

Finishing, recycling, and the whole factory HL

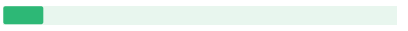
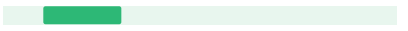
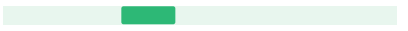
60 minutes • D1.2.18, D1.2.19 • Chapter 12

Pre-proinsulin to insulin, proteasomes and a working proteome, then the whole process in the protein factory

BY THE END, STUDENTS CAN

- ☐ Explain how pre-proinsulin becomes insulin, and why proteasomes keep breaking proteins down D1.2.18, D1.2.19

TIMING

0-6	6 min	Do now	
6-18	12 min	Pre-proinsulin to insulin	
18-26	8 min	Proteasomes	
26-42	16 min	The protein factory	
42-54	12 min	An extended question	
54-60	6 min	Exit	
	60 min	One lesson	

STARTER

6
min

Do now

"Is a polypeptide a protein?" A vote, then one reason each side.

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.

12 Finished, then recycled

CHAPTER 12 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. Pre-proinsulin: a **signal peptide** sends it into the rough ER.
2. Stage 1: the signal peptide is cut off, leaving **proinsulin**.
3. Proinsulin folds and **disulfide bonds** form.
4. Stage 2: the **C-peptide** is cut out.
5. **Insulin**: two chains held by disulfide bonds.

Step through the figure (3 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A tagged protein reaches a **proteasome**.
2. Its peptide bonds are **hydrolysed**.
3. The amino acids are used again to build new proteins.

Predict box: Insulin's two chains are 21 and 30 amino acids long, and pre-proinsulin is 110. How many amino acids are cut away in all? Hands up or mini whiteboards first.

Answer B: 59

THE LESSON

12 min	Pre-proinsulin to insulin <u>Chapter 12</u> 's step-through of the two stages, with its first predict box (59 amino acids).
8 min	Proteasomes <u>Chapter 12</u> 's proteasome figure and its second predict box (is it wasteful?), then the proteome in one sentence.
16 min	The protein factory In pairs, the higher level orders: rounds 6 to 10.
12 min	An extended question A timed extended question on D1.2 from the exam maker (higher level), peer-marked against its markscheme.

ACTIVITIES

GAME

The protein factory

One device per pair. The standard level rounds are for lesson 3 and the higher level rounds for lesson 6; its record downloads as a CSV for a class comparison.

Needs: one device per pair.

PLENARY

6 min	Exit One sentence answering each guiding question.
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WHAT STUDENTS GET WRONG

Proteasomes only remove faulty proteins. They also clear proteins no longer needed, and the amino acids are reused.

Insulin is made as two separate chains. One chain, cut twice.

STRETCH AND SUPPORT

Stretch: why might cells make insulin as a longer chain and cut it, rather than as two chains? (One gene, and one folding step that lines the disulfide bonds up correctly.)

Stretch: the ribosome and the proteasome in the Molecule of the Month pages of PDB-101 (RCSB), to see the real shapes.

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

IN THE GUIDE

- 12** [Finished, then recycled](#)
- 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 \(HL\)](#)

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.

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

