1.2 Ultrastructure of Cells

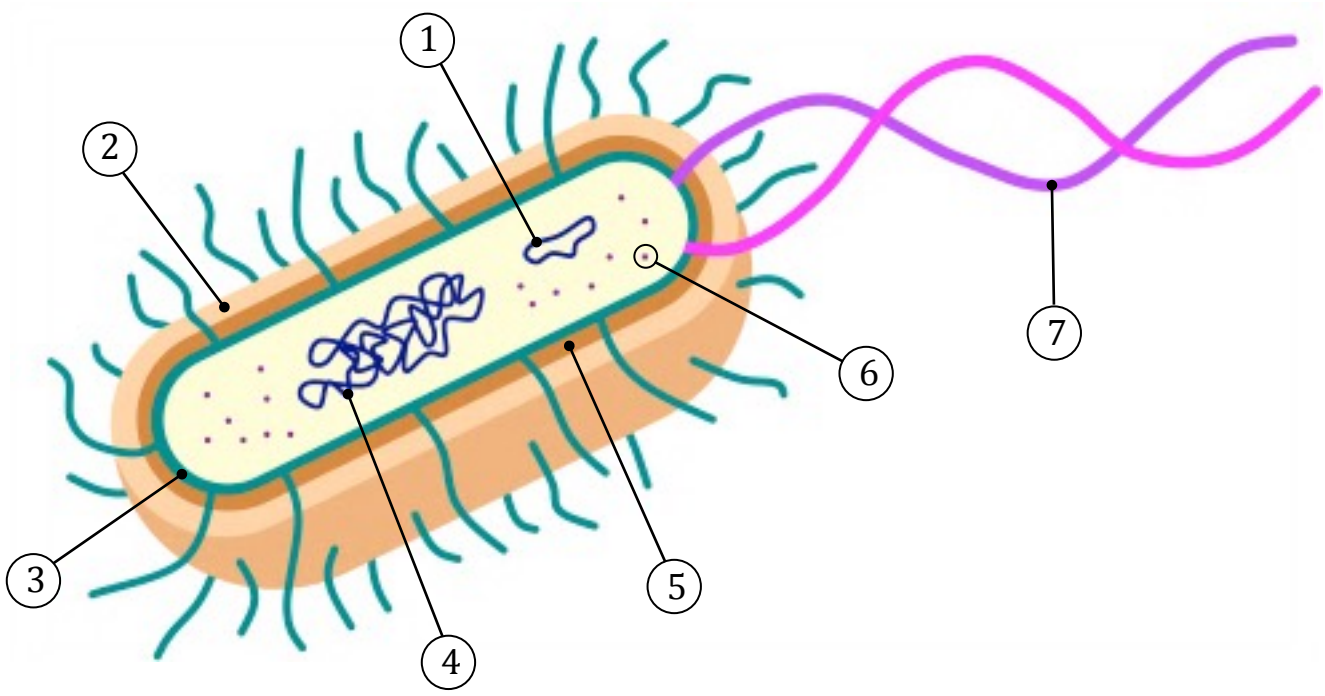
Prokaryotic Cells

Define prokaryote

A prokaryote is a simple cell that lacks a nucleus and all membrane-bound organelles

Bacteria are prokaryotic cells

Label the following diagram of a prokaryotic cell



1. Plasmid
2. Glycocalyx (slime capsule)
3. Cell membrane (with pili)
4. Nucleoid
5. Cell wall
6. Ribosome (70S)
7. Flagellum

Distinguish between the genophore and plasmids

The genophore is a circular DNA molecule that contains the genetic material (i.e. bacterial 'chromosome')

Plasmids are additional autonomous DNA molecules that can be transferred via bacterial conjugation

