

Edexcel (B) Biology A-level

2.1 - Eukaryotic and prokaryotic cell structure and function

Flashcards

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State the principle of cell theory.



State the principle of cell theory.

Cells are fundamental structural units in all living organisms. They determine the function and organisation of biological systems.



State the relationship between a system and specialised cells.



State the relationship between a system and specialised cells.

Specialised cells → tissues that perform specific function → organs made of several tissue types → organ systems



What is the nucleoid?



What is the nucleoid?

Irregularly-shaped region of cytoplasm where loop of bacterial DNA is located.



What is a plasmid?



What is a plasmid?

1 or more rings of DNA found in some bacterial cells.

Contains non-essential genes.

Can be exchanged between bacterial cells via conjugation.



Describe the structure of a bacterial cell wall and slime capsule.



Describe the structure of a bacterial cell wall and slime capsule.

Peptidoglycan (murein) cell wall provides mechanical strength.

May be coated by slime layer to prevent desiccation, adhere cells & provide nutrients.



Outline the process of Gram staining.



Outline the process of Gram staining.

1. Stain culture with crystal violet. Remove & rinse with water.
2. Add iodine solution & remove after 1 min.
3. Add alcohol.
4. Counterstain with red safranin for 1 min.
5. Dry and examine sample under microscope.



Describe Gram positive cell walls.



Describe Gram positive cell walls.

Thick peptidoglycan layer (insoluble in alcohol).

Purple under microscope when stained.



Describe Gram negative cell walls.



Describe Gram negative cell walls.

Thin peptidoglycan layer with outer lipopolysaccharide membrane (alcohol-soluble).

Red under microscope when stained.



Why do Gram positive and Gram negative bacteria respond differently to certain antibiotics?



Why do Gram positive and Gram negative bacteria respond differently to certain antibiotics?

Antibiotics that inhibit peptidoglycan formation e.g. penicillin work on Gram positive bacteria. Since Gram negative bacteria have an outer membrane & a much thinner peptidoglycan layer, they are not affected.



Compare ribosomes in eukaryotic and prokaryotic cells.



Compare ribosomes in eukaryotic and prokaryotic cells.

Formed of **protein & rRNA**.

Have **large subunit** which joins amino acids & **small subunit** with mRNA binding site.



Contrast ribosomes in eukaryotic and prokaryotic cells.



Contrast ribosomes in eukaryotic and prokaryotic cells.

large subunit eukaryotic: 80S (bigger)

large subunit prokaryotic: 70S (smaller)



Describe the structure of the nucleus.



Describe the structure of the nucleus.

Surrounded by **nuclear envelope**, a semi-permeable double membrane.

Nuclear pores allow substances to enter/exit

Dense **nucleolus** made of RNA & proteins
assembles ribosomes.



Describe the function of the nucleus.



Describe the function of the nucleus.

- Contains DNA coiled around chromatin into chromosomes.
- Controls cellular processes: gene expression determines specialisation & site of mRNA transcription, mitosis, semiconservative replication.



Describe the structure and function of the endoplasmic reticulum (ER).



Describe the structure and function of the endoplasmic reticulum (ER).

Cisternae: network of tubules & flattened sacs extends from cell membrane & connects to nuclear envelope.

- **rough ER:** many ribosomes attached for protein synthesis & transport
- **smooth ER:** lipid synthesis



Describe the structure of a mitochondrion.



Describe the structure of a mitochondrion.

Surrounded by double membrane folded inner membrane forms **cristae**: site of electron transport chain.

Fluid **matrix**: contains mitochondrial DNA, respiratory enzymes, lipids, proteins.



Describe the structure of a chloroplast.



Describe the structure of a chloroplast.

- Vesicular plastid with double membrane.
- **Thylakoids:** flattened discs stack to form **grana**; contain photosystems with chlorophyll.
- **Intergranal lamellae:** tubes attach thylakoids in adjacent grana.
- **Stroma:** fluid-filled matrix.



State the function of mitochondria and chloroplasts.



State the function of mitochondria and chloroplasts.

Mitochondria: site of aerobic respiration to produce ATP.

Chloroplasts: site of photosynthesis to convert solar energy to chemical energy.



Describe the structure and function of the Golgi apparatus.



Describe the structure and function of the Golgi apparatus.

