

Copying the code

60 minutes • D1.1.1 to D1.1.3 • Chapters 1, 2, 3

Why cells copy DNA, how the copy stays exact, and the two enzymes that do it

BY THE END, STUDENTS CAN

- ☐ Explain why cells copy their DNA, and why every copy must carry the same base sequence D1.1.1
- ☐ Explain what semi-conservative means, and how complementary base pairing makes copying accurate D1.1.2
- ☐ Describe what helicase and DNA polymerase do at a replication fork D1.1.3

TIMING

0-6	6 min	Do now: draw it again	
6-14	8 min	Why copy, and how many times?	
14-26	12 min	One old strand, one new	
26-40	14 min	Unzip, then build	
40-54	14 min	Improve the answer	
54-60	6 min	Exit	
	60 min	One lesson	

STARTER

6
min

Do now: draw it again

Students sketch one nucleotide the IB way, then three nucleotides of one strand paired with their partners (Draw it again, below). Check the drawings against the ones in A1.2.

ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

01 A copy for every new cell

CHAPTER 01 IN THE SLIDES

Step through the figure (4 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A cell holds one copy of its **DNA**.
2. Before it divides, it **copies** it, so each new cell has a full set.
3. Cells divide to **reproduce**, to **grow** and to **replace** what is lost.
4. Every one of your cells came from one by **division**.

Predict box: You began as one fertilised egg and now have about 30 trillion cells. If every cell divided in step, about how many rounds of copying and dividing would it take? Hands up or mini whiteboards first.

Answer B: About 45

02 One old strand, one new

CHAPTER 02 IN THE SLIDES

Switch the figure through Conservative, Semi-conservative, Dispersive and What they saw, and have the class say what will change before each.

Step through the figure (5 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. One molecule: two **old** strands.
2. A new partner is built along each strand: its **template**.
3. Each new molecule keeps one old strand: **semi-conservative**.
4. Copied again: **every** strand is a template.
5. Count the old strands.

Predict box: A DNA molecule is copied, and then both copies are copied again. Of the four molecules, how many still contain a strand from the original? Hands up or mini whiteboards first.

Answer C: Two: each old strand sits in one molecule

03 Unzip, then build

CHAPTER 03 IN THE SLIDES

Tap the parts of the figure in turn: An old strand, An old strand, Hydrogen bonds, A new strand, A new strand, Exposed bases, Exposed bases, A free nucleotide, A free nucleotide, DNA polymerase, DNA polymerase and Helicase.

Step through the figure (4 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. One molecule: two **old** strands.
2. **Helicase** unwinds the helix and breaks the hydrogen bonds.
3. **DNA polymerase** joins nucleotides that pair with each exposed base.
4. Two molecules, each with one **old** strand and one **new**.

Predict box: A drug stops helicase but leaves DNA polymerase working. What happens to replication? Hands up or mini whiteboards first.

Answer A: It stops: polymerase needs single strands to read

THE LESSON

8
min

Why copy, and how many times?

Chapter 1's figure on the board, then chapter 1's predict box (how many rounds) by show of hands. Land on doubling: it comes back in lesson 2.

12
min

One old strand, one new

Chapter 2: the predict box first (four molecules, how many hold an old strand), then chapter 2's figure step by step. Then the How we know box: show chapter 2's Meselson and Stahl states, and students predict each model's tubes on mini whiteboards before each state is shown (Predict the tubes, below).

14
min

Unzip, then build

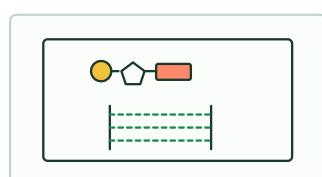
Chapter 3's figure: tap helicase and DNA polymerase. Then Run the fork's standard level rounds in pairs (chapter 3's game): compare each pair's speed with the real polymerase's.

14
min

Improve the answer

Students mark a weak eight-mark answer about copying a skin cell's DNA against the points the class has agreed from chapters 1 to 3, then rewrite it (Improve the answer, below).

