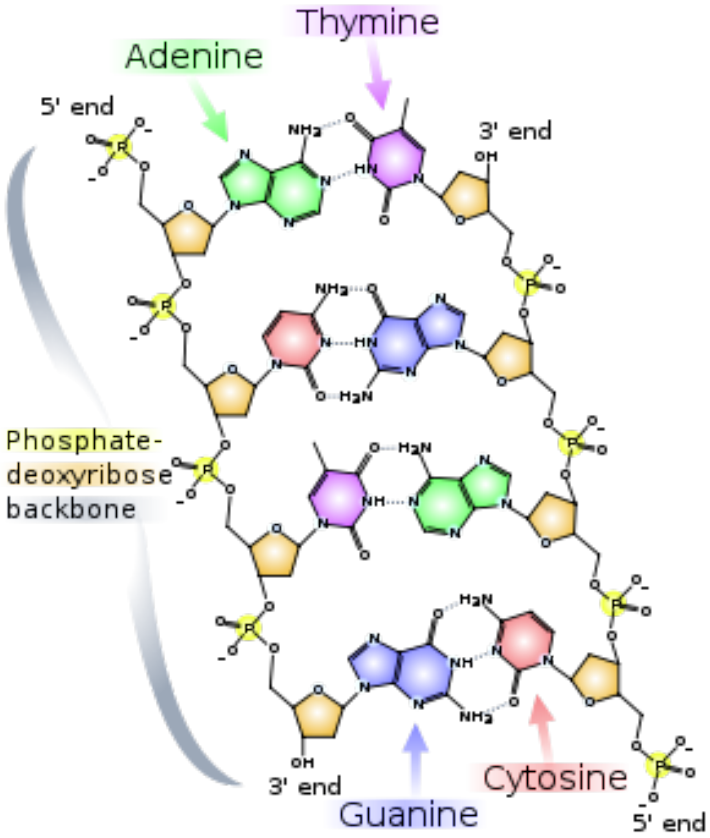
AS 91156

Demonstrate understanding of life processes at the cellular level

Steps in DNA replication

NOTE:

- DNA replication is the copying of the DNA before the cell divides so that each generation receives a complete set of genetic information.
- DNA replication occurs during the S stage (synthesis stage) of the cell cycle.
- DNA replication is semi-conservative because one side of the final DNA strand is made up of original DNA and one strand is new.
- DNA strands are anti-parallel: this means that the two sides of the DNA run in opposite directions. Head to Tail (3' to 5') and Tail to Head (5' to 3'). This anti-parallel nature is due to the numbering of the carbons in the sugar (see diagram below)



Steps in DNA replication.

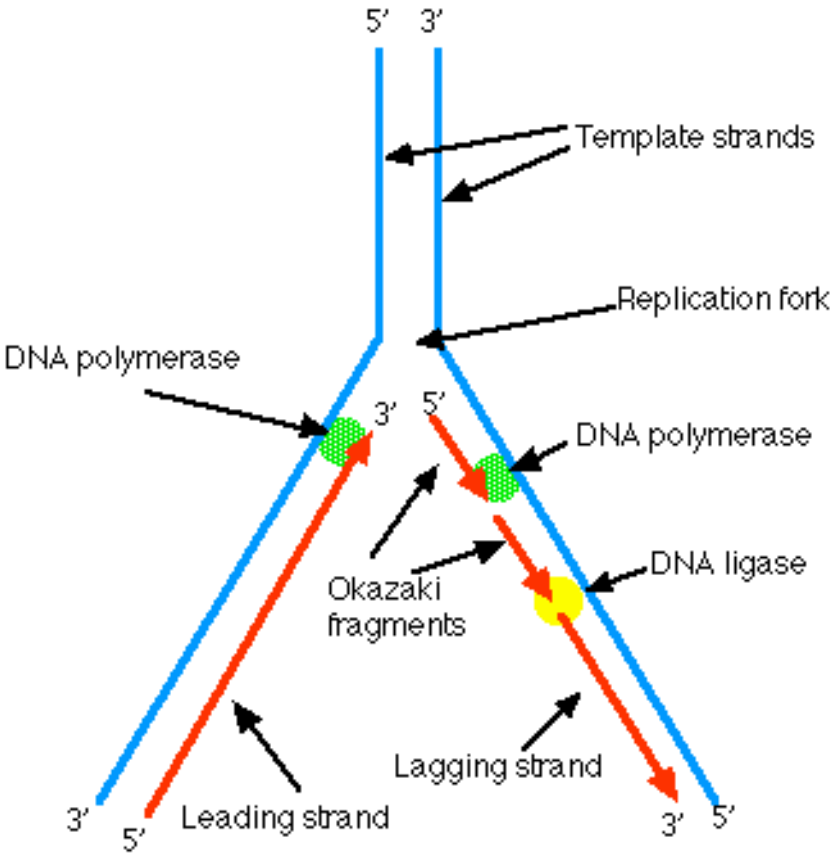
- DNA molecule is unzipped by the enzyme **helicase** breaking the comparatively weak hydrogen bonds between the complementary base pairs.
- Nucleotides from within the nucleus are used to produce the new strands of DNA.

Leading Strand:

- As the DNA is unzipped the enzyme **DNA polymerase III** adds new nucleotides (A bonds with T and C bonds with G) to the 3' end of the original strand producing a continuous strand.

Lagging strand:

- DNA polymerase is only able to add nucleotides to the 3' end of the original strand therefore DNA polymerase must work from the replication fork down the strand, producing small fragments – Okazaki fragments - that are later joined together.



- As the DNA molecule unwinds a **RNA primer** is produced so the DNA polymerase can attach to the strand and copy.
- **DNA polymerase III** adds nucleotides using the complementary base pairing rule until it reaches a primer where it is released. The piece of DNA is now known as an Okazaki fragment.
- **DNA polymerases I** comes in and removes the primer. It fills the gap with nucleotides, ready for **DNA ligase** which will join the fragments together.
- This process continues until the whole strand of DNA has been copied.

Factors that effect DNA replication:

- This process is controlled by enzymes, and so any factor that affect enzymes will affect the rate- temperature, amount of nucleotides present (substrate), amount of enzymes present.
- Plants grow more in spring (as seen by cells dividing more) because its warm with unlimited resources for all cell processes including DNA replication.
- Animals grow more at certain stages of their life cycle e.g. foetus.