

Exercise walk-through

6.2

DNA Replication

AP Biology

DNA replication

Replication is **semiconservative** : each new molecule keeps one old strand, one new.

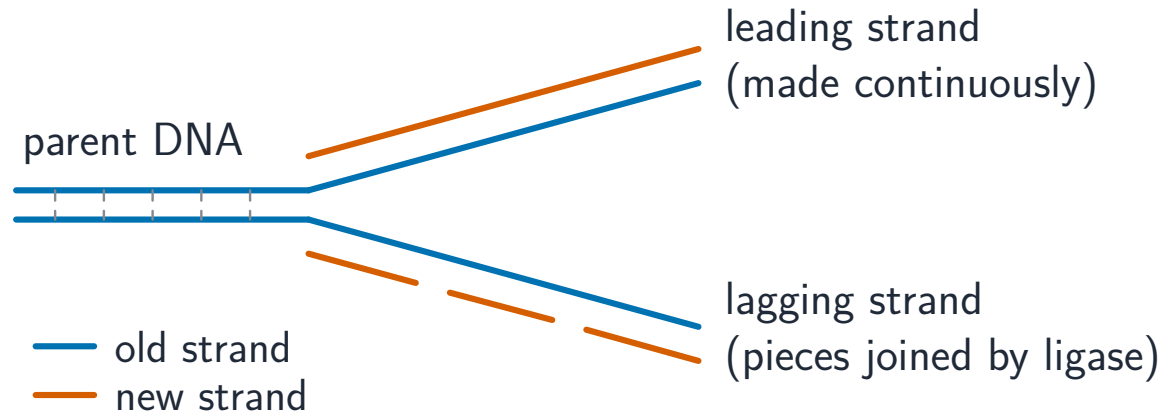
- **helicase** unzips the helix
- **DNA polymerase** DNA builds $5' \rightarrow 3'$
- **ligase** joins the pieces

Continuous **leading strand** ;
piecewise **lagging strand** .



Thermal cycler

Semi-conservative DNA replication at a replication



each new molecule = one old strand + one new strand (semi-conservative)

Semi-conservative DNA replication at a replication fork

Semiconservative replication, and the tools of biotechnology

semiconservative

the helix unwinds and each old strand templates a new one

the consequence

every daughter molecule has one old and one new strand

complementary base pairing

A with T, C with G – which is what makes each strand a template at all

PCR

copies a chosen stretch of DNA, doubling it each cycle

gel electrophoresis

separates fragments by size: shorter fragments travel further

mRNA tRNA

RNA and RNA

carry the message out of the nucleus, and bring the matching amino acid to the ribosome

Meselson and Stahl's experiment is the standard evidence: after one round, all the DNA is intermediate in density – which only semiconservative replication predicts.

What replication produces, and what RNA does

semiconservative

the helix unwinds and each old strand templates a new one

the result

every daughter molecule has one old and one new strand

mRNA

RNA

carries the transcribed message out of the nucleus to the ribosome

tRNA

RNA

brings the amino acid matching each codon

PCR

copies a chosen stretch of DNA, doubling it each cycle

gel electrophoresis

separates fragments by size – shorter ones travel further

Meselson and Stahl's result is the evidence: after one round all the DNA is of intermediate density, which only semiconservative replication predicts.

The three RNAs, spelled out

messenger RNA (mRNA)

transcribed from the template strand, it **carries the message** out of the nucleus

transfer RNA (tRNA)

brings the amino acid matching each codon, using its own anticodon

ribosomal RNA (rRNA)

with protein, it builds the ribosome itself and catalyses the peptide bond

replication is semiconservatively

done – each daughter molecule keeps one old strand

why that phrasing

“conservative” would mean one wholly old and one wholly new molecule, which is what the experiment ruled out

the evidence

Meselson and Stahl: after one round **all** the DNA is of intermediate density

Learn the full names as well as the abbreviations – the exam uses “messenger RNA” and “transfer RNA” in its stems, and expects them back.

Exercises 2.1-2.3

2.1 What does “semiconservative” mean for DNA replication?

[1]

2.2 What does helicase do?

[1]

2.3 What does DNA polymerase do?

[1]

Exercises 2.1-2.3

2.1 What does “semiconservative” mean for DNA replication? [1]

2.1

- Each new molecule keeps one original strand and gains one new strand
-

2.2 What does helicase do? [1]

2.2

- Unwinds and separates the two DNA strands
-

2.3 What does DNA polymerase do? [1]

2.3

- Adds complementary nucleotides to build the new strand

Exercise 3.1

3.1 After replication, each new DNA molecule contains

[1]

☐

A two new strands

B two old strands

C one old and one new strand

D only RNA

Exercise 3.1

3.1 After replication, each new DNA molecule contains

[1]

☐

A two new strands

B two old strands

C one old and one new strand

D only RNA

3.1 C

- one old and one new strand

Exercise 3.2 (a)

3.2 A cell replicates its DNA.

(a) Describe the roles of helicase and DNA polymerase.

[2]

Exercise 3.2 (a)

3.2 A cell replicates its DNA.

(a) Describe the roles of helicase and DNA polymerase. [2]

(a)

- Helicase unwinds/separates the strands; DNA polymerase adds complementary bases to each template

Exercise 3.2 (b)

3.2 A cell replicates its DNA.

(b) A template strand reads 3'-AATGCC-5'. Write the new strand.

[2]

Exercise 3.2 (b)

3.2 A cell replicates its DNA.

(b) A template strand reads 3'-AATGCC-5'. Write the new strand.

[2]

(b)

- 5'-TTACGG-3'

Exercise 3.3

3.3 Explain why semiconservative replication ensures the two daughter molecules are identical to the original. [2]

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3.3

- Each original strand acts as a template, and complementary base pairing forces the new strand to match exactly, so both daughter molecules are copies of the original