At what stage of cell cycle does DNA replication occur?

What type of replication is it?

What proteins does it involve?

What strand is synthesised in bits?

Where does replication start?

Role of helicase?

What does SSB stand for and what does it do?

What prevents supercoiling further down the helix?

What does primase do?

What is meant by antiparallel?

DNA Replication, Mutation and Repair

Aims:

1) Mechanism of replication of DNA in eukaryotic cells
2) Discontinuous nature of DNA polymerisation and formation of Okazaki fragments
3) Proof-reading and error correction by DNA polymerases
4) Ways in which DNA can be damaged by environmental or natural agents
5) Importance of DNA repair enzymes in controlling mutations
6) Types of mutation: point, insertion and deletion mutations.

DNA Replication

- Occurs in *cell cycle*: **Interphase**
- G1 → Synthesis of components needed to complete the cell cycle such as histones and enzymes for replication.
- S Phase → DNA synthesis begins.
- DNA replication = SEMI-CONSERVATIVE
  - Each strand of the double helix = parent strand and acts as a template for a second strand of DNA to be synthesised onto.
  - Each new DNA molecule contains one parent and one daughter strand.
- Involves proteins such as helicase, SSB protein, primase, the sliding clamp, DNA polymerase III, DNA polymerase I and DNA ligase.
- The leading strand is synthesised continuously whilst the lagging strand is synthesised discontinuously (ookazaki fragments).

DNA Replication Process

1) At *origin of replication* the DNA double helix is unwound and separated by **helicase enzyme**. The point where DNA is separated into single strands and where the new DNA will be synthesised is called the **replication fork**.
2) **Single Stranded Binding Protein (SSB)** coats the exposed single strands to maintain their separated state preventing the helix from reforming. It binds loosely to the DNA and is displaced when polymerase enzymes begin DNA synthesis.
3) **Topoisomerase** binds ahead of the replication fork and prevents supercoiling of the helix further down the helix which would otherwise occur when the strands are pulled apart.
4) **RNA Polymerase Enzyme called PRIMASE** copies a short stretch of DNA strand to create a complementary RNA segment (approx 60 nucleotides long). This is a *primer*.