

STUDYING CELLS

- Cells can be observed using microscopes such as
 - Optical microscopes
 - Laser scanning microscopes
 - Electron microscopes
- These microscopes produce high-resolution, magnified images of specimens

OPTICAL MICROSCOPES

- First type of microscope
- A beam of light is focused with lenses to produce an image
- Relatively cheap
- Easy to use
- Can study WHOLE LIVING ORGANISMS
- Poor resolving power of 100nm due to the long wavelength of light
- Magnification of up to x1500

LASER MICROSCOPES

- Also called confocal microscopes
- Laser light scans object point by point and computer assembles it into an image
- Can study WHOLE LIVING ORGANISMS
- More expensive than light microscopes
- Have depth selectivity so can focus on structures at different depths



MAGNIFICATION

the number of times larger an image appears compared to the actual size of the object

RESOLUTION

the clarity of an image, the ability to distinguish between two points that are close together

MAGNIFICATION	IMAGE SIZE	ACTUAL SIZE
x100	mm	m
x10	cm	cm
x1000	µm	µm
x1000	nm	nm

EUKARYOTIC CELLS

- Eukaryotic cells are complex and include
 - Animals
 - Plants
 - Fungi
- have range of organelles with specific functions & most are membrane-bound



ORGANELLES

components of cells which perform specific functions

PROKARYOTIC CELLS

- Prokaryotic cells are the most common type of cell on Earth
- They are small cells which contain
 - Cell membrane
 - Cell wall (made of peptidoglycan)
 - No nucleus (DNA in loop or plasmid and nucleoid)
 - Cytoplasm
 - 70S ribosomes

- Glycogen granules & oil droplets (energy stores)
- Cytoskeleton (less developed, no centrioles)
- Flagellum (rotates for movement)
- Capsule (protects from detection)
- PSI (made of protein, for adhesion to host cells/prokaryotes)



2.1.1 cell structure MICROSCOPY & CELLS

STAINING SPECIMENS

- Some structures are easy to see with a microscope (eg chlorophyll naturally modifies light)
- Other structures must be stained to be seen
- Dye is used to highlight cells and their structures which makes them easier to see with a microscope
- Stains bind to different types of molecules or cell structures which allows different components of cells to be identified → DIFFERENTIAL STAINING

SUDAN RED

stains lipids

ACETIC ORCEIN

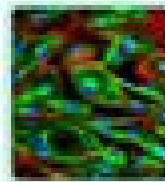
binds to DNA allows chromosomes to be seen

IODINE

stains starch granules purple & plant cell walls yellow



PHOTOMICROGRAPH



LASER SCANNING MICROGRAPH

ELECTRON MICROSCOPES

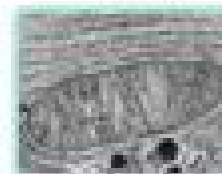
- Beam of electrons fired from cathode & focused with magnets
- Electron beam has short wavelength (0.001nm) so has a high resolving power
- Samples must be observed in a vacuum so only DEAD ORGANISMS can be studied
- Can be transmission electron (TEM) or scanning electron microscopes (SEM)
- Very large & expensive
- Require training & skill to use

TRANSMISSION ELECTRON

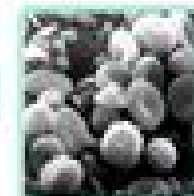
- Beam of electrons passes through specimen
- Forms 2D black & white image
- Specimen chemically fixed by being dehydrated & stained with metal salts

SCANNING ELECTRON

- Beam of electrons bounce off the specimen's surface
- Forms 3D black & white image but computers can add colour
- Specimen placed in vacuum & often coated in fine metal film



ELECTRON MICROGRAPHS



	OPTICAL	LASER	TEM	SEM
BEAM	Light	Light	Electrons	Electrons
PREPARATION	Simple	Simple	Stain & metal film	Stain
SPECIMEN	Alive	Alive	Dead	Dead
MAGNIFICATION	x1500	x1500	x2,000,000	x100,000
RESOLUTION	100nm	160nm	0.1nm	10nm
2D OR 3D?	2D	3D	2D	3D
COLOR?	Colour	Colour	False colour	Black & white

	NUCLEUS	DNA	CYTOPLASM	CELL MEMBRANE	MEMBRANE BOUND ORGANELLES	RIBOSOMES	CELL WALL
EUKARYOTE	Present	Linear	Present	Present	Present	Larger	Cellulose/chitin
PROKARYOTE	Absent	Circular	Present	Present	Absent	Smaller	Peptidoglycan

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