

DNA replication

Question 1

DNA replication involves several different enzymes. What is the function of the:

(a) DNA-Helicase

to separate and unwind the two strands of DNA in order to give the other replication enzymes access to the DNA stands

(b) Primase

to synthesize de novo a first short nucleic acid strand (10-20 bases of RNA); at its 3' OH end the DNA polymerase can continue the polymerization of a new DNA strand

(c) DNA polymerase

synthesize new DNA-strand; needs a free 3'-OH strand to add next nucleotide.

Question 2

E. coli genome is made of 4.6×10^6 base pairs. Knowing that the replication speed in E. coli is 1,000 bases per second, calculate how much time is necessary for the replication of the entire E. coli genome.

Because replication is bidirectional the question is how much time to copy 2.3×10^6 bases. It takes 2.3×10^3 s (2300 seconds) = 38 minutes and 20 seconds

Question 3

Under optimal conditions (rich culture medium, optimal temperature, etc.) E. coli doubling time is 20 minutes. This doubling time is shorter than the time required for the genome replication.

Explain how is this possible.

It would not be possible if E. coli would wait until one round of replication is completed before starting a new round of replication.

In reality, E. coli can start a new replication round before the previous round is completed; Almost immediately after the the OriC DNA has been copied.

The daughter cells receive a genome that is already half duplicated.

This is illustrated in the figures.

