increased prevalence of coexisting systemic disease.

As a person ages, their anatomy and physiology undergo many changes that become more apparent with increasing chronological age. Ageing is a progressive physiological process that is characterized by degeneration of organ systems and tissues with consequent loss of functional reserve of these systems. Loss of these functional reserves impairs an individual's ability to cope with physiological challenges such as anesthesia and surgery.

Individuals of the same chronological age may differ significantly in the rate and severity of functional decline. Patients who maintain greater than average functional capacity are considered 'physiologically young' and those whose function declines at an earlier age appear to be 'physiologically old'.

The loss of some body cells and reduced metabolism in other cells characterize ageing. The processes cause a decline in bodily function and changes in body composition.

Certainly a person's heart, lungs, kidneys and other organs will be less efficient at age 60 than they were at age 20. It is important for all health workers to recognize the gradual changes in body function that normally accompany ageing.

The important anatomical and physiological changes that occur in the elderly are considered below.

3.2 AGING CELLS

As cells age, they function less well. Eventually, old cells must die, as a normal part of the body's functioning.

Old cells sometimes die because they are programmed to do so. The genes of cells program a process that, when triggered, results in death of the cell. This programmed death, called apoptosis, is a kind of cell suicide. The aging of a cell is one trigger. Old cells must die to make room for new cells. Other triggers include an excess number of cells and possibly damage to a cell.

Old cells also die because they can divide only a limited number of times. This limit is programmed by genes. When a cell can no longer divide, it grows larger, exists for a while, and then dies. The mechanism that limits cell division involves a structure called a telomere. Telomeres are used to move the cell's genetic material in preparation for cell division. Every time a cell divides, the telomeres shorten a bit. Eventually, the telomeres become so short that the cell can no longer divide.

Sometimes damage to a cell directly causes its death. Cells may be damaged by harmful substances, such as radiation, sunlight, and chemotherapy drugs. Cells may also be damaged by certain by-products of their own normal activities. These by-products, called free radicals, are given off when cells produce energy.

3.3 AGING ORGANS

How well organs function depends on how well the cells within them function. Older cells function less well. Also, in some organs, cells die and are not replaced, so the number of cells decreases. The number of cells in the testes, ovaries, liver, and kidneys decreases markedly as the body ages. When the number of cells becomes too low, an organ cannot function normally. Thus, most organs function less well as people age. However, not all organs lose a large number of cells. The brain is one example. Healthy older people do not lose many brain cells. Substantial losses occur mainly in people who have had a stroke or who have a disorder that causes the progressive loss of nerve cells (neurodegenerative disorders), such as Alzheimer disease or Parkinson disease.

A decline in one organ's functioned, whether due to a disorder or to aging itself, can affect the function of another. For example, if atherosclerosis narrows blood vessels to the kidneys, the kidney function less well because blood flow to them is decreased.

Often, the first signs of aging involve the musculoskeletal system. The eyes, followed by the ears, begin to change early in mid-life. Most internal functions also decline with aging. Most bodily functions peak shortly before age 30 and then begin a gradual but continuous decline. However, even with this decline, most functions remain adequate because most organs start with considerably more functional capacity than the body needs (functional reserve). For example, if half the liver is destroyed, the remaining tissue is more than enough to maintain

normal function. Thus, disorders, rather than normal aging, usually account for most of the loss of function in old age.

Even though most functions remain adequate, the decline in function means that older people are less able to handle various stresses, including strenuous physical activity, extreme temperature changes in the environment, and disorders. This decline also means that older people are more likely to experience side effects from drugs. Some organs are more likely to malfunction under stress than others. These organs include the heart and blood vessels, the urinary organs (such as the kidneys), and the brain.

3.4 MUSCULOSKELETAL SYSTEM

Bones tend to become less dense. Thus, bones become weaker and more likely to break. In women, loss of bone density speeds up after menopause because less estrogen is produced. Estrogen helps prevent too much bone from being broken down during the body's normal process of forming, breaking down, and re-forming bone.

