NAME _____ CLASS _____ DATE _____

AP BIOLOGY · 2.1, 2.2

Cell structure and size

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

- [ ] Name the four structures every cell has and compare prokaryotic and eukaryotic cells 2.1.A
- [ ] Describe ribosomes and explain why their presence in all life is evidence of common ancestry 2.1.A
- [ ] Describe the structure and function of the nucleus, rough and smooth ER, Golgi complex, lysosomes and vacuoles 2.1.A
- [ ] Explain how the folded inner membrane of a mitochondrion and the thylakoids of a chloroplast let a cell capture and use energy 2.1.A
- [ ] Compare plant and animal cells and identify cells and organelles in electron micrographs 2.1.A
- [ ] Calculate surface area-to-volume ratios and explain how they limit cell size and shape the exchange surfaces of cells and organisms 2.2.A

01 Every cell, the same four parts 2.1.A

CUES

Predict: A new single-celled organism is found in a hot spring. Which of these must it have?

What is meant by prokaryotes?

What is meant by eukaryotes?

NOTES

1 Living things come in two kinds of cell. _____, the bacteria and archaea, are small and simple inside. _____, the cells of animals, plants, fungi and protists, are usually ten times wider and divided into compartments.

2 A _____ wraps it and controls what crosses. _____, mostly water, fills it. _____ carries its instructions.

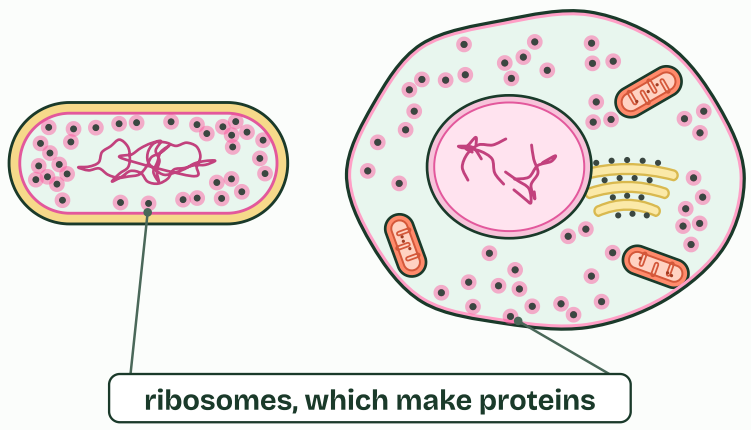
3 And _____ read those instructions to make proteins.

4 _____: bacteria and archaea. Eukaryotes: animals, plants, fungi, protists.

Your own notes

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each: 1 plasma membrane; 2 cytoplasm; 3 DNA; 4 ribosomes.



SPOT THE MISTAKE

A student writes: "Prokaryotes have no DNA because they have no nucleus." Spot 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 A cell with no rooms

2.1.A

CUES

Predict: A drug blocks the ribosomes of bacteria but not ours. Why could it still stop a bacterium growing, though bacteria have no organelles for it to target?

What is meant by nucleoid?

What is meant by plasmids?

NOTES

1 Its DNA, a single loop, lies in a region of the cytoplasm called the _____, with no membrane round it.

2 Outside the membrane most prokaryotes have a _____, which in bacteria is made of peptidoglycan.

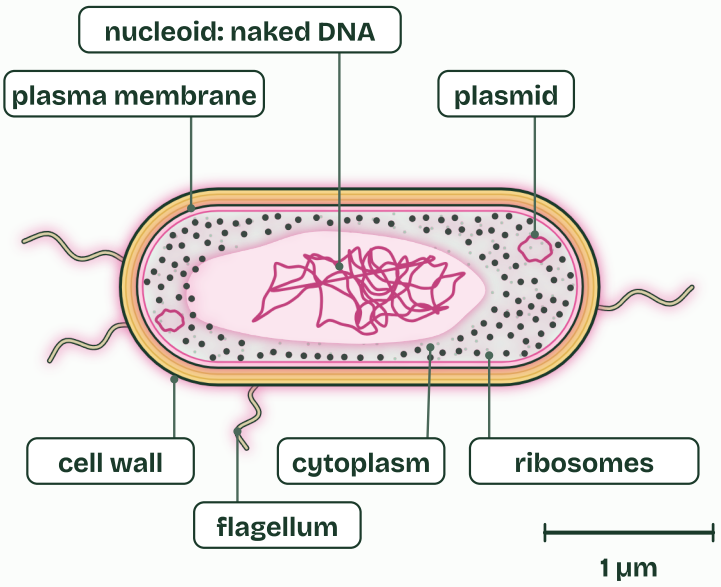
3 Many also have small extra loops of DNA, _____, and some have a flagellum to swim.

