

- electrogenic pumps, such as sodium potassium, and proton pumps contribute to electrochemical gradients
- cotransport of two solutes occurs when membrane protein enables downhill diffusion of one solute to drive uphill transport of another

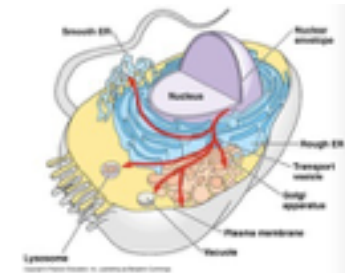
7.5 - bulk transport

- exocytosis: transport vesicles migrate to membrane fuse with it and release contents
- endocytosis: molecules enter cells within vesicles that pinch inwards from the plasma membrane
 - phagocytosis, pinocytosis receptor mediated endocytosis

lecture 7 - cell biology I - organelles

ENDOMEMBRANE SYSTEM

- a system of internal membrane bound compartments within the cell that can form physical links to exchange components
 - nuclear envelope (nucleus)
 - endoplasmic reticulum
 - golgi apparatus
 - lysosomes and vacuoles



in the endomembrane system:

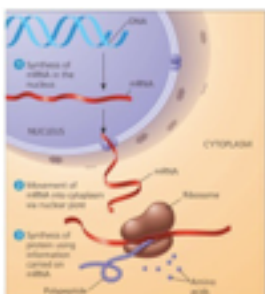
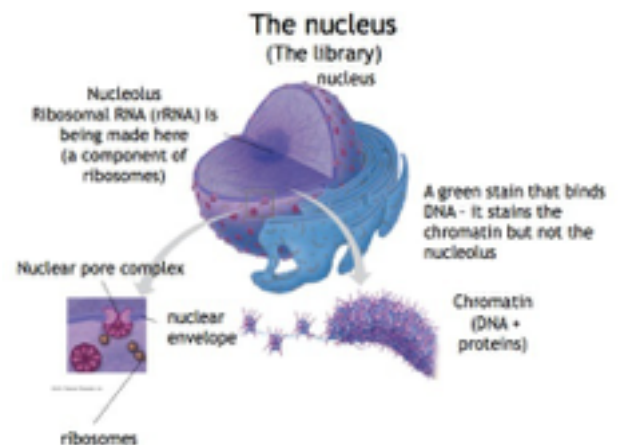
- nucleus
- ER
- golgi
- Lysosomes
- Vesicles and vacuoles
- plasma membrane

not in endomembrane system

- mitochondria
- chloroplasts
- peroxisomes

nucleus

- contains the DNA organised so that genes are held in specific chromosomes
- *nucleolus* produces ribosomal RNA and assembles ribosomes
- enclosed by nuclear envelope
- inner membrane supported by nuclear lamina
- outer membrane supported by cytoskeleton
- nuclear pore complexes in the envelope regulate entry and exit
- nuclear envelope is continuous with the ER



ribosomes

- large subunit and small subunit
- consist of ribosomal RNA (rRNA) and proteins
- carry out protein synthesis (translation)
- free in the cytoplasm and also:
- bound to the membrane of the ER

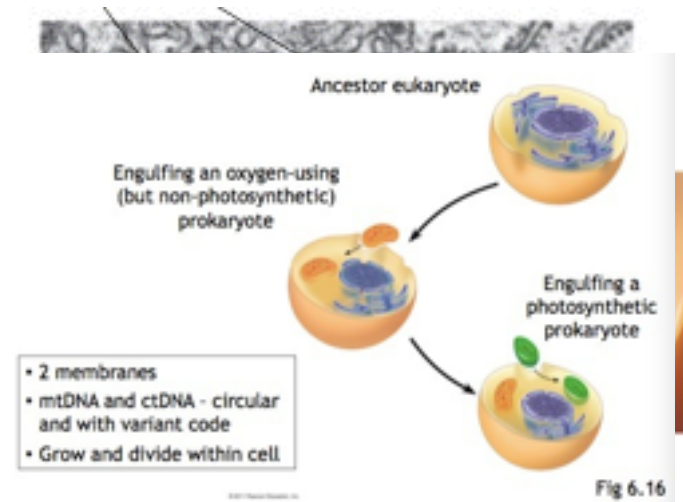
Endoplasmic Reticulum

- proteins enter the ER using a signal sequence of amino acids
- smooth*
- metabolises carbs
- makes lipids, phospholipids and steroid hormones
- detoxification of drugs/poisons

