Theories of Ageing

There are many theories about the mechanisms of age-related changes, and they are mutually exclusive, no one theory is sufficiently able to explain the process of aging, and they often contradict one another. A popular review highlights that centenarians have healthy ageing because of the delay in processes like physiological decline and age-related diseases or syndromes.

Modern biological theories of aging in humans currently fall into three main categories:

a) Cellular Theories
b) Extracellular Theories
c) Combined Theories

a) Cellular Theories:

Theories attempt to explain the ageing process as result of defective intracellular process. The basic assumption is that there is limited frequency of error in the biochemical operation of every cell. Over a period of time these errors might accumulate to produce a cell with defective function or they might result in the death of the cell.

i) **Theory of genetic blueprint and Hayflick limit:** The Hayflick Limit (by Leonard Hayflick) is a concept that helps to explain the mechanisms behind cellular aging. The concept states that a normal human cell can only replicate and divide forty to sixty times before it cannot divide anymore, and will break down by programmed cell death or apoptosis. Cell division will cease once telomeres shorten to a critical length. Also, longer the life span of species, the greater was the number of divisions of the cells. Hayflick concluded that senescence is due to loss of cell functions that occurs before cells reach their maximum division point.

ii) **Theory of Free Radical:** Theory proposes that free radicals produced in the cells, particularly those of oxygen, cause much damage to cell and bring about death of the cell. In aerobic cells, certain enzymatic reactions are responsible for generation of free oxygen radical. These radicals reacts with unsaturated lipids and produce age pigments **lipofuscin.**

Lester Packer and James smith provided evidence in support of free radical theory. Vit E is a natural antioxidant, and its addition to the human embryonic cells in culture doubled the number of times of divisions of the cells.

iii) **The Error theories:** Cell generally functions in normal ways but errors do take place. Such errors might occur at the level of DNA, RNA, protein synthesizing mechanisms, and enzymatic reactions.

   a) **Errors at the level of DNA:** Though DNA replicates very accurately, it may commit errors which pile up in the DNA as individual ages. There is evidence that the efficacy of DNA repair correlates with longevity.
   b) **The Error catastrophe Theory:** Accumulation of simple random mutations may not prove as fatal to the cell. Leslie Orgel proposes that certain types of errors are likely to produce a great numbers of subsequent errors. A mutation in The DNA polymerase gene will give rise to an enzyme that will make further mistakes during replication. Thus, error in the replication would lead to “error catastrophe”.
   c) **Theory of Missing factors:** According to M.S. Kanungo the reproductive phase of an individual deplete certain factors essential for maintenance of adulthood and reproductive phase, and the result in senescence and ageing. Thus, senescence may not be due to any specific gene for ageing but rather may be due to non-functioning of genes necessary for maintenance of adulthood.

b) Extra Cellular Theories: Ageing factors lies outside the cells.

i) Collagen theory: Collagen is estimated to account for large part of extracellular substances. It is made up of three polypeptide chains wound into a super helix. The three chains are stabilised by non covalent bonds. As the age advances the chains are further stabilised by covalent bonds making them practically insoluble. It creates problem in maintaining healthy of intracellular substance as there will be difficulty in ingesting and expulsion of materials from cell.

ii) Immunological theory: Body fights antigens by antibodies. The efficiency of immune system decreases with age. Amount of antibodies produced in old rat is one fifth to that produced in young rats.

iii) Brain as a pacemaker: It was observed by a group of scientists that if ovary of a old rat is transplanted into young one it starts secreting oestrogen and begins to function normally. The same result can be obtained by stimulating old rat's brain electrically or pharmacologically by administering drugs like L-Dopa. L-Dopa is known to build substances called neurotransmitters called Catecholamines. Catecholamines are released at nerve endings in hypothalamic section of brain that trigger release of hypothalamic release factors, which in turn, act on pituitary to secrete its hormones. It has been found that rate of catecholamine synthesis is reduced in old mice. In human Parkinson's disease, which is associated with 50-80% losses of dopamine, a precursor of catecholamine, is inflicted after age of 40 years.

Social Theories of Ageing

The social theories of ageing attempts to explain how certain people age well. The main social theories are:

Disengagement Theory: The disengagement theory of aging states that "aging is an inevitable, mutual withdrawal or disengagement, resulting in decreased interaction between the aging person and others in the social system he belongs to". The theory claims that it is natural and acceptable for older adults to withdraw from society.

Disengagement theory was formulated by Cumming and Henry in 1961 in the book Growing Old

- Everyone expects death, and one's abilities will likely deteriorate over time. As a result, every person will lose ties to others in his or her society.
- Because individual interactions between people strengthen norms, an individual who has fewer varieties of interactions has greater freedom from the norms imposed by interaction. Consequently, this form of disengagement becomes a circular or self-perpetuating process.
- Because men have a centrally instrumental role in America, and women a socioemotional one, disengagement differs between men and women.

This theory is being criticized as it does not explain the large number of older people who do not withdraw from society.

Activity Theory was developed in 1953 by Havighurst and colleagues. The basis of activity theory is that the need to remain involved in activities continues into older life, but the meaning and focus changes. Older people have the same wants, needs and motivation as their middle-life counterparts. With the activity theory it is assumed that people will transition from middle life to older age and remain at their current level of activity. The actual activities they take part in, though, may change as

their priorities change. Before, they may have been involved with their children, but as the kids moved out, the parents may take a greater role with pets or animals. There is a shifting of priorities, not a reduction in them.

Social Clock theory describes how major life changes are expected to take place at a certain time during a person's life time. Societal expectations regarding when these changes should occur make up the social clock timeline. This clock provides a way of determining a person's progress within his particular age range. Those who have accomplished the expected tasks by certain age are considered well-adjusted within society's framework, whereas those who are ahead or behind schedule are viewed as either ahead of the pack or lagging behind.

As social roles for men and women have changed in the past 40 years, social clock timelines for landmark events have become more and more flexible. Timelines for marriage has become flexible. Timelines for women in terms of having children have drifted as many women opt to postpone having children until after establishing a career.

Cultural theories of ageing begin with the argument that human beings seek meaning in life which is particularly significant in later life. Theories from the social sciences, as well as those from psychology and psychiatry, have suggested the importance of finding a sense of meaning in later life. Research suggests that older people who receive emotional support from family members and close relatives are more likely to find a sense of meaning in life than older adults who do not have well-developed social support systems (Krause, 2004).