4 DNA: one loop in the _____, no nuclear membrane.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: flagellum, cell wall, plasma membrane, cytoplasm, nucleoid, plasmid, ribosomes.



SPOT THE MISTAKE

What do students often get wrong about cell structure and function? 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 The one structure in every cell

2.1.A

CUES

Predict: A cell secretes large amounts of a digestive enzyme. Where would you expect most of its ribosomes to be?

What is meant by ribosome?

NOTES

1 A _____ is made of _____ and protein, in two subunits that clamp round a strand of messenger RNA.

2 In a eukaryote, ribosomes work in two places. _____ in the cytoplasm make proteins that stay in the cytoplasm. _____ on the rough ER make proteins that go into the ER: for the membrane, for lysosomes, or for export.

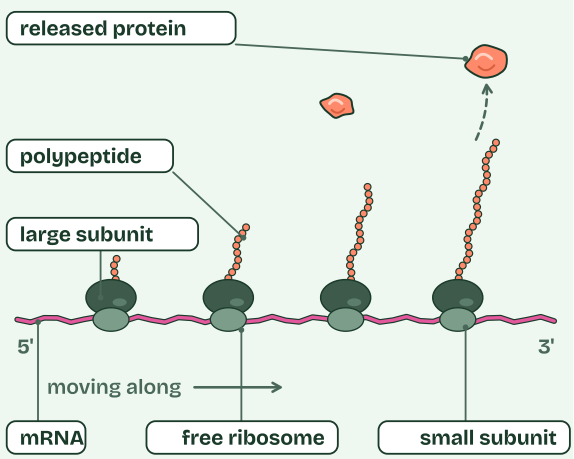
3 Ribosomes: _____.

4 Found in all life: _____.

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

A student writes: “Ribosomes are made in the ER.” Spot 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 A eukaryotic cell, room by room

2.1.A

CUES

Predict: Liver cells break down drugs and alcohol. Which organelle would you expect a liver cell to have a lot of?

What is meant by organelles?

What is meant by endoplasmic reticulum?

What is meant by golgi complex?

What is meant by lysosomes?

What is meant by vacuoles?

NOTES

1 A eukaryotic cell is divided by membranes into _____, each with its own job.

2 The _____ holds the DNA behind a double membrane with pores.

3 The _____ runs through the cytoplasm: _____, studded with ribosomes, makes proteins and sends them on; _____ has no ribosomes and makes lipids and breaks down toxins.

4 The _____ is a stack of flattened sacs.

5 It folds and modifies proteins from the ER, adding sugar chains for example, and sorts them into _____ for the membrane, for lysosomes or for export. _____ are sacs of hydrolytic enzymes that break down worn-out parts and whatever the cell takes in. _____ store water, food or waste.

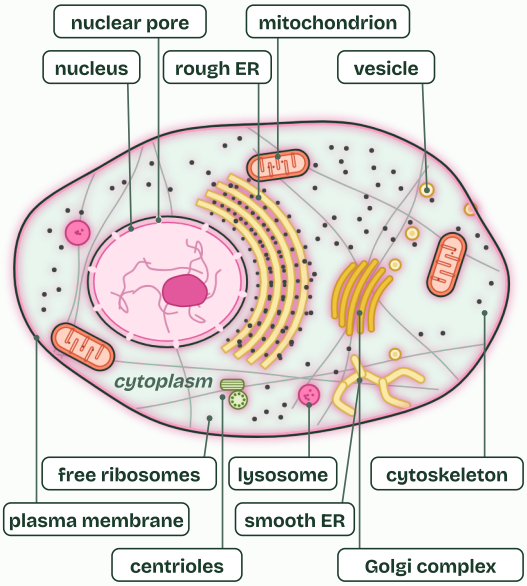
6 The ER, Golgi, vesicles, lysosomes and the outer membrane of the nucleus pass membrane and cargo between them: together they are the _____, which Unit 2's last guide follows in more detail.

