NAME _____ CLASS _____ DATE _____

IB BIOLOGY · B2.2

Organelles and compartmentalization

Notes to fill in alongside the guide. Each numbered block matches a chapter of the guide, and of the lesson slides. Write in the gaps, answer the cues, annotate the figures, and sum up each section in your own words.

BY THE END YOU CAN

- [ ] Say which parts of a cell are organelles and which are not, and how cell fractionation let biologists study them one at a time B2.2.1
- [ ] Explain the advantage of separating transcription in the nucleus from translation in the cytoplasm B2.2.2
- [ ] Explain how compartments concentrate enzymes and substrates and keep incompatible processes apart, with lysosomes and phagocytic vacuoles B2.2.3
- [ ] Explain how the mitochondrion is adapted for making ATP by aerobic respiration B2.2.4
- [ ] Explain how the chloroplast is adapted for photosynthesis B2.2.5
- [ ] Explain the benefits of the double nuclear membrane, its pores, and its breaking into vesicles when a cell divides B2.2.6
- [ ] Contrast proteins made by free ribosomes with those made on the rough ER B2.2.7
- [ ] Describe how the Golgi apparatus processes proteins and sends them for secretion B2.2.8
- [ ] Describe how vesicles form and move, and the role of clathrin B2.2.9

01 Rooms with jobs

B2.2.1

CUES

Predict: Why is the buffer used in fractionation kept ice cold and at the same concentration as the cytoplasm?

What is meant by organelle?

What is meant by cell fractionation?

NOTES

1 An _____ is a discrete part of a cell with its own job and a structure that suits it.

2 The _____ is everything inside the membrane, organelles and all, so it is not one unit.

3 The _____ is a network of fibres running through the whole cell, not a separate part.

4 The _____ lies outside the plasma membrane, made and laid down by the cell but not a working part inside it.

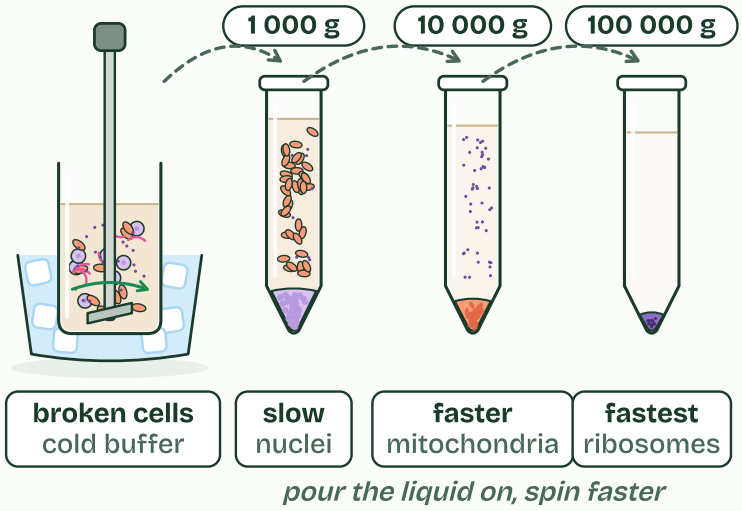
5 That came with the _____ and _____: cells are broken in a cold buffer of the same concentration as the cell, then spun faster and faster.

6 The biggest, densest parts settle first as a _____; the liquid is poured into a new tube and spun harder.

Your own notes

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each: 1 cold, isotonic buffer; 2 nuclei; 3 mitochondria; 4 ribosomes.



SPOT THE MISTAKE

What do students often get wrong about organelles as discrete subunits of cells that are adapted to perform specific functions? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 01 in two or three sentences of your own.

02 Genes behind a wall

B2.2.2

CUES

Predict: What could go wrong if ribosomes reached a eukaryote's mRNA before it left the nucleus?

What is meant by introns?

NOTES

1 To make a protein, a gene is first copied into mRNA, _____, and the mRNA is then read by ribosomes, _____.

2 Before the mRNA leaves, it can be modified: stretches that do not code, _____, are cut out, and the ends are protected.

