# **Hayflick limit**

## Source: IE

# Why in News?

The recent death of **Leonard Hayflick**, a prominent biomedical researcher has brought renewed attention to his groundbreaking **discovery**, **known as the Hayflick limit**.

 This discovery fundamentally altered the understanding of ageing, challenging the previous belief that ageing was solely influenced by external factors such as disease, and environmental conditions.

# What is the Hayflick Limit?

- About: Leonard Hayflick, in the 1960s discovered that <u>somatic (non-reproductive) cells</u> can only divide approximately 40-60 times before they stop dividing, a phenomenon known as cellular senescence (those that have stopped dividing).
  - This cessation (ceasing) of cell division, which leads to the **accumulation of senescent cells,** is posited to be a key factor in ageing. As more cells stop dividing, the **body begins to age and experience decline.**
  - The Hayflick limit suggests that there is an inherent cellular clock in organisms, including humans, **determining the maximum lifespan**.
    - For humans, this limit is estimated to be around 125 years, beyond which no external factors or genetic modifications can extend life.
- Comparison of Species: Hayflick and other scientists documented the Hayflick limits in various animals.
  - For example, cells of Galapagos turtles, which can live for over 200 years, divide approximately 110 times before reaching senescence.
  - In contrast, laboratory mice cells become senescent after just 15 divisions, correlating with their much shorter lifespans.
- Further Studies: In the 1970s, researchers discovered telomeres, which are repetitive <u>Deoxyribonucleic Acid (DNA)</u> sequences at the end of <u>chromosomes</u> that protect them during cell division.
  - With each cell division, telomeres become shorter until they reach a critical length, signalling the end of cell division and contributing to ageing.
  - While **telomere shortening is linked to ageing**, the exact correlation between telomere length and lifespan is not straightforward. For instance, Mice have longer telomeres than humans but live significantly shorter lives.
  - Some researchers argue that telomere loss and the Hayflick limit are not direct causes of ageing but symptoms of the ageing process.



Note: In the 1980s, scientists discovered a protein called **telomerase that can produce new** telomeres. This protein is active in cancer cells, allowing them to bypass the **Hayflick limit and** continue dividing indefinitely. This is why, as Hayflick himself said, cancer cells are not subject to the Hayflick Limit.

- However, telomerase is primarily active in cancer cells, complicating its potential use in healthy cells.
- Although scientists have synthesised telomerase and some in vitro studies have indicated they may slow down telomere loss in normal human cells, practical application remains distant.

# What is Cell Division?

- About: Cell division is a fundamental biological process where a parent cell divides to form two or more daughter cells. This process is critical for growth, repair, and reproduction in living organisms.
- Cell division in humans occurs through two main processes: mitosis and meiosis.
  Mitosis: This is the process through which somatic (body) cells divide.
  - Mitosis results in two daughter cells, each with the same number of chromosomes as the original cell. It is crucial for growth, tissue repair, and asexual reproduction in unicellular organisms.
  - Mitosis is a highly regulated process that ensures genetic consistency in somatic cells.
- Meiosis: This type of cell division is specific to the formation of gametes (sperm and egg cells).
  - Meiosis reduces the chromosome number by half, creating four non-identical daughter cells, each with 23 chromosomes.
    - This reduction is essential for **maintaining the species' chromosome number** across generations.
  - Meiosis also introduces genetic variation through processes like crossing over and independent assortment (different genes independently separate from one another during the development of reproductive cells).



**UPSC Civil Services Examination, Previous Year Question (PYQ)** 

### Prelims

# Which one of the following statements best describes the role of B cells and T cells in the human body?(2022)

- (a) They protect the environmental allergens. body
- (b) They alleviate the body's pain and inflammation.
- (c) They act as immunosuppressants in the body.
- (d) They protect the body from diseases caused by pathogens.

### Ans: (d)



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