- stores calcium
- rough*
- bound ribosomes
- proteins are passed into the lumen
- carbs can be added - glycoproteins
- makes phospholipids and proteins - assembles membrane

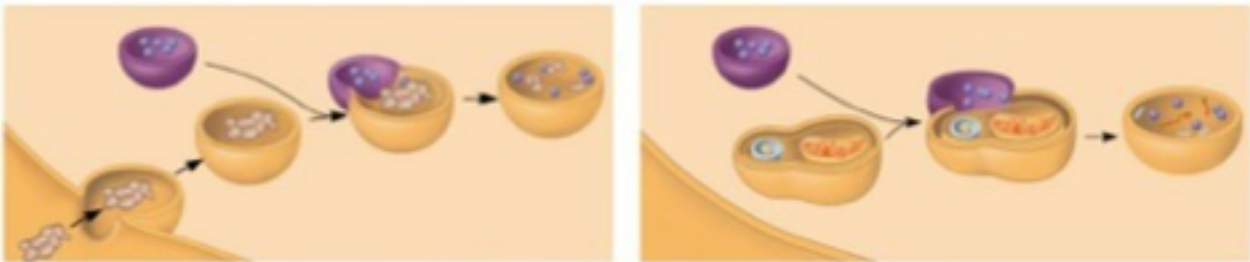
golgi apparatus

- warehouse: receiving sorting shipping and some manufacturing
- a dynamic process
 - vesicles fuse at the cis-golgi to form new cisternae (long vesicles)
 - cisternae 'mature'
 - vesicles bud off the trans golgi



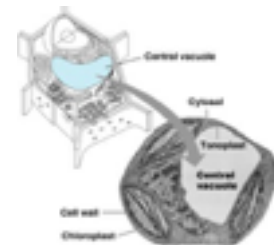
Lysosomes

- vesicles full of hydrolytic (digestive) enzymes
- highly acidic environment
- phagocytosis: 'food' from outside the cell is phagocytosed
- macrophages are white blood cells that engulf bacteria
- autophagy: breaking down damaged organelles for recycling
- a human liver recycles half its macromolecules each week



vacuoles

- in single celled animals are usually contractile water expulsion vacuoles
- vacuoles are found in most plant cells and give young tissue physical support
- plant cell vacuoles also store ions toxic waste products



OTHER ORGANELLES/STRUCTURES

peroxisomes

- oxidative organelles that transfer hydrogen from various compounds to oxygen, forming hydrogen peroxide e.g.) detoxification of alcohols by liver

glyoxysomes

- specialised peroxisomes in plant tissue break down fat reserves in seeds to produce sugars from the growing seedling

endosymbiont theory: that chloroplasts and mitochondria derive from ancestral prokaryotes that became symbionts (symbiosis)

mitochondria

- have an enclosing outer membrane
- internal highly folded membrane - cristae, enclosing the matrix
- found in almost all eukaryote cells
- responsible for synthesis of ATP from stored compounds