State the composition of a bacterial cell wall

The bacterial cell wall is composed of peptidoglycan

Outline the role of pili

Attachment pili allow bacteria to adhere to surfaces

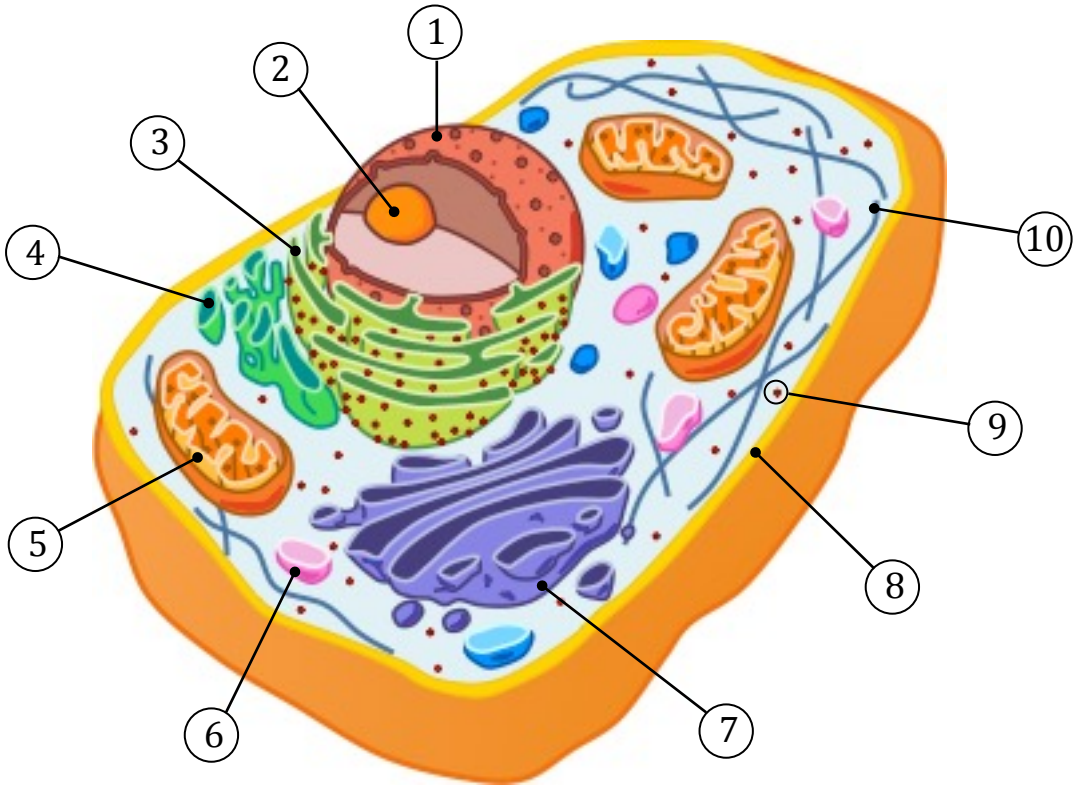
Sex pili allow bacteria to exchange genetic information (plasmids) via bacterial conjugation

Describe how bacterial cells divide

- Bacterial cells divide by binary fission (asexual reproduction)
- The circular DNA molecule is copied and then is anchored to the plasma membrane
- The DNA loops are drawn apart as the cell elongates, before dividing (cytokinesis) to form two clones

Eukaryotic Cells

Label the following diagram of an animal cell



1. Nucleus
2. Nucleolus
3. Rough Endoplasmic Reticulum (rER)
4. Smooth Endoplasmic Reticulum (sER)
5. Mitochondrion
6. Lysosome (or peroxisome)
7. Golgi apparatus
8. Plasma membrane
9. Ribosome (80S)
10. Cytosol / Cytoskeleton (NOT cytoplasm)

Explain how the compartmentalisation of eukaryotic cells allows for greater complexity

Eukaryotic cells contain sub-cellular structures called organelles (i.e. 'little organs')

These membrane-bound compartments perform specialised functions that provide eukaryotic cells with a greater level of functional complexity

