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QUESTION: Outline the steps involved in DNA replication and outline the enzymes of DNA replication.

ANSWER:

There are three main steps that takes place when DNA replication us to occur and they include;

1. Initiation
2. Elongation
3. Termination

INITIATION:

The initiation stage is where the splitting starts and its called origin of replication and the structure that is formed is known as “ Replication Fork”.The first major step for the DNA Replication to take place is the breaking orsplitting of hydrogen bonds between bases of the two antiparallel strands which is seen as the starting point. The splitting happens in places of the chains which are rich in A-T ( Adenine and Thymine). That is because there are only two bonds between Adenine and Thymine (there are three hydrogen bonds between Cytosine and Guanine). Helicase is the enzyme that splits the two strands. A crucial part of DNA replication is binding of RNA primase to the 3’-5’ parent chain. This Primase attracts RNA nucleotide that binds to the nucleotide of the DNA due to the hydrogen bond between the bases of the 3’-5’ strand and they are seen as the starters of DNA binding

ELONGATION:

This stage is different for 3’-5’ and 5’-3’ arrangement of the DNA strand. For 5’-3’ the proceeding daughter chain that uses this template is called the LEADING STRAND because DNA polymerase continuously adds nucleotides (Adenine and Thymine)

The elongation process is different for the 5'-3' and 3'-5' template. a)5'-3' Template: The 3'-5' proceeding daughter strand -that uses a 5'-3' template- is called leading strand because DNA Polymerase ä can "read" the template and continuously adds nucleotides (complementary to the nucleotides of the template, for example Adenine opposite to Thymine etc) then for the 3'-5' template or strand it cannot be "read" by DNA Polymerase ä. The replication of this template is complicated and the new strand is called lagging strand. In the lagging strand the RNA Primase adds more RNA Primers. DNA polymerase å reads the template and lengthens the bursts. The gap between two RNA primers is called "Okazaki Fragments". The daughter strand is elongated with the binding of more DNA nucleotides. Each new double helix is consisted of one old and one new chain and this is termed semiconservative replication.

TERMINATION:

This process happens when the DNA Polymerase reaches to an end of the strands. When the last section of the lagging strand, the RNA primer is removed, it is not possible for the DNA Polymerase to seal the gap because there is no primer. So, the end of the parental strand where the last primer binds isn't replicated. These ends of linear (chromosomal) DNA consists of noncoding DNA that contains repeat sequences and are called telomeres. As a result, a part of the telomere is removed in every cycle of DNA Replication. The DNA Replication is not completed before a mechanism of repair fixes possible errors caused during the replication. Enzymes like nucleases remove the wrong nucleotides and the DNA Polymerase fills the gaps.

ENZYMES OF DNA REPLICATION:

Helicase: Unwounds a portion of the DNA Double Helix

RNA Primase: Attaches RNA primers to the replicating strands.

DNA Polymerase delta (ä): Binds to the 5' - 3' strand in order to bring nucleotides and create the daughter leading strand.

DNA Polymerase epsilon (å): Binds to the 3' - 5' strand in order to create discontinuous segments starting from different RNA primers.

Exonuclease (DNA Polymerase I): Finds and removes the RNA Primers

DNA Ligase: Adds phosphate in the remaining gaps of the phosphate - sugar backbone

Nucleases: Remove wrong nucleotides from the daughter strand.