

Two directions at one fork HL

60 minutes • D1.1.6, D1.1.7 • Chapters 7, 8

Why polymerase adds only at the 3' end, and what that means for the two new strands

BY THE END, STUDENTS CAN

- ☐ Explain why DNA polymerases add nucleotides only to the 3' end, so new strands grow 5' to 3' D1.1.6
- ☐ Compare replication on the leading and lagging strands, with Okazaki fragments and RNA primers D1.1.7

TIMING

0-6	6 min	Do now: ends and numbers	
6-16	10 min	Only at the 3' end	
16-28	12 min	One strand smooth, one in pieces	
28-48	20 min	Be the fork	
48-56	8 min	A written question	
56-60	4 min	Exit	
	60 min	One lesson	

STARTER

6 Do now: ends and numbers

min

Students sketch a short double strand, number the carbons of one nucleotide and mark the 5' and 3' ends of both strands.

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.

07 Only ever at the 3' end

CHAPTER 07 IN THE SLIDES

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

- Every strand has a **5'** end and a **3'** end.
- DNA polymerase joins a nucleotide's 5' phosphate to the **3' end**.
- There is nothing to join to at the **5' end**.
- So new strands grow **5' to 3'**.
- The templates are antiparallel, so the new strands grow in **opposite** directions.

Predict box: A free nucleotide arrives at the 5' end of a growing new strand, and its base pairs with the template. What happens? Hands up or mini whiteboards first.

Answer B: It is not joined: there is no free 3' OH there

Step through the figure (6 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. Helicase opens the fork and moves on.
2. **Leading strand**: one primer, then built **continuously**, towards the fork.
3. **Lagging strand**: built away from the fork, so it must start again.
4. Each new stretch gets its own **primer**.
5. The lagging strand comes in **Okazaki fragments**.
6. One primer on the leading strand; one per fragment on the lagging strand.

Predict box: A fork opens 10,000 bases of a bacterial chromosome. Okazaki fragments there are about 1,000 to 2,000 nucleotides long. How many RNA primers does each new strand need? Hands up or mini whiteboards first.

Answer C: Leading just 1, lagging about 5 to 10

THE LESSON

10
min

Only at the 3' end

Chapter 7's figure, one step at a time, then chapter 7's predict box on mini whiteboards.

12
min

One strand smooth, one in pieces

Chapter 8: the predict box first (primers on each strand), then chapter 8's figure step by step.

20
min

Be the fork

In groups of five, students act out a fork with paper strips and sticky notes, then swap roles (Be the fork, below).

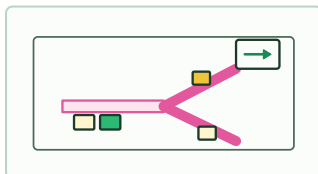
8
min

A written question

Set a compare-and-contrast question on the leading and lagging strands from the D1.1 exam maker (in Practise and revise), timed, then marked in pairs against its markscheme.

A mnemonic for the board once chapter 8's predict box is answered (not before, as it gives the answer away): "Lagging needs lots": lots of primers, lots of fragments, lots of sealing.

ACTIVITIES



MODEL · HL

Be the fork

A table-top role play of a fork. Two long paper strips are taped down running opposite ways, each with its 5' and 3' ends marked, and a stack of sticky-note nucleotides sits to one side. The roles: helicase slides a ruler along to "open" the strips a hand's width at a time; primase places a different colour of sticky note, written in RNA letters; polymerase III may only place notes moving away from a primer in the 5' to 3' direction of the new strand, shown by an arrow card held in one direction; polymerase I swaps primer notes for DNA notes; ligase draws the last link with a pen. Run it for a few minutes, then swap roles. Finish on the limits of the model: no hydrogen bonds, no twist, no speed, and enzymes not to scale.

Needs: paper strips, two colours of sticky notes, arrow cards and pens.

PLENARY

4
min

Exit

"Why can the lagging strand not be copied continuously?" One sentence.

WHAT STUDENTS GET WRONG

New strands grow 3' to 5', or the template is read 5' to 3'. New strands grow 5' to 3', and templates are read 3' to 5'.

The lagging strand is copied after the leading strand. Both are made at the same time, the lagging one in pieces.

Only the lagging strand needs a primer. Both do: the leading strand once.

STRETCH AND SUPPORT

Support: cut [chapter 8's](#) captions up for students to put in order, and give a fork outline with the enzymes' places marked for the higher level drawing.

Stretch: in *E. coli* two forks leave one starting point and meet halfway round the circle. Sketch both forks and mark the leading and lagging strands at each.

IN THE GUIDE

7 [Only ever at the 3' end](#)

8 [One strand smooth, one in pieces](#)

A11 [The whole guide, with the figures that play](#)

PPTX [This lesson's slides, in the order of this plan](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on D1.1 at higher 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=HL&paper=quiz&marks=15&src=ep



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](#)

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.