Bones become less dense partly because they contain less calcium (which gives bones strength). The amount of calcium decreases because the body absorbs less calcium from foods. Also, levels of vitamin D, which helps the body use calcium, decrease slightly. Certain bones are weakened more than others. Those most affected include the end of the thighbone (femur) at the hip, the ends of the arm bones (radius and ulna) at the wrist, and the bones of the spine (vertebrae).

Changes in vertebrae at the top of the spine cause the head to tip forward, compressing the throat. As a result, swallowing is more difficult, and choking is more likely. The vertebrae become less dense and the cushions of tissue (disks) between them lose fluid and become thinner, making the spine shorter. Thus, older people become shorter.

The cartilage that lines the joints tends to thin, partly because of the wear and tear of years of movement. The surfaces of a joint may not slide over each other as well as they used to, and the joint may be slightly more susceptible to injury. Damage to the cartilage due to lifelong use of joints or repeated injury often leads to osteoarthritis, which is one of the most common disorders of later life.

Ligaments, which bind joints together, and tendons, which bind muscle to bone, tend to become less elastic, making joints feel tight or stiff. These tissues also weaken. Thus, most people become less flexible. Ligaments tend to tear more easily, and when they tear, they heal more slowly. These changes occur because the cells that maintain ligaments and tendons become less active.

The amount of muscle tissue (muscle mass) and muscle strength tend to decrease beginning around age 30 and continuing throughout life. Some of the decrease is caused by decreasing levels of growth hormone and testosterone, which stimulate muscle development. Also, muscles cannot contract as quickly because more fast-contracting (fast-twitch) muscle fibers are lost than slow-contracting (slow-twitch) muscle fibers. However, aging's effects reduce muscle mass and strength by no more than about 10 to 15% during an adult's lifetime. More severe muscle loss (called sarcopenia , which literally means loss of flesh) results from disease or extreme inactivity, not from aging alone.

Older people retain enough muscle mass and strength for all necessary tasks. Many older people remain strong athletes. They compete in sports and enjoy vigorous physical activity. However, even the fittest notice some decline as they age.

3.5 INTEGUMENTARY SYSTEM

The skin tends to become thinner, less elastic, drier, and finely wrinkled. However, exposure to sunlight over the years greatly contributes to wrinkling and to making the skin rough and blotchy. People who have avoided exposure to sunlight often look much younger than their age.

The skin changes partly because the aging body produces less collagen (a tough, fibrous tissue that makes skin strong) and elastin (which makes skin flexible). As a result, the skin tears more easily.

The fat layer under the skin thins. This layer acts as a cushion for the skin, helping protect and support it. The fat layer also helps conserve body heat. When the layer thins, wrinkles are more likely to develop, and tolerance for cold decreases.

The number of nerve endings in the skin decreases. As a result, people become less sensitive to pain, temperature, and pressure, and injuries may be more likely.

The number of sweat glands and blood vessels decreases, and blood flow in the deep layers of the skin decreases. As a result, the body is less able to move heat from inside the body through blood vessels to the surface of the body. Less heat leaves the body, and the body cannot cool itself as well. Thus, the risk of heat-related disorders, such as heatstroke, is increased. Also, when blood flow is decreased, the skin tends to heal more slowly.

The number of pigment-producing cells (melanocytes) decreases. As a result, the skin has less protection against ultraviolet (UV) radiation, such as that from sunlight. Large, brown spots (age spots) develop on skin that has been exposed to sunlight, perhaps because the skin is less able to remove waste products.

The skin is less able to form vitamin D when it is exposed to sunlight. Thus, the risk of vitamin D deficiency increases.

3.6 NERVOUS SYSTEM

The number of nerve cells in the brain typically decreases. However, the brain can partly compensate for this loss in several ways:

- As cells are lost, new connections are made between the remaining nerve cells.
- New nerve cells may form in some areas of the brain, even during old age.
- The brain has more cells than it needs to do most activities—a characteristic called redundancy.