3 Prokaryotes: _____.

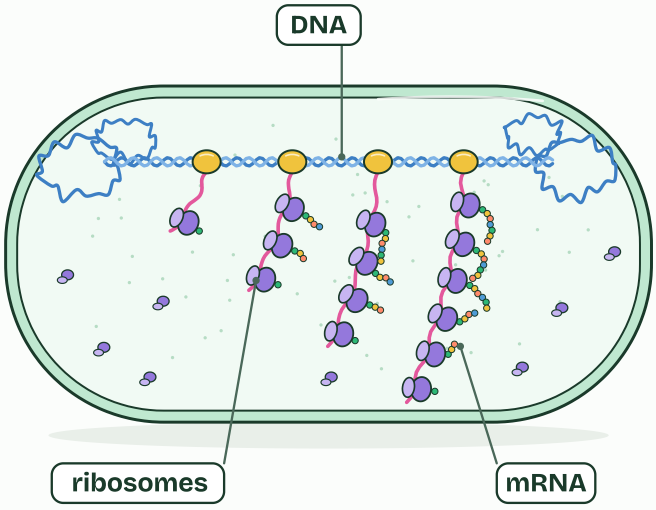
4 Eukaryotes: _____.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Prokaryote and Eukaryote. Note what changes each time.

Translation starts while transcription goes on



SPOT THE MISTAKE

What do students often get wrong about advantage of the separation of the nucleus and cytoplasm into separate compartments? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 02 in two or three sentences of your own.

03 Keep it apart, keep it close

B2.2.3

CUES

Predict: A lysosome leaks a little of its contents into the cytoplasm. Why does this do the cell little harm?

What is meant by lysosomes?

What is meant by phagocytic vacuole?

NOTES

1 Membranes divide the cytoplasm of a eukaryote into compartments, and that helps in two ways. _____ Enzymes and the substances they act on are packed into a small space, so they meet more often and reactions run faster. _____ Processes that would harm each other are kept apart, and each compartment can hold the conditions its enzymes need, such as a different pH.

2 _____ show both.

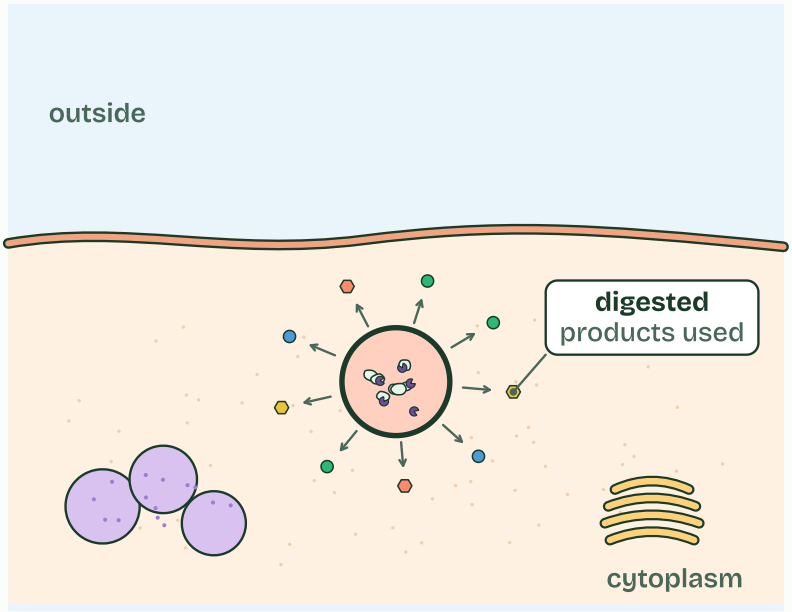
3 When a white blood cell takes in a bacterium, it wraps it in a _____.

4 _____ digest the contents of phagocytic vacuoles, sealed off from the cytoplasm.

Your own notes

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each: 1 bacterium; 2 phagocytic vacuole; 3 Lysosomes fuse; 4 digested.



SPOT THE MISTAKE

What do students often get wrong about advantages of compartmentalization in the cytoplasm of cells? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 03 in two or three sentences of your own.

04 The ATP factory

B2.2.4 HL

CUES

Predict: Heart muscle cells have mitochondria with many more cristae than those of skin cells. Why?

What is meant by mitochondria?

What is meant by intermembrane space?

What is meant by cristae?

What is meant by matrix?

NOTES

1 Most of a cell's ATP is made in its _____, and their structure fits the job.

2 A _____ encloses them.

3 Between the two membranes is a very small _____: protons are pumped into it, and because it is so small their concentration rises quickly, giving the steep gradient that drives ATP synthase.

4 The inner membrane is folded into _____.

5 Inside is the _____, a compartment that keeps the enzymes and substrates of the Krebs cycle together, so they meet often.