State the role of the following organelles

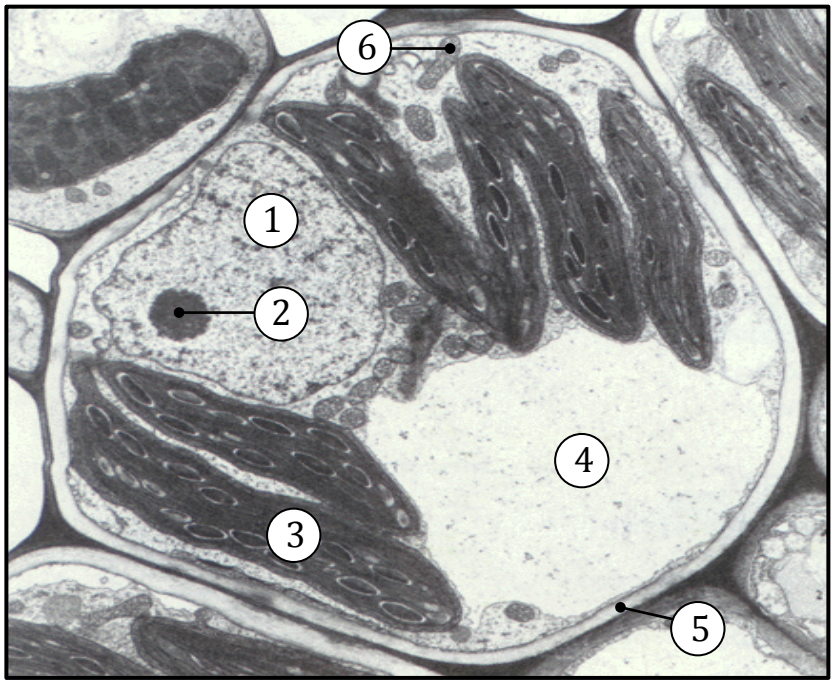
Nucleus	The nucleus is a double membrane structure (with pores) that stores DNA It is the site of transcription (RNA synthesis)
Nucleolus	The nucleolus is a region within the nucleus where ribosomes are assembled
Endoplasmic Reticulum	The endoplasmic reticulum is a membrane network that transports materials between organelles (via vesicles)
Golgi Apparatus	The golgi apparatus is involved in the sorting, storing, modification and export of secretory products from the cell
Ribosomes	Ribosomes are responsible for protein synthesis (translation) They can be found freely within the cytosol or may be embedded on the rough ER
Mitochondria	Mitochondria are responsible for aerobic respiration (ATP synthesis via oxygen)
Lysosome	The lysosome is responsible for the breakdown of macromolecules (the digestion of toxic metabolites occurs within the peroxisome)

Distinguish between the structure and function of smooth ER and rough ER

Rough ER is embedded with ribosomes and is therefore responsible for the transport of proteins

Smooth ER is NOT embedded with ribosomes and is involved in the transport and synthesis of carbohydrates and lipids

Label the following micrograph of a plant cell



1. Nucleus
2. Nucleolus
3. Chloroplast
4. Large, central vacuole
5. Cell wall
6. Mitochondrion

Outline five differences between animal and plant cells

1. Plant cells may have chloroplasts, animal cells do not
2. Plant cells have a cell wall (and connecting plasmodesmata), animal cells do not
3. Plant cells have a large, central vacuole whereas animal cells have small, temporary vacuoles (if any)
4. Animal cells have cholesterol in their plasma membranes, plant cells do not
5. Plant cells store excess glucose as starch, animal cells store excess glucose as glycogen

State the composition of a plant cell wall

The cell wall of a plant cell is composed of cellulose

Identify the function of chloroplast and identify where it is found in the plant tissue

Chloroplast are the organelle responsible for photosynthesis (they contain the pigment chlorophyll)

Chloroplast are found in photosynthetic tissues (i.e. in the palisade mesophyll of the leaf)

Chloroplast are NOT found in all plant tissues (i.e. they are absent from root cells)

Prokaryotic vs Eukaryotic Cells

Compare prokaryotic and eukaryotic cells according to the following features

	Prokaryote	**Eukaryote**
DNA	DNA is naked	DNA is bound to histone proteins
	DNA molecules are circular	DNA molecules are linear
	DNA is freely floating in the cytosol (specifically in the nucleoid region)	DNA is contained within the nucleus
Organelles	Does NOT have any membrane-bound organelles	Has membrane-bound organelles
	Ribosomes are 70S in size	Ribosomes are 80S in size
Reproduction	Reproduce via binary fission	May reproduce via numerous methods (mitosis, meiosis, budding, etc.)
	Reproduction is asexual (cells haploid)	Reproduction may be sexual or asexual (cells may be diploid)
Average Size	Smaller (typically 1 – 5 μm)	Larger (typically 10 – 100 μm)