7 Golgi: modifies, sorts and packages proteins. _____: hydrolytic enzymes.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: cytoskeleton, nucleus, rough endoplasmic reticulum, golgi complex, smooth endoplasmic reticulum, mitochondrion, lysosome, vesicle, centrioles, free ribosomes, plasma membrane.



SPOT THE MISTAKE

What do students often get wrong about cell structure and function? 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 folded membrane for energy

2.1.A

CUES

Predict: Two cells have the same number of mitochondria. In one the inner membranes are much more folded. What follows?

What is meant by mitochondrion?

What is meant by cristae?

What is meant by matrix?

NOTES

1 A _____ has a _____.

2 The inner one is folded into _____, and the fluid inside it is the _____.

3 The _____ runs in the matrix, where its enzymes and substrates are kept close together.

4 The _____ sit in the inner membrane.

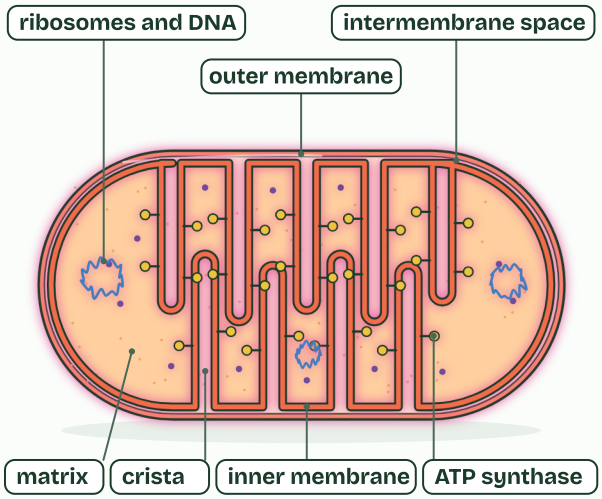
5 Double membrane: smooth outer, folded inner (_____).

6 _____: the Krebs cycle.

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 cell structure and function? 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 Stacks of membrane that catch light

2.1.A

CUES

Predict: A chloroplast is broken open and its thylakoids separated from the stroma. Which part can still absorb light and pass on electrons?

What is meant by chloroplasts?

What is meant by thylakoids?

What is meant by grana?

What is meant by stroma?

NOTES

1 _____ are found in plants and photosynthetic algae.

2 Like mitochondria they have a _____.

3 Inside are flattened sacs of membrane, _____, stacked like coins into _____, in a fluid called the _____.

4 The thylakoid membranes hold the chlorophyll and the electron transport proteins of the photosystems, so the _____ happen in the grana.

5 The _____, which fixes carbon dioxide into sugar, runs in the stroma.

6 Double membrane round the _____.

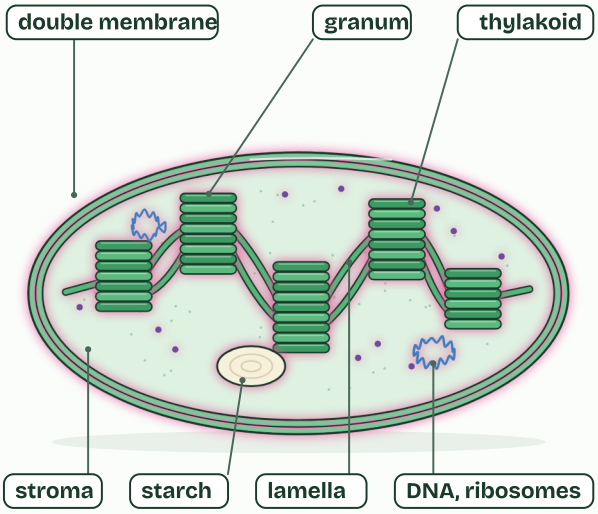
7 _____ stacked in grana: chlorophyll and the light-dependent reactions.

