

Direction, promoters and non-coding DNA HL

60 minutes • D1.2.12 to D1.2.14 • Chapters 8, 9

The direction of transcription and translation, transcription factors at the promoter, and DNA that codes for no polypeptide

BY THE END, STUDENTS CAN

- ☐ Explain what 5' to 3' means for transcription and for translation D1.2.12
- ☐ Explain how transcription factors start transcription at a promoter, and name four kinds of DNA that code for no polypeptide D1.2.13, D1.2.14

TIMING

0-6	6 min	Do now	
6-16	10 min	Which way it runs	
16-34	18 min	Gene expression simulation	
34-42	8 min	Switch the gene on	
42-54	12 min	What is in a genome?	
54-60	6 min	Exit	
	60 min	One lesson	

STARTER

- 6 min** **Do now**
 Chapter 8's predict box (3'-TACAAGCGT-5') on mini whiteboards.

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.

08 Five prime to three prime, both times

CHAPTER 08 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. The polymerase reads the **template 3' to 5'**.
2. Each new nucleotide joins the RNA's **3' end**.
3. Nothing can join at the 5' end.
4. The ribosome reads the mRNA **5' to 3'** too.

Predict box: A template strand reads 3'-TACAAGCGT-5'. Written 5' to 3', what is the mRNA? Hands up or mini whiteboards first.

Answer B: 5'-AUGUUCGCA-3'

09 Where a gene starts, and DNA that codes for nothing

CHAPTER 09 IN THE SLIDES

Switch the figure through Absent and Present, and have the class say what will change before each.

Tap the parts of the figure in turn: Telomere, tRNA gene, Regulatory sequence, Promoter, Exon, Intron, Exon, Intron, Exon, rRNA gene and Telomere.

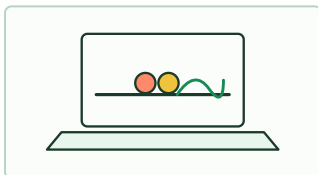
Predict box: A gene for a tRNA is transcribed in every cell, but its RNA is never translated. Is it coding or non-coding DNA? Hands up or mini whiteboards first.

Answer A: Non-coding: its RNA is the product

THE LESSON

- 10**
min **Which way it runs**
Chapter 8's figure. Students add 5' and 3' labels and two arrows to their lesson 1 drawing.
- 18**
min **Gene expression simulation**
Pairs work through the simulation and its questions (activity below).
- 8**
min **Switch the gene on**
Chapter 9's switch figure, then chapter 9's predict box (the tRNA gene).
- 12**
min **What is in a genome?**
Pairs estimate and shade a 100-square grid, then check it against chapter 9's chromosome figure (activity below).

ACTIVITIES

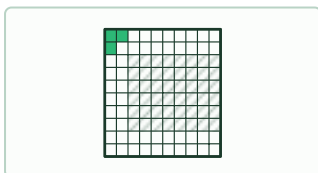


SIMULATION · HL

Gene expression simulation

The free [Gene Expression Essentials](#) simulation from PhET, with these questions. What must be on the regulatory region before RNA polymerase will transcribe the gene? What does a positive transcription factor do, and what does a negative one do? Why would a cell destroy its mRNA? Which slider on the mRNA screen changes the rate most? What does "affinity" mean here? Land on this: the regulatory region in the simulation stands for the promoter, and the factors decide whether a gene is read.

Needs: laptops or tablets (it runs in a browser).



DATA · HL

What is in a genome?

Pairs estimate, then shade, a 100-square grid for the human genome: protein-coding exons, introns, regulators, rRNA and tRNA genes, telomeres, and other. Then compare with the real figures: about 1 to 2% codes for protein ([chapter 9](#)), and introns make up roughly a quarter or more of the genome. The point is the size of the coding share, not exact numbers for the rest.

Needs: printed grids and coloured pencils.

PLENARY

- 6**
min **Exit**
"Name four kinds of non-coding DNA and say what each does."

WHAT STUDENTS GET WRONG

The ribosome reads 3' to 5'. 5' to 3'; it is the template that is read 3' to 5' in transcription.

The promoter is the TATA box, and it is transcribed. The promoter is a region, not transcribed; a TATA box is one sequence found in many.

Non-coding DNA is junk, or is never transcribed. It has jobs; introns and rRNA and tRNA genes are transcribed.

STRETCH AND SUPPORT

Support: play the factory's "Let the cell do it" on the board before pairs try a round.

IN THE GUIDE

- 8** [Five prime to three prime, both times](#)
- 9** [Where a gene starts, and DNA that codes for nothing](#)
- 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 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=D1.2&level=HL&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.