Levels of the chemical substances involved in sending messages in the brain change. Most decrease, but some increase. Nerve cells may lose some of their receptors for messages. Blood flow to the brain decreases. Because of these age-related changes, the brain may function slightly less well. Older people may react and do tasks somewhat more slowly, but given time, they do these things accurately. Some mental functions—such as vocabulary, short-term memory, the ability to learn new material, and the ability to recall words—may be subtly reduced after age 70.

After about age 60, the number of cells in the spinal cord begins to decrease. Usually, this change does not affect strength or sensation.

3.7 RESPIRATORY SYSTEM

The muscles used in breathing, such as the diaphragm, tend to weaken. The number of air sacs (alveoli) and capillaries in the lungs decreases. Thus, slightly less oxygen is absorbed from air that is breathed in. The lungs become less elastic. In people who do not smoke or have a lung disorder, these changes do not affect ordinary daily activities, but these changes may make exercising more difficult. Breathing at high altitudes (where there is less oxygen) may also be harder.

The lungs become less able to fight infection, partly because the cells that sweep debris containing microorganisms out of the airways are less able to do so. Cough, which also helps clear the lungs, tends to be weaker. With advancing age, loss of elastic tissue around the oropharynx can lead to collapse of the upper airway. Sleep or sedative states may result in partial or complete obstruction of the airway. A progressive increase in the number of episodes of arterial desaturation during sleep occurs with advancing age and a history suggestive of obstructive sleep apnea should be sought in older patients.

Patients are often edentulous making bag-mask ventilation difficult. Adjuvant airway devices such as an oropharyngeal airway help maintain an open airway during anesthesia. Osteoarthritis changes may limit cervical spine flexibility and can make tracheal intubation more difficult. Care must be taken to avoid stressing the cervical spine as fragile ligaments and bones may be injured when subjected to mechanical forces.

3.8 DIGESTIVE SYSTEM

Overall, the digestive system is less affected by aging than most other parts of the body. The muscles of the esophagus contract less forcefully, but movement of food through the esophagus is not affected. Food is emptied from the stomach slightly more slowly, and the stomach cannot hold as much food because it is less elastic. But in most people, these changes are too slight to be noticed.

Certain changes cause problems in some people. The digestive tract may produce less lactase, an enzyme the body needs to digest milk. As a result, older people are more likely to develop intolerance of dairy products (lactose intolerance). People with lactose intolerance may feel bloated or have gas or diarrhea after they consume milk products.

In the large intestine, materials move through a little more slowly. In some people, this slowing contributes to constipation.

The liver tends to become smaller because the number of cells decreases. Less blood flows through it, and liver enzymes that help the body process drugs and other substances work less efficiently. As a result, the liver may be slightly less able to help remove drugs and other substances from the body. And that effects of drugs—intended and unintended—last longer.

3.9 CARDIOVASCULAR SYSTEM

Large and medium sized vessels become less elastic and therefore become less compliant with age. This results in raised systemic vascular resistance and hypertension, which in turn may lead to left ventricular strain and left ventricular hypertrophy. Cardiac output falls by 3% per decade which is due to reduced stroke volume and ventricular contractility. The reduction in cardiac output with age increases the arm-brain circulation time for drugs and means intravenous anesthesia is achieved more slowly and with reduced doses of anesthetic agent. Cardiac conducting cells decrease in number making heart block, ectopic beats, arrhythmias and arterial fibrillation more prevalent. Since arterial contraction contributes approximately one third of the volume towards normal ventricular filling, patients with arterial fibrillation suffer a reduction in cardiac output of about 30%.

Catecholamine b adrenergic receptors in the myocardium are down regulated in the elderly resulting in a decreased responsiveness to catecholamine and sympathomimetic agents. The non-compliant vascular systems may result in reduced efficacy of vasoconstriction drugs such as ephedrine and metaraminol. There is global impairment of autonomic homeostasis and impaired carotid baroreceptor response such that the heart rate cannot always respond to maintain arterial blood pressure. Postural hypotension is common in the elderly population and may be exacerbated by diuretics, antihypertensive drugs and hypovolaemia.