8 _____: the Calvin cycle.

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

A student writes: "Plant cells have chloroplasts instead of mitochondria." Spot 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 Plant cell, animal cell

2.1.A

CUES

Predict: A cell from an onion bulb has a wall and a large vacuole but no chloroplasts. What is it?

What is meant by central vacuole?

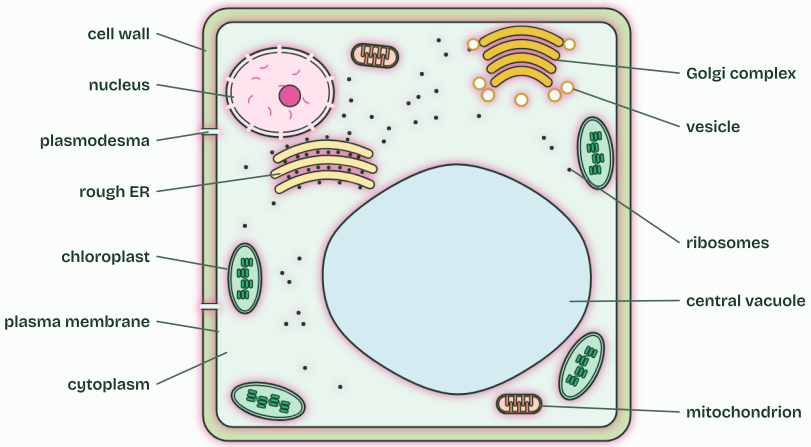
NOTES

1. A _____ of cellulose outside the membrane holds its shape.
2. A large _____, often most of the cell's volume, holds water and pushes the cytoplasm against the wall.
3. And _____ carry out photosynthesis, in the cells that photosynthesize.
4. Animal cells have no wall, so their shape is held by the cytoskeleton, and they often have many small vacuoles rather than one. _____ are common in animal cells; plants do much of the same breaking down in the central vacuole.
5. Animal cells also have _____, which plant cells lack.
6. Plant cells only: cell wall, large _____, chloroplasts.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: cell wall, plasma membrane, plasmodesmata, central vacuole, ribosomes, nucleus, rough endoplasmic reticulum, golgi complex, vesicle, vesicle, chloroplast, chloroplast, chloroplast, chloroplast, mitochondrion, mitochondrion.



SPOT THE MISTAKE

What do students often get wrong about cell structure and function? 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 Name it from a micrograph

2.1.A

CUES

Predict: A micrograph of a gut cell shows rows of tiny fingers on one surface, many mitochondria and much rough ER. What is the cell specialized to do?

NOTES

1 Nucleus: _____.

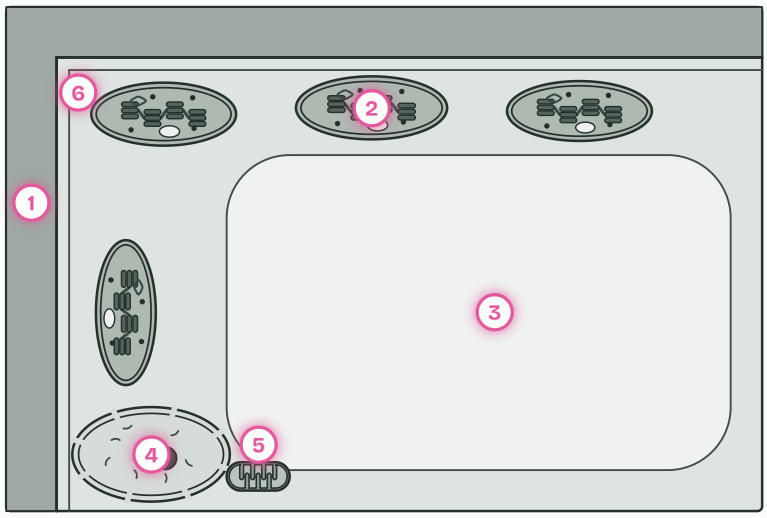
2 Rough ER: _____.

