

Copying a gene

60 minutes • D1.2.1 to D1.2.4 • Chapters 1, 2

Transcription by RNA polymerase, complementary pairing, a template that never changes and genes switched on or off

BY THE END, STUDENTS CAN

- ☐ Explain how RNA polymerase uses one strand of a gene as a template, pairing U in the RNA with A on the template
D1.2.1, D1.2.2
- ☐ Explain why a template can be read for a lifetime without changing, and why transcription is where a gene is switched on or off
D1.2.3, D1.2.4

TIMING

0-6	6 min	Do now: The kitchen	
6-18	12 min	Transcription step by step	
18-28	10 min	One gene, read again	
28-40	12 min	Stepping stones	
40-52	12 min	Improve this answer	
52-60	8 min	Exit	
60 min		One lesson	

STARTER

- 6 min** **Do now: The kitchen**
- Students match eight kitchen cards to eight cell cards (activity 1 below), then spend one minute on where the comparison breaks.

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 Copying a gene into RNA

CHAPTER 01 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.

1. A gene: two strands of DNA, held by **hydrogen bonds**.
2. **RNA polymerase** parts the strands.
3. RNA nucleotides pair with the **template strand**: U opposite A.
4. The enzyme joins them into a strand and moves on; the DNA closes behind it.
5. The RNA has the **coding strand's** sequence, with U in place of T.

Predict box: A gene's template strand reads T A C C T G. Which RNA does RNA polymerase make from it? Hands up or mini whiteboards first.

Answer B: A U G G A C

Remember it: Apples Under Cars Garage (A on the template, U in the RNA, C on the template, G on the template).

02 Read for a lifetime, read when needed

CHAPTER 02 IN THE SLIDES

Switch the figure through Pancreatic beta cell, Developing red blood cell and Skin cell, and have the class say what will change before each.

Play the animation, One gene, copied. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. RNA polymerase unzips a short stretch of the gene: the hydrogen bonds holding its bases together give way.
2. Free RNA nucleotides pair with the template by complementary base pairing, U opposite A.
3. Behind the enzyme the RNA peels off and the DNA closes up again.
4. The RNA has the coding strand's sequence, with U in place of T. The template has not changed.

Predict box: A nerve cell in your brain is 60 years old and has never divided. Its genes have been transcribed all that time. What has happened to their base sequences? Hands up or mini whiteboards first.

Answer C: Read many times, and still the same

THE LESSON

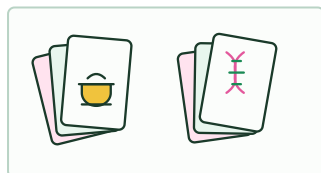
12 min **Transcription step by step**
Chapter 1's figure on the board, step by step, with students drawing each step on mini whiteboards. Then chapter 1's predict box by vote, and Apples Under umbrellas.

10 min **One gene, read again**
The transcription film, One gene, copied, after chapter 2. Then chapter 2's switch figure: why does the beta cell copy the insulin gene and the skin cell not? Finish with chapter 2's predict box, the 60-year-old nerve cell.

12 min **Stepping stones**
Six prompts build an explanation of transcription (activity below). Pairs say it aloud, then swap roles.

12 min **Improve this answer**
A weak answer to "Outline how mRNA is made from a gene (5 marks)", marked and rewritten (activity below).

ACTIVITIES

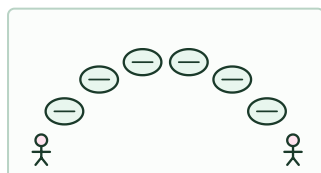


CARD MATCH

The kitchen

Eight kitchen cards (the recipe book, one recipe, the photocopier, the photocopy, the cook, the kitchen hands, the ingredients, the dish) to match with eight cell cards (the genome, a gene, RNA polymerase, mRNA, the ribosome, tRNAs, amino acids, the polypeptide). Then ask: where does it break? Push for these. A photocopy is identical, but mRNA pairs with the template and so matches the coding strand. A cook reads the whole recipe, but a ribosome reads three letters at a time. Recipes are not switched on and off.

Needs: two sets of cards for each pair, printed.

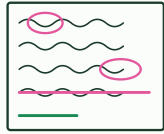


TALK

Stepping stones

Six stones on the floor or the board, each a prompt that starts a sentence: "RNA polymerase binds...", "It separates...", "Free RNA nucleotides...", "U pairs with...", "The enzyme joins...", "Behind it...". A student crosses the stones saying each sentence in full while a partner checks against chapter 1's captions, then they swap. Then do it again with the first words only.

Needs: six cards or six chalk circles.



WRITING

Improve this answer

This weak answer goes on the board: "Transcription makes RNA. The enzyme unzips the DNA and bases pair up, A with T and C with G. The RNA is a copy of the DNA. It then leaves." Students underline what earns credit and mark what is vague or wrong (A pairs with U in RNA; which strand; the enzyme's name; a copy of which strand; where), then write a 5-mark version. No markscheme is shown: the class builds the points from [chapter 1](#).

Needs: the answer on the board or printed.

PLENARY

8

min

Exit

"Why can the same gene be read for 80 years without changing?" and "Where is a gene switched on or off?" One sentence each.

WHAT STUDENTS GET WRONG

Helicase unwinds DNA for transcription. RNA polymerase does it in transcription; helicase is replication's.

The mRNA is a copy of the template strand. It is complementary to the template and matches the coding strand, with U for T.

A pairs with T in transcription. A on the template pairs with U in the RNA.

Transcription uses up the gene. The template is read, not changed, and can be read again.

Different cells have different genes. Same genes, different ones transcribed.

STRETCH AND SUPPORT

Support: cut the figures' captions into cards to put in order, use the dotted key terms as a glossary, and give a codon table with the reading path printed on it (row, column, line).

Support: use the mnemonics (Apples Under umbrellas; Same, Swapped, Stopped) as starters.

IN THE GUIDE

- 1 [Copying a gene into RNA](#)
- 2 [Read for a lifetime, read when needed](#)
- A11 [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 D1.2, built from its key terms and ready to print
- A [pub quiz](#) with rounds on D1.2, to present or run with no projector
- An [escape room](#) built from the [question bank](#) on D1.2

ALREADY ON THE SITE FOR D1.2

- Quiz: [Protein Synthesis \(HL\)](#)
- Quiz: [Protein Synthesis](#)
- Revision map: [D1.2 Protein synthesis](#), to fill in
- Exam questions: [D1.2 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.

- [D1.2 Protein Synthesis \(SL\)](#)
- [D1.2 Protein Synthesis \(HL\)](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on D1.2 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=D1.2&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.