The heart and blood vessels become stiffer. The heart fills with blood more slowly. The stiffer arteries are less able to expand when more blood is pumped through them. Thus, blood pressure tends to increase.

Despite these changes, a normal older heart functions well. Differences between young and old hearts become apparent only when the heart has to work hard and pump more blood—for example, during exercise or an illness. An older heart cannot speed up as quickly or pump as fast or as much blood as a younger heart. Thus, older athletes are not able to perform as well as younger athletes. However, regular aerobic exercise can improve athletic performance in older people.

3.10 BLOOD PRODUCTION

The amount of active bone marrow, where blood cells are produced, decreases. Therefore, fewer blood cells are produced. Nonetheless, the bone marrow can usually produce enough blood cells throughout life. Problems may occur when the need for blood cells is greatly increased—for example, when anemia or an infection develops or bleeding occurs. In such cases, bone marrow is less able to increase its production of blood cells in response to the body's needs.

3.11 EXCRETORY SYSTEM

The kidneys tend to become smaller because the number of cells decreases. Less blood flows through the kidneys, and at about age 30, they begin to filter blood less well. As years pass, they may remove waste products from the blood less well. They may excrete too much water and too little salt, making dehydration more likely. Nonetheless, they almost always function well enough to meet the body's needs.

Certain changes in the urinary tract may make controlling urination more difficult:

- The maximum volume of urine that the bladder can hold decreases. Thus, older people may need to urinate more often.
- The bladder muscles may contract unpredictably (become overactive), regardless of whether people need to urinate.

- The bladder muscles weaken. As a result, they cannot empty the bladder as well, and more urine is left in the bladder after urination.
- The muscle that controls the passage of urine out of the body (urinary sphincter) is less able to close tightly and prevent leakage. Thus, older people have more difficulty postponing urination.

These changes are one reason that urinary incontinence (uncontrollable loss of urine) becomes more common as people age.

In women, the urethra (the tube through which urine leaves the body) shortens, and its lining becomes thinner. The decrease in the estrogen level that occurs with menopause may contribute to this and other changes in the urinary tract.

In men, the prostate gland tends to enlarge. In many men, it enlarges enough to interfere with the passage of urine and to prevent the bladder from emptying completely. As a result, older men tend to urinate with less force, to take longer to start the stream of urine, to dribble urine at the end of the stream, and to urinate more often. Older men are also more likely to be unable to urinate despite having a full bladder (called urinary retention). This disorder requires immediate medical care.

3.12 REPRODUCTIVE SYSTEM

3.12.1 Changes in Women

The effects of aging on sex hormone levels are more obvious in women than in men. In women, most of these effects are related to menopause, when the levels of female hormones (particularly estrogen) decrease dramatically, menstrual periods end permanently, and pregnancy is no longer possible. The decrease in female hormone levels causes the ovaries and uterus to shrink. The tissues of the vagina become thinner, drier, and less elastic (a condition called atrophic vaginitis). In severe cases, these changes can lead to itching, bleeding, pain during intercourse and a need to urinate immediately (urinary urgency). Decreased quantity of pubic hair & decreased size of labia & clitoris.

The breast become less firm and more fibrous and they tend to sag. This change makes finding lumps in the breast more difficult. Nipples decrease in size and become flat.

3.12.2 Changes in Men

In men, changes in sex hormone levels are less sudden. Levels of the male hormone testosterone decrease, resulting in fewer sperm and a decreased sex drive (libido), but the decrease is gradual. Although blood flow to the penis tends to decrease, most men can have erections and orgasms throughout life. However,

erections may not last long, may be slightly less rigid, or may require more stimulation to maintain. A second erection may require more time. Erectile dysfunction (impotence) becomes more common as men age and is often due to a disorder, usually a disorder that affects blood vessels (such as a vascular disease) or diabetes. Seminal fluid decreases in volume &becomes less viscous. Decrease intensity of sensation. Prostate gland enlarges &its secretion diminishes.