6 Double membrane; a small _____ for a steep proton gradient.

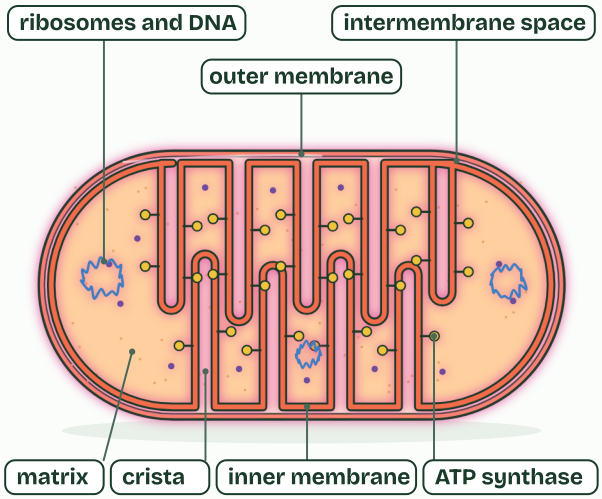
7 _____: a large surface for electron transport and ATP synthase.

8 _____: Krebs cycle enzymes and substrates kept together.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: outer membrane, matrix, inner membrane, ribosomes.



SPOT THE MISTAKE

What do students often get wrong about adaptations of the mitochondrion for production of ATP by aerobic cell respiration? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 04 in two or three sentences of your own.

05 A stack of solar panels

B2.2.5 HL

CUES

Predict: Chloroplasts of plants grown in dim shade have more thylakoids in each granum than those grown in full sun. Why might this help?

What is meant by chloroplast?

What is meant by thylakoids?

What is meant by grana?

What is meant by stroma?

NOTES

1 A _____ also has a double membrane, and inside it a system of flattened sacs, the _____, often in stacks called _____.

2 The thylakoid membranes hold the _____ that absorb light, so a large area of membrane means more light caught.

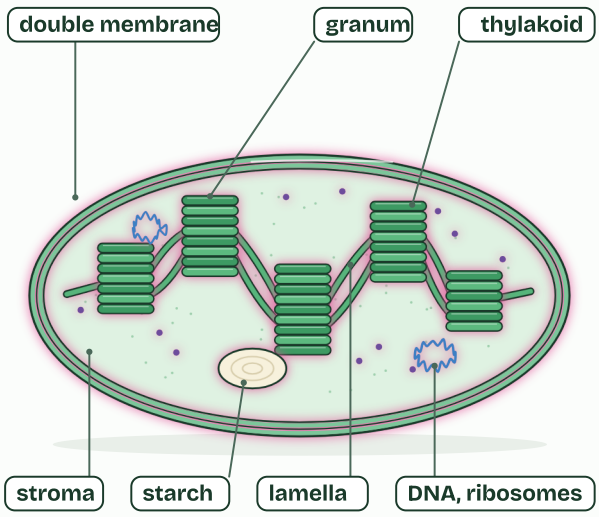
3 Around the thylakoids is the _____, a compartment holding the enzymes and substrates of the _____, with Rubisco the most plentiful.

4 _____: Calvin cycle enzymes and substrates kept together.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: stroma, double membrane, lamellae, thylakoids, starch grain, ribosomes.



SPOT THE MISTAKE

What do students often get wrong about adaptations of the chloroplast for photosynthesis? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 05 in two or three sentences of your own.

06 Two membranes, many doors

B2.2.6 HL

CUES

Predict: Why does the nuclear envelope break down when a cell divides?

What is meant by nuclear envelope?

What is meant by nuclear pores?

NOTES

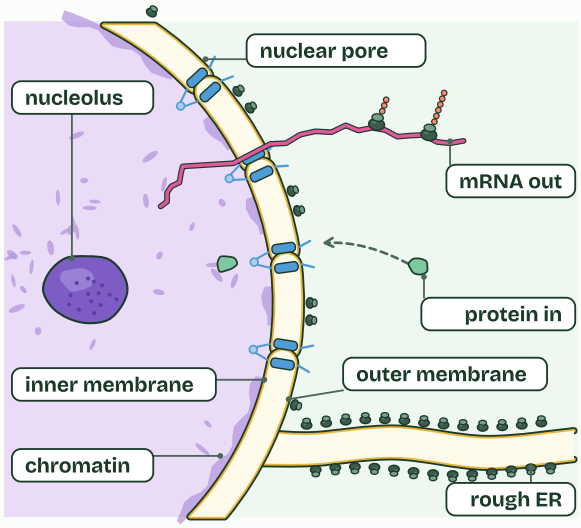
1 The nucleus is wrapped in a _____ of two membranes.

