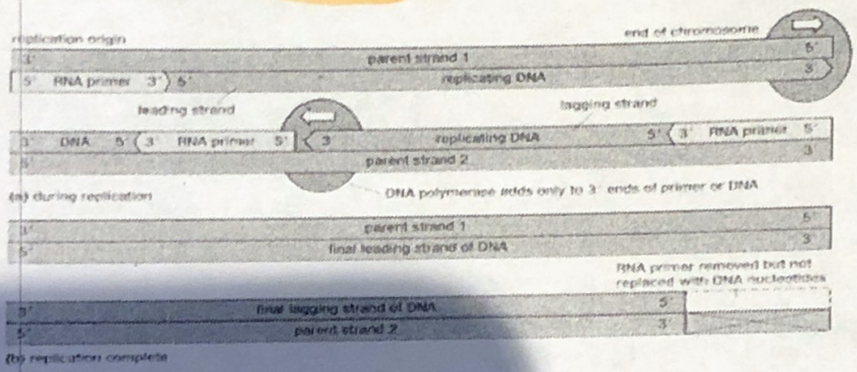
DNA Replication and Aging

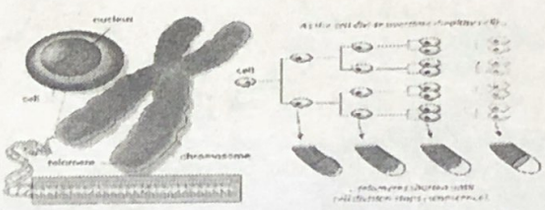
- **Telomeres** are non-coding sections of DNA found at the end of chromosomes. They are composed of repeating sequences. **'Protective Caps'**
  - They have many functions:
    - prevent chromosome ends from fusing with other chromosomes
    - prevent DNA degradation
    - help guard cells against mutations and cancer
    - may play a role in determining the number of times that a cell can divide - therefore play a role in determining the lifespan of an organism

Recall that during DNA replication, RNA primers need to be removed and replaced with DNA. The final Primer on the lagging strand can be removed, but not replaced

- This leads to a segment of the chromosome being lost with each replication
- Fortunately, the lost code is part of the telomere



- After many replications (and cell divisions), the telomeres are lost and can no longer protect the chromosome
- This loss signals to the cell that it's time for the cell to 'retire'
- One of two things happen:
  - **Cellular senescence** (resting state = no cell division)
  - And/or programmed **apoptosis** (cell death) will occur



Telomeres and Cancer

- Unlike non-cancerous cells, which have a 'limit' to the number of times they can divide (due to the loss of telomeres), cancerous cells can divide 'indefinitely'
  - this is because they produce an enzyme called telomerase in great quantities
  - **telomerase** replaces telomeres that are lost after a division
  - telomerase is active in many non-cancerous cells during childhood to accommodate the growth that occurs during that time in development, but it is then turned off
  - Some cancer research is now targeting telomerase, and trying to find ways to successfully inactivate it in cancerous cells