3.13 ENDOCRINE SYSTEM

The level and activity of hormones, produced by endocrine glands may result in adverse effects like

- Growth hormone levels decrease, leading to decreased muscle mass.
- Aldosterone levels decrease, making dehydration more likely. This hormone signals the body to retain salt and therefore water.
- Insulin, which helps control the sugar level in blood, is less effective, and less insulin may be produced. Insulin enables sugar to move from the blood into cells, where it can be converted to energy. The changes in insulin mean that the sugar level increases more after a large meal and takes longer to return to normal.
- Decreased secretion of adrenocorticotrophic hormone & cortisol leads to decreased efficiency of the stress response.
- Decreased secretion of thymus contributes to decreased immune system response.
- Decreased secretion of progesterone & testosterone.
- Decreased secretion of estrogen, FSH, & LH.

For most people, the changes in the endocrine system have no noticeable effect on overall health. But in some, the changes may increase the risk of health problems. For example, the changes in insulin increase the risk of type 2 diabetes. Thus, exercise and diet, which can enhance insulin's action, become more important as people age.

3.14 SENSORY SYSTEM

3.14.1 EYE

A change in vision is often the first undeniable sign of aging.

As people age, the following occur:

- The lens stiffens, making focusing on close objects harder.
- The lens becomes denser, making seeing in dim light harder.
- The pupil reacts more slowly to changes in light.
- The lens yellows, changing the way colors are perceived.
- The number of nerve cells decrease, impairing depth perception.
- The eyes produce less fluid, making them feel dry.

Changes in the lenses of the eye can cause or contribute to the following:

- **Loss of near vision:** During their 40s, most people notice that seeing objects closer than 2 feet becomes difficult. This change in vision, called presbyopia, occurs because the lens in the eye stiffens.
- **Need for brighter light**: As people continue to age, seeing in dim light becomes more difficult because the lens tends to become less transparent. A denser lens means that less light passes through to the retina at the back of the eye. Also, the retina, which contains the cells that sense light, becomes less sensitive. So for reading, brighter light is needed. On average, 60-year-olds need 3 times more light to read than 20-year-olds.
- **Changes in color perception**: Colors are perceived differently, partly because the lens tends to yellow with aging. Colors may look less bright and contrasts between different colors may be more difficult to see.

  The pupil of the eye reacts more slowly to changes in light. The pupil widens and narrows to let more or less light in, depending on the brightness of the surroundings. A slow-reacting pupil means that older people may be unable to see when they first enter a dark room. Or they may be temporarily blinded when they enter a brightly lit area. Older people may also become more sensitive to glare. However, increased sensitivity to glare is often due to darkened areas in the lens or to cataracts.

The appearance of the eyes changes in several ways:

- The whites (sclera) of the eyes may turn slightly yellow or brown. This change results from many years of exposure to ultraviolet light, wind, and dust.
- Random splotches of color may appear in the whites of the eyes, particularly in people with a dark complexion.
- A gray-white ring (arcus senile) may appear on the surface of the eye. The ring is made of calcium and cholesterol salts. It does not affect vision.
- The lower eyelid may hang away from the eyeball because the muscles around the eye weaken and the tendons stretch. This condition (called ectropion) may interfere with lubricating the eyeball and contribute to dry eyes.
- The eye may appear to sink into the head because the amount of fat around the eye decreases.

3.14.2 EARS

Most changes in hearing are probably due as much to noise exposure as to aging. Exposure to loud noise over time damages the ear's ability to hear. Nonetheless,

some changes in hearing occur as people age, regardless of their exposure to loud noise.

As people age, hearing high-pitched sounds becomes more difficult. This change is considered age-associated hearing loss (presbycusis). For example, violin music may sound less bright.

Many older people have more trouble hearing in loud places or in groups because of the background noise. Also, earwax, which interferes with hearing, tends to accumulate more.

Thick hairs may grow out of the ears.