3 Wall and no nucleus: _____.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: 1 Cell wall, 2 Chloroplast, 3 Sap vacuole, 4 Nucleus, 5 Mitochondrion, 6 Plasma membrane.



SPOT THE MISTAKE

What do students often get wrong about cell structure and function? 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 Why cells stay small

2.2.A

CUES

Predict: Cube A has sides of 1 cm; cube B has sides of 3 cm. How do their surface area-to-volume ratios compare?

What is meant by surface area-to-volume ratio?

NOTES

1 Everything a cell takes in or gets rid of crosses its plasma membrane, so its rate of exchange depends on its _____.

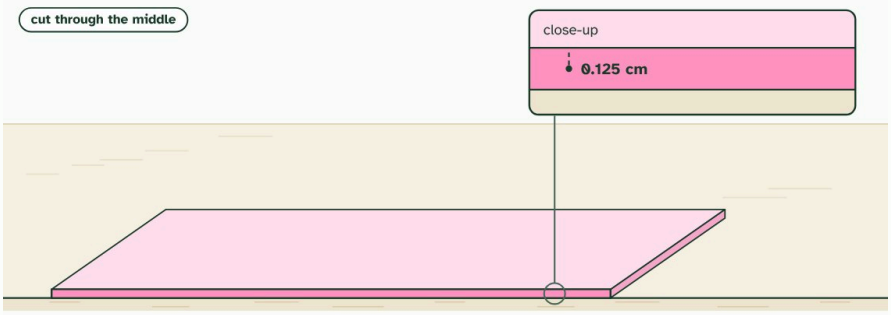
2 Its need for exchange depends on how much cytoplasm is using things up: its _____.

3 A cube of side 1 cm has a surface area of $6 \times 1^2 = 6$ cm^2 and a volume of $1^3 = 1$ cm^3: a _____ of 6.

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (Bigger cells, slower supply): what is happening, and why?



shape	4 cm cube	sheet
surface area (cm^2)	96	528
volume (cm^3)	64	64
surface area : volume	1.5 : 1	8.25 : 1
center to nearest face (cm)	2	0.125
middle after soaking	pale	dyed

SPOT THE MISTAKE

What do students often get wrong about cell size? 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.

10 Flatten it, fold it, fringe it

2.2.A

CUES

Predict: Which change would most increase the rate at which a cell absorbs glucose from the gut?

NOTES

1. They raise their surface area instead. _____ a red blood cell is a disc thinner in the middle than at the rim, so no hemoglobin is far from the surface. _____ cells lining the small intestine and kidney tubules carry thousands of tiny fingers of membrane, which multiply the area for absorption. _____ the membrane at the base of a kidney cell folds inward, like the inner membrane of a mitochondrion.

2. A _____ grows a long thin extension into the soil, adding surface for taking in water and minerals.

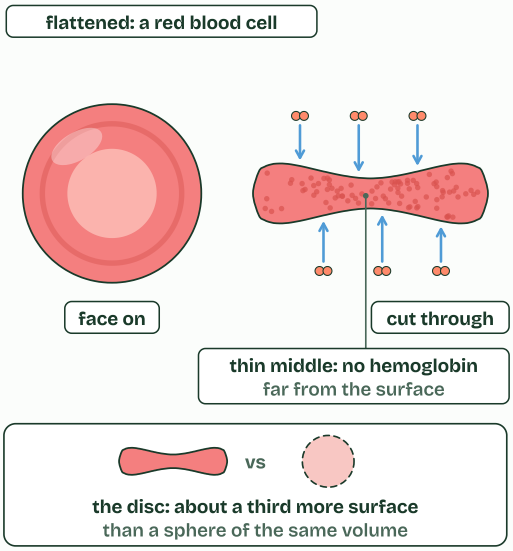
3. Leaves are thin and flat, so gases reach every cell, and _____ open and close the pores that let them in.

4. Flattening: _____.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Flattened and Microvilli and folds. Note what changes each time.



SPOT THE MISTAKE

What do students often get wrong about cell size? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 10 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 2.1, 2.2 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.

biologybybradford.com/exam-maker/sit?program=ap&units=U2&ced=2.1,2.2&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.