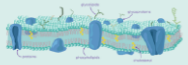
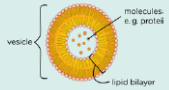
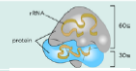
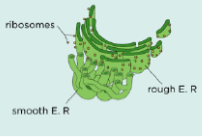
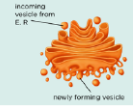
science

biology

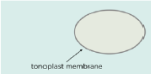
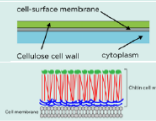
A-Level Cell Structure

Eukaryotic cells

- Eukaryotes include animal, plant & fungal cells.
- The following organelles are present in eukaryotic cells

Organelle	Structure	Function
Cell surface membrane		• Controls passage of entry of substance into the cell • Site of cell communication via receptors
Nucleus		• Stores DNA • Nuclear pores allow mRNA & ribosomes to pass through
Mitochondria		• Carry out aerobic respiration to produce ATP
Lysosomes		• Contains digestive enzymes to break down pathogens, old organelles, cells & food molecules
Ribosomes		• Site of protein synthesis
Rough endoplasmic reticulum		• Provide a large surface area for protein synthesis
Smooth endoplasmic reticulum		• Synthesise, store and transport lipids and carbohydrates.
Golgi Apparatus		• Modifies proteins • Sort, package, and transport molecules around the cell

There are additional organelles in plants, algae & fungi:

Organelle	Structure	Function	Present in which organism
Chloroplasts		• Site of photosynthesis	Plants & algae
Cell vacuole		• Maintains cell structure • Act as a tempo-rary energy store	Plants
Cell wall		• Provides support & mechanical strength	Plants & algae Fungi

In complex multicellular organisms, eukaryotic cells become
• Specialised for specific functions.
• Specialised cells are organised into tissues, tissues into organs and organs into systems.

Prokaryotic cells

- Prokaryotic cells are much smaller than eukaryotic cells.

They also differ from eukaryotic cells in having:

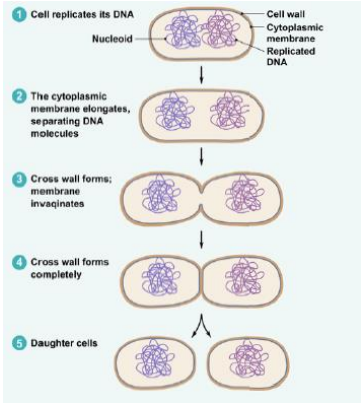
- cytoplasm that lacks membrane-bound organelles
- smaller ribosomes
- no nucleus; instead they have a single circular DNA molecule that is free in the cytoplasm and is not associated with proteins
- a cell wall that contains murein, a glycoprotein.

Many prokaryotic cells have:

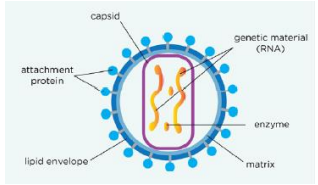
- one or more plasmids
- a capsule surrounding the cell
- one or more flagella.

Binary fission in prokaryotic cells involves:

- replication of the circular DNA and of plasmids
- division of the cytoplasm to produce two daughter cells.
- each daughter cell has a single copy of the circular DNA and a variable number of copies of plasmids.



Viruses



- Viruses are acellular and non-living.
- The structure of virus particles includes genetic material, capsid and attachment proteins.
- Being non-living, viruses do not undergo cell division.
- Following injection of their nucleic acid, the infected host cell replicates the virus particles.

Methods of studying cells

There are 3 main types of microscopes used to observe cells:

	Light Microscope	Scanning Electron Microscope	Transmission Electron Microscope
Medium	Light Beam	Electron Beam	Electron Beam
Dimensions	2D	3D	2D
Max Magnification	X1,500	X200,000	X2,000,000
Max Resolution	200 nm	20 nm	0.1 nm

Methods of studying cells

- Magnification is how much bigger the image is compared to the original object viewed with the naked eye

Actual size = size of image/ magnification

- Resolution is how well a microscope distinguishes between two points that are close together.

Cell fractionation can be used to separate organelles

- Homogenisation - grinding cells release the organelles into
- solution
- Filtration - separates organelles & debris
- Ultracentrifugation - using a centrifuge the organelles are
- separated out in order of mass

The tissue is placed in a cold, buffered solution of the same water potential of the tissue. The solution is:

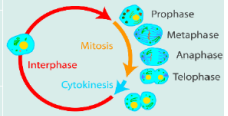
- Cold- to reduce enzyme activity that might break down the organelles
- Same water potential as the tissue- to prevent organelles bursting or shrinking as a result of osmotic gain or loss of water
- Buffered- so that the pH does not fluctuate

Cell Division

Within multicellular organisms, not all cells retain the ability to divide. Eukaryotic cells that do retain the ability to divide show a cell cycle.

•The eukaryotic cell cycle has three main stages:
• Interphase consists of two growth phases (G1&G2) and a DNA synthesis stage (S).
• Mitosis is the nuclear division
• Cytokinesis is when the cell splits in two, forming two identical daughter cells.

Stage	Description
Prophase	DNA condenses & coils, nuclear envelope breaks down, centrioles move to opposite poles
Metaphase	Spindle fibres attach to centromeres & chromosomes line at the equator
Anaphase	Centromeres divides, chromatids move to opposite poles
Telophase	Chromosomes uncoil, nuclear envelope reforms



- Mitosis is a controlled process.
- Uncontrolled cell division can lead to the formation of tumours and of cancers. Many cancer treatments are directed at controlling the rate of cell division.

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