chloroplasts

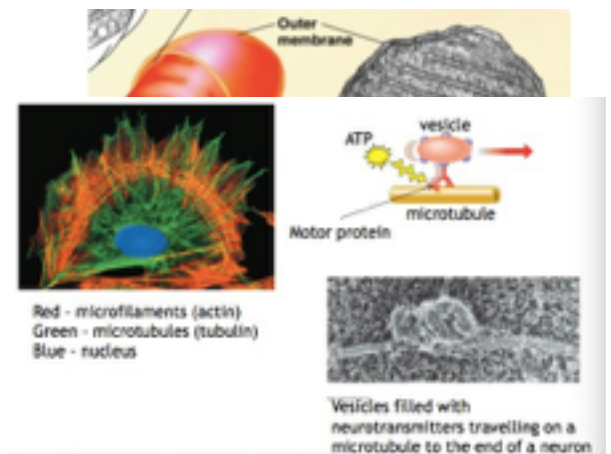
- two enclosing outer membranes
- internal elaborately folded specialised membrane system - thylakoid membrane
- found in many plant cells exposed to light (leaves etc)
- responsible for conversion of light energy to chemical energy - ATP and other energy currency

cytoskeleton

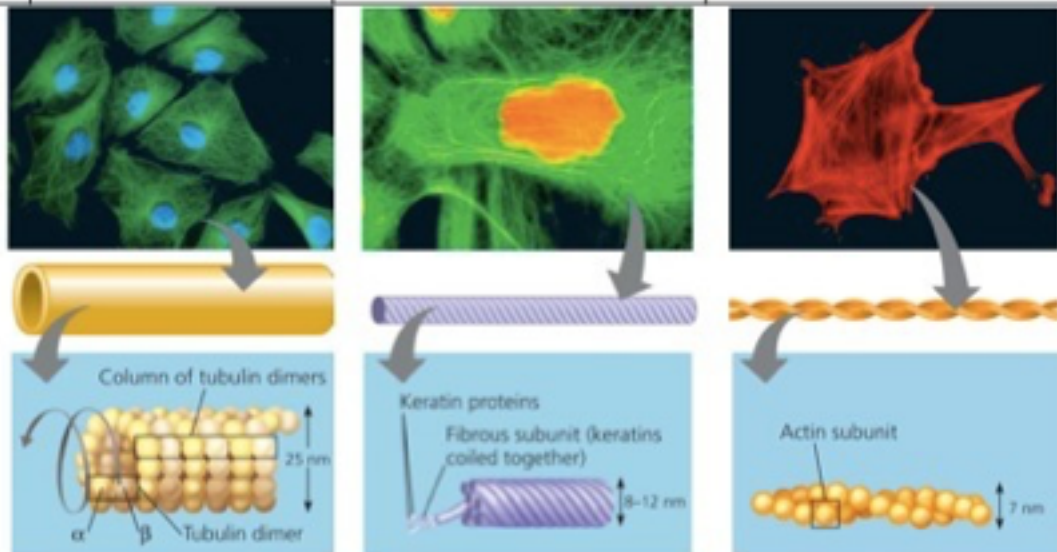
- movement of cells, movement of vesicles/organelles, and overall cell structure/shape

organisation of microtubules

- constructed from dimers of alpha tubulin and beta tubulin
- very dynamic assembly/disassembly
- one end can be grown/shrunk much faster than the other
- are usually organised by an organising centre
 - eg) a centrosome during cell division in animals



	microtubules	Intermediate filaments	Microfilaments
Polymers of:	Tubulin (2 subunits)	Various proteins eg. keratin	actin
Diameter:	large	Intermediate (varies)	small
Functions:	Maintains cell shape In cilia/flagella Cell division Movements of organelles	Maintains cell shape Anchoring organelles Nuclear lamina	Maintains or changes cell shape - Cell migration Muscle contraction Cytoplasmic streaming cytokinesis



microfilaments in movement

- muscle fibre contracting - myosin is the motor protein that pulls on actin filaments
- amoeboid movement - actin and myosin pull the back end of the cell
- cytoplasmic streaming - cytoplasm moves around cells over actin filaments

cell junctions - plants

- plasmodesmata
 - so large, water and small solutes pass through
 - sometimes proteins and RNA can pass through