3.14.3 MOUTH AND NOSE

Generally, when people are in their 50s, the ability to taste and smell starts to gradually diminish. Both senses are needed to enjoy the full range of flavors in food. The tongue can identify only five basic tastes: sweet, sour, bitter, salt, and a relatively newly identified taste called umami (commonly described as meaty or savory). The sense of smell is needed to distinguish more subtle and complex flavors (such as raspberry).

As, people age taste buds on the tongue decrease in sensitivity. This change affects tasting sweet and salt more than bitter and sour. The ability to smell diminishes because the lining of the nose becomes thinner and drier and the nerve endings in the nose deteriorate. However, the change is slight, usually affecting only subtle smells. Because of these changes, many foods tend to taste bitter, and foods with subtle smells may taste bland.

The mouth tends to feel dry more often, partly because less saliva is produced. Dry mouth further reduces the ability to taste food.

As, people age the gums recede slightly. Consequently, the lower parts of the teeth are exposed to food particles and bacteria. Also, tooth enamel tends to wear away. These changes, as well as a dry mouth, make the teeth more susceptible to decay and cavities (caries) and thus make tooth loss more likely.

With aging, the nose tends to lengthen and enlarge, and the tip tends to droop.

Thick hairs may grow in the nose and on the upper lip and chin.

3.14.4 TOUCH

- Decreased touch sensation
- Decreased vibratory sense & awareness
- Decreased deep sensation
- Decreased temperature regulation

3.15 IMMUNE SYSTEM

The cells of the immune system act more slowly. Decreased number & function of T-cells, leading to impaired ability to produce antibodies. These cells identify and destroy foreign substances such as bacteria, other infecting microbes, and probably cancer cells. This immune slowdown may partly explain several findings associated with aging:

- Cancer is more common among older people.
- Vaccines tend to be less protective in older people.
- Some infections, such as pneumonia and influenza, are more common among older people and result in death more often.
- Allergy symptoms may become less severe.

As the immune system slows down, autoimmune disorders become less common.

AGE-RELATED CHANGES IN BODY SYSTEMS AND HEALTH PROMOTION STRATEGIES		
Changes	**Subjective& objectives findings**	**Health promotion strategies**
Cardiovascular system:		
Decreased cardiac output: Diminished ability to respond to stress; heart rate stroke volume do not increase with maximum demand, slower heart recovery rate, increased blood pressure.	Complains of fatigue with increased activity, increased heart rate recovery time, optimal blood pressure< 120/80 mm Hg prehypertension. >120-139/80-89mm Hg. Hypertension >149/90mm Hg.	Exercise regularly; pace activities, avoid smoking, eat a low-salt diet, participate in stress-reduction activities, check blood pressure reduction regularly, medication regimen, and weight control.
Respiratory system:		
Increase in residual lung volume, decrease in muscle strength, endurance, and vital capacity, decreased gas exchange and diffusing capacity, decreased cough efficiency.	Fatigue and breathlessness with sustained activity, decreased chest/lung expansion with less effective exhalation.	Exercise regularly, avoid smoking, and take adequate fluids to liquefy secretions, receive yearly influenza immunization and pneumonia vaccine at 65 yrs of age.
Integumentary system		
Decreased subcutaneous fat, interstitial fluid, muscle tone, decreased protection against sun exposure.	Thin, wrinkled and dry skin, complaints of injuries and sun burn, complaints intolerance to heat, bone	Limit sun exposure to10-15 minutes daily for vitamin D, use protective clothing and sunscreen, lubricate skin