2 So the envelope is crossed by thousands of _____, protein channels that control what passes.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Between divisions and Dividing. Note what changes each time.



A double membrane, crossed by pores.
mRNA leaves through the pores, and proteins the nucleus needs, such as DNA polymerase, come in.

SPOT THE MISTAKE

What do students often get wrong about functional benefits of the double membrane of the nucleus? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 06 in two or three sentences of your own.

07 Made here, sent there

B2.2.7 HL

CUES

Predict: A cell from the pancreas makes large amounts of a digestive enzyme for export. Which would you expect in its cytoplasm?

What is meant by rough endoplasmic reticulum?

NOTES

1 All of them start translating in the cytoplasm, but where they finish depends on the protein. _____ stay in the cytosol and release their proteins there: proteins for use inside the cell, such as the enzymes of glycolysis.

2 If the first part of a new protein is a signal sequence, the ribosome is taken to the _____ and binds to its membrane.

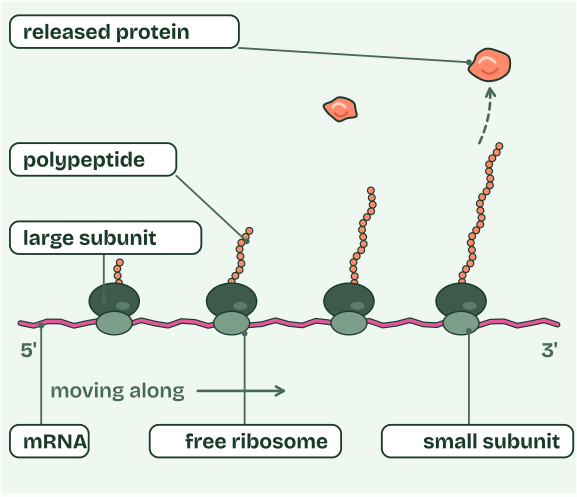
3 Free ribosomes: _____.

4 Bound ribosomes on rough ER: _____.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Free and On the rough ER. Note what changes each time.



Free ribosomes: proteins for the cytosol.
Each releases its protein into the cytosol, for use in the cell, such as enzymes of glycolysis.

SPOT THE MISTAKE

What do students often get wrong about structure and function of free ribosomes and of the rough endoplasmic reticulum? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 07 in two or three sentences of your own.

08 Finish, label, ship

B2.2.8 HL

CUES

Predict: A drug stops vesicles leaving the rough ER. Where would a protein meant for secretion build up?

What is meant by golgi apparatus?

What is meant by cisternae?

What is meant by exocytosis?