ACTIVITIES

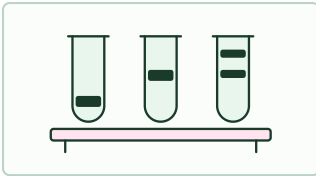


DRAWING

Draw it again

Students sketch one nucleotide the IB way: a circle for the phosphate, a pentagon for the sugar and a rectangle for the base. Then they draw three nucleotides of one strand paired with three of its partner, running the other way, A with T and C with G. They check against the drawings in A1.2.

Needs: mini whiteboards and pens.



DATA

Predict the tubes

With [chapter 2's](#) Meselson and Stahl figure on the board, pairs draw the three tubes that each model predicts before its state is shown. Then they draw the tubes that were observed and say which generation ruled out which model.

Needs: mini whiteboards.

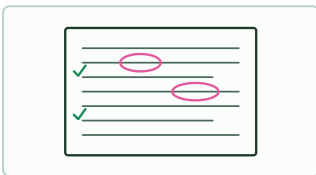


DOODLE

Meselson and Stahl doodle

Homework after lesson 1, in the summary doodle style: three small doodles and eight keywords that fit on one sticky note, telling the story of the experiment. A small prize for the best.

Needs: sticky notes and pens.



WRITING

Improve the answer

The question: "A skin cell is about to divide. Explain how it makes two identical copies of each of its DNA molecules. (8 marks)" Give students this weak answer: "The DNA comes apart into two halves. Each half picks up new bases that match it. An enzyme sticks them together. You end up with two lots of DNA that are the same because the bases match up."

Students mark it against the points the class agrees from chapters 1 to 3: helicase named, hydrogen bonds broken, strands as templates, free nucleotides (not "bases"), complementary pairing, DNA polymerase joining nucleotides, semi-conservative explained, two identical molecules, and why (growth, repair, reproduction). Then they rewrite it. Tips to draw out: begin by saying what replication is, name each enzyme and give its job in the same sentence, write "nucleotides" where the weak answer says "bases", and reach for the exact term ("semi-conservative", "complementary", "hydrogen bonds") rather than an everyday phrase that circles it.

Needs: the answer printed or on the board.

PLENARY

6

min

Exit

"Explain why DNA replication is described as semi-conservative, using the words template and complementary." Homework: the Meselson and Stahl doodle (below).

WHAT STUDENTS GET WRONG

Replication happens during division. It happens before it, in interphase.

The new molecule is all new, or each strand is half old and half new. It is one whole old strand and one whole new one (the site's misconception 38).

Helicase breaks the strands, or the bonds between sugar and phosphate. It breaks only the hydrogen bonds between bases.

DNA polymerase "adds bases". It adds nucleotides.

STRETCH AND SUPPORT

Support: use the dotted key terms as a glossary, and cut [chapter 4's](#) captions up for students to put in order.

Stretch: Meselson and Stahl ran a third generation. Predict the bands for each model, and the ratio of hybrid to light.

IN THE GUIDE

- 1 [A copy for every new cell](#)
- 2 [One old strand, one new](#)
- 3 [Unzip, then build](#)
- All [The whole guide, with the figures that play](#)
- PPTX [This lesson's slides, in the order of this plan](#)

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- [Tarsia puzzle, dominoes and picture reveal](#) on D1.1, built from its key terms and ready to print
- A [pub quiz](#) with rounds on D1.1, to present or run with no projector
- An [escape room built from the question bank](#) on D1.1

ALREADY ON THE SITE FOR D1.1

- Quiz: [DNA Replication \(HL\)](#)
- Quiz: [DNA Replication](#)
- Revision map: [D1.1 DNA replication](#), to fill in
- Exam questions: [D1.1 in the exam maker](#), a paper with its markscheme

CARD SETS ON SPLYCR

Open a set to host it as a class game, or make a copy to edit.

- [D1.1 DNA Replication](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on D1.1 at standard level each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=D1.1&level=SL&paper=quiz&marks=15&src=ep



How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.