Planar **stack of membrane-bound, flattened sacs**
cis face aligns with rER:

molecules are processed in **cisternae**

vesicles bud off **trans face** via exocytosis

- modifies & packages proteins for export
- synthesises glycoproteins



Describe the structure and function of a lysosome.



Describe the structure and function of a lysosome.

Sac surrounded by single membrane
embedded **H⁺ pump** maintains acidic conditions
contains digestive **hydrolase enzymes**
glycoprotein coat protects cell interior.

- digests contents of phagosome
- exocytosis of digestive enzymes



Describe the structure and function of a plant cell wall.



Describe the structure and function of a plant cell wall.

- Made of cellulose **microfibrils** for mechanical support.
- **Plasmodesmata** form part of apoplast pathway to allow molecules to pass between cells.
- **Middle lamella** separates adjacent cell walls.



Describe the structure and function of the cell vacuole in plants.



Describe the structure and function of the cell vacuole in plants.

Surrounded by single phospholipid membrane called **tonoplast**.

Stores **cell sap**, which contains mineral ions, water, enzymes, soluble pigments.



Describe the function of the cell vacuole
in plants.



Describe the function of the cell vacuole in plants.

- Controls turgor pressure.
- Absorbs and hydrolyses potentially harmful substances to detoxify cytoplasm.



Describe the structure and function of animal vacuoles.



Describe the structure and function of animal vacuoles.

More commonly referred to as vesicles.

Temporary membrane-bound sacs containing water & chemicals.

Numerous & much smaller than in plants.



Describe the structure and function of centrioles.



Describe the structure and function of centrioles.

Spherical group of 9 microtubules arranged in triples.

Located in centrosomes.

Migrate to opposite poles of cell during prophase & spindle fibres form between them.



Why do samples need to be stained for microscopy?



Why do samples need to be stained for microscopy?

Stain binds to structures.

heavy metals: electron microscopes

coloured dye: optical microscopes

Facilitates absorption of electrons/wavelengths of light to produce image. Contrast between heavily & lightly stained areas distinguishes structures.



Define magnification and resolution.



Define magnification and resolution.

Magnification: factor by which the image is larger than the actual specimen.

Resolution: smallest separation distance at which 2 separate structures can be distinguished from one another.



State the magnification and resolution of a compound optical microscope.



State the magnification and resolution of a compound optical microscope.

magnification: x 2000

resolution: 200 nm



How does an optical microscope work?



How does an optical microscope work?

1. Lenses focus rays of light and magnify the view of a thin slice of specimen.
2. Different structures absorb different amounts and wavelengths of light.
3. Reflected light is transmitted to the observer via the objective lens and eyepiece.



What limits the resolution of an optical microscope?



What limits the resolution of an optical microscope?

Diffraction of light.

Any structures closer than half the wavelength of light cannot be distinguished as separate.



Describe how a transmission electron microscope (TEM) works.



Describe how a transmission electron microscope (TEM) works.

1. Pass a high energy **beam of electrons** through thin slice of specimen.
2. More dense structures appear darker since they absorb more electrons.
3. Focus image onto fluorescent screen or photographic plate using magnetic lenses.



State the magnification and resolution of a TEM.



State the magnification and resolution of a TEM.

magnification: x 500 000

resolution: 0.5 nm



Describe how a scanning electron microscope (SEM) works.



Describe how a scanning electron microscope (SEM) works.

1. Focus a beam of electrons onto a specimen's surface using electromagnetic lenses.
2. Reflected electrons hit a collecting device and are amplified to produce an image on a photographic plate.



State the magnification and resolution of an SEM.



State the magnification and resolution of an SEM.

magnification: x 500 000

resolution: 3 - 10 nm



Explain how to use an eyepiece graticule and stage micrometer to measure the size of a structure.



Explain how to use an eyepiece graticule and stage micrometer to measure the size of a structure.

1. Place micrometer on stage to calibrate eyepiece graticule.
2. Line up scales on graticule and micrometer. Count how many graticule divisions are in $100\mu\text{m}$ on the micrometer.
3. length of 1 eyepiece division = $100\mu\text{m} / \text{number of divisions}$
4. Use calibrated values to calculate actual length of structures.



State an equation to calculate the actual size of a structure from microscopy.



State an equation to calculate the actual size of a structure from microscopy.

$$\begin{array}{l} \text{actual size} \\ = \\ \text{image size} \\ / \\ \text{magnification} \end{array}$$