NOTES

1 The _____ is a stack of flattened, curved membrane sacs, the _____, with no ribosomes.

2 A _____ carries its protein to the plasma membrane and fuses with it, releasing the protein outside: _____.

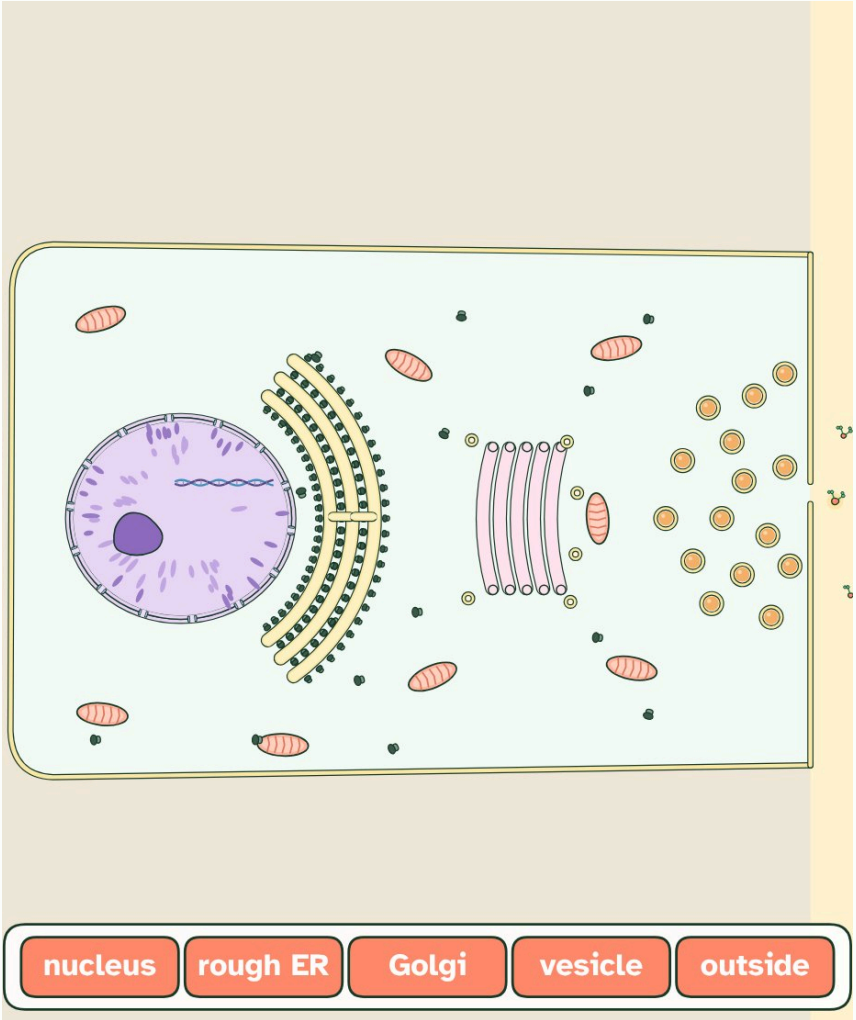
3 Golgi: stacked _____, no ribosomes.

4 Secretory vesicles release proteins by _____.

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (From gene to outside): what is happening, and why?



SPOT THE MISTAKE

What do students often get wrong about structure and function of the Golgi apparatus? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 08 in two or three sentences of your own.

09 Bubbles that carry

B2.2.9 HL

CUES

Predict: A cell cannot make clathrin. What would it have trouble doing?

What is meant by vesicle?

What is meant by clathrin?

NOTES

1 A _____ is a small sac of membrane that carries substances inside the cell.

2 Many vesicles are shaped by a protein called _____.

3 In _____, cargo molecules outside the cell bind receptors in the membrane.

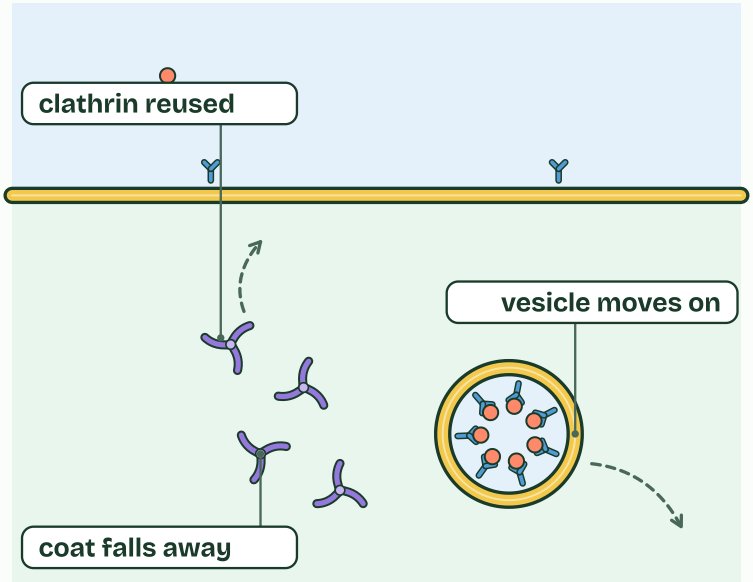
4 _____ forms a coat that bends the membrane into a pit.

5 The pit pinches off as a coated _____; the coat is recycled.

Your own notes

ANNOTATE THE FIGURE

Number the 5 steps on the figure and note what happens at each: 1 Cargo, receptors; 2 Clathrin; 3 coated pit; 4 coated vesicle; 5 coat falls away.



SPOT THE MISTAKE

What do students often get wrong about structure and function of vesicles in cells? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 09 in two or three sentences of your own.

Check yourself

The check for this guide is online: a fresh paper of past-paper style questions from the exam bank on B2.2 each time, marked as you go, and saved to your Exam practice progress when you are signed in. Scan the code, or type the link.

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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.