	structure is prominent.	with lotion that contain petroleum jelly.
Reproductive system		
Female: vaginal narrowing and decreased elasticity, and vaginal secretion. Male: less firm testis and decreased sperm production. Male and Female slower sexual response.	Female: painful intercourse, vaginal bleeding following intercourse, vaginal itching and irritation. Delayed orgasm. Male: delayed erection and achievement of orgasm.	May require vaginal estrogen replacement, Gynecology/urology follow up, use a lubricant with sexual intercourse.
Musculoskeletal system		
Loss of bone density. Loss of muscle strength and size , degenerated joint cartilage.	Heat loss, prone to fractures, kyphosis, back pain, loss of strength, flexibility, and joint pain.	Exercise regularly, eat a high calcium diet, limit phosphorus intake, take calcium and Vitamin D supplements.
Changes	**Subjective& objectives findings**	**Health promotion strategies**
Genitourinary system		
Male: benign prostate hyperplasia. Female: relaxed perineal muscle, urethral dysfunction.	Urinary retention, irritating voiding symptoms – frequency, feeling of incomplete bladder emptying. Urgency/ frequency syndrome, decreased "warning time" drops of urine lost with cough, laugh.	Male: limit drinking in evening (E.g. –alcohol) do not wait long periods between voiding and empty bladder all the way when passing urine. Female: wear easily manipulated clothing drink adequate fluids, avoid bladder irritants (E.g., caffeinated beverages, alcohol), pelvic floor muscle exercises.
Gastrointestinal system		
Decreased sense of thirst, smell and taste, decreased salivation, smell and taste, decreased salivation, difficulty swallowing food, delayed esophageal and gastric emptying, reduced gastrointestinal motility.	Risk of dehydration, electrolyte imbalance, and poor nutritional intake, complaints of dry mouth, complaints off fullness, heart burn, and indigestion, constipation, flatulence and abdominal discomfort.	Use ice chips, mouthwash, brush, floss and massage gums daily, receive regular dental care, eat small, frequent meals, sit up and avoid heavy activity after eating, limit antacids, eat a high-fiber, low fat diet, toilet regularly, drink adequate fluids.
Nervous system		
Reduced speed in nerve conduction, increased confusion with physical illness and loss of environmental cues, reduced cerebral circulation.	Slower to respond and react, learning takes longer, becomes confused with hospital admission, faintness, frequent falls	Pace teaching, with hospitalization, encourage visitors, enhance sensory stimulation, with sudden confusion, look for cause, encourage slow rising from a resting position.
Special senses		
Vision: Diminished ability to focus on close objects,	Holds objects far away from face, complains of	Wear of glasses, use sunglass outdoors, avoid

inability to tolerate glare, difficulty adjusting to changes of light intensity, and decreased ability to distinguish colors.	glare, poor night vision, confuse colors.	abrupt changes from dark to light, use adequate indoor lighting with area lights and light nights, use large print books, use magnifier for reading, avoid night driving, use contrasting colors for color coding, avoid glare of shiny surfaces and direct sunlight.
Hearing: Decreased ability to hear high frequency sounds, tympanic membrane thinning and loss of resiliency.	Gives inappropriate responses, asks people to repeat words, stains forward to hear.	Recommend a hearing examination, reduce background noise, face person, enunciate clearly, speak with a low pitched voice, and use non verbal cues.
Taste and smell: decreased ability to taste and smell.	Uses excessive sugar and salt.	Encourage use of lemon, spices, and herbs. Recommend smoking cessation.

3.16 SELF ASSESSMENT QUESTIONS:

Long question

1. What physiological changes to the cardiovascular system occur in the elderly?
2. Briefly explain about changes with ageing in different system?

Multiple questions

1. Sign of ageing include-

a. loss of hair b. Thinning in the layer of the skin
c. Decreased in muscle tone d. All of the above

2. The study of ageing is-

a. Gerontology b. Epistemology
c. Oncology d. Anthropology

3. Age related changes in the Digestive system can lead to-

a. Indigestion b. Constipation
c. Changes in taste d. All of the above

4. Presbyopia is characterized by-

a. Thickening of the lens b. loss of elasticity in the lens
c. Loss of the eye's ability to accommodate d. All of the above

5. Gastro intestinal problems of elderly include all the following except:

a. Tooth loss b. Poor appetite
c. Constipation d. Dysuria

6. Changes of Musculoskeletal system include all the following except:

a. Decreased joint mobility b. Decreased immune response

c. Osteoporosis d. Decreased muscle tone

Answer- 1.d 2.a 3.d 4.d 5.d 6.b

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Web site

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