

AS Level Biology A
H020/01 Breadth in Biology

Question Set 9

1. Semi-conservative replication describes the process by which DNA is replicated in all living organisms.

(a) (i) Explain the meaning of the phrase *semi-conservative replication*. [1]

The replication of DNA to produce two new DNA molecules which both contain one new strand and one original parent strand.

(ii) DNA ligase is one enzyme involved in the replication of DNA.

State **two** other enzymes involved and describe their functions. [4]

DNA helicase unwinds the DNA double helix, breaking hydrogen bonds between the base pairs. DNA polymerase joins adjacent nucleotides by catalysing a condensation reaction to form phosphodiester bonds.

(b) In 1958, Matthew Meselson and Franklin Stahl carried out an experiment that provided evidence to support the hypothesis of semi-conservative replication of DNA. Meselson and Stahl grew *E. coli* bacteria in a growth medium that contained only the heavy isotope of nitrogen ^{15}N . They transferred the bacteria to a growth medium that had the light ^{14}N isotope and allowed the bacteria to undergo cell division. After each division, the DNA from some of the bacteria was extracted from the culture and centrifuged to separate it. Fig. 25 shows the bands of DNA in the centrifuge tubes after a specific number of divisions.

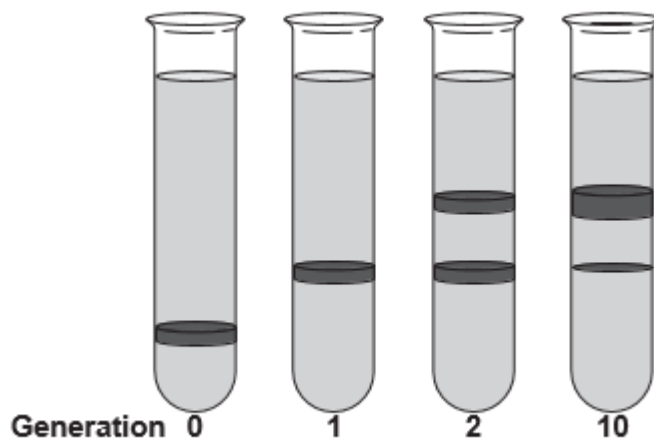


Fig. 25

The tube labelled **Generation 0** in Fig. 25 shows a single band of DNA containing bases that contain only the heavy isotope of nitrogen ^{15}N .

Explain how the results from the other generations provide evidence to support the hypothesis that DNA replication is semi-conservative. [2]

The tube with generation 1 shows new DNA molecules consisting of a strand of old DNA (heavy ^{15}N) and a strand of new DNA (light ^{14}N). The DNA molecules thus all take the same intermediate weight. The tube with generation 2 shows that new DNA molecules are only made from ^{14}N , the template strand for new DNA molecules. This is the same in generation 10 which has a thicker ^{14}N band.

Total Marks for Question Set 9: 7

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