Cell Notes

Sec 4.5

Mitochondria & Chloroplasts

- site of cellular respiration
- generate ATP

- site of photosynthesis
- synthesize sugars

→ similar origins

→ **Endosymbiont Theory**

"endosymbiont" — a cell living within another cell

Ancestor of eukaryotic cell engulfed an oxygen-using non-photosynthetic prokaryotic cell

↓

then one MERGED into a eukaryotic cell with mitochrondrion

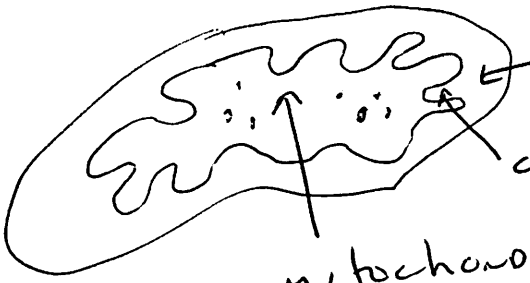
Why: What's the evidence?

1. mitochondria & chloroplasts are DOUBLE-MEMBRANED
2. they contain RIBOSOMES
3. they have their own DNA !!
   → they make their own proteins

(4) they are AUTONOMOUS - they grow and reproduce within the cell.

MITOCHONDRIA

- 2 membranes
  - inner - infoldings called CRISTAE
  - outer - smooth



- DNA (mitochondrial)
- enzymes
- RIBOSOMES

CRISTAE ⟹ SURFACE AREA

⟹ ENZYMES that make ATP built into inner membrane

- MITOCHONDRIA in plants, animals, fungi, and most protists (one big one up to thousands)
  - ↳ proportional to level of metabolic activity ⟹ i.e. muscle cells have more mitochondria

Chloroplasts

- contain green pigment chlorophyll
- 2 membraned
- ✱ Thylakoids – membranous system
  - flattened, inter-connected sacs
- form stacks called GRANA (sing. GRANUM)
- FLUID outside GRANA is called STROMA

⇒ STROMA contains chloroplast DNA, RIBOSOMES, and ENZYMES

① intermembrane space
② stroma
③ thylakoid space

} functional areas

→ can reproduce themselves
→ mobile

PLASTIDS – besides our fave, the chloroplast

① Amyloplast – stores starch in (amylose)
roots & tubers

② Chromoplast – pigments – flower/fruit color

Peroxisomes

- single-membrane.
- ENZYMES remove hydrogen atoms from molecules → transfer them to H_2O, making H_2O_2 (hydrogen peroxide)
- H_2O_2 toxic but other enzymes break it down to H_2O
- ?? grow larger with proteins & lipids
  How? wtf?

CYTOSKELETON

- mechanical support; maintain shape
- anchorage for organelles and even enzymes

DYNAMIC !!! remember "Inner Life of Cell"

Cell Motility - changes in cell location and movement of parts of the cell.

MOTOR PROTEINS

- ATP-powered
- "walk" along microtubules or microfilaments with vesicles

✱ Cytoskeleton can manipulate the plasma membrane so that it bends inward to form food vacuoles and other vesicles

Components of Cytoskeleton

(1) Microtubules – thickest
(2) Microfilaments – thinnest (ACTIN fibers)
(3) Intermediate – middle range

MICROTUBULES

- hollow rods made of globular protein called TUBULIN
- each tubulin is a DIMER (made up of 2 subunits)

✱ – α-tubulin and β-tubulin

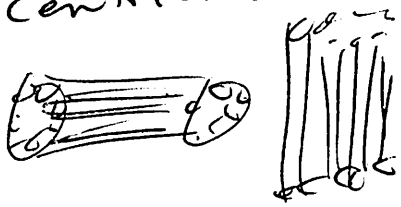
→ shape & support cell
→ serve as "tracks" for organelles
→ separation of chromosomes in cell division

Centrosome (animal cells)

- micro-tubule organizing center near the nucleus from which microtubules "grow" out of
- CENTRIOLES are within the centrosome region

★ 9-3 ⇒ Nine sets of 3 microtubules arranged in a RING

→ 2 centrioles at right angles



?? Fungi and Plants don't have them but still manage to have microtubules

Cilia and Flagella

- Microtubule "extensions" from cells

→ propulsion, sweeping

- trachae
- female reproductive tract

Cilia – lots of them

Flagella – one or a few

→ work like oars

→ work like tail of fish – undulating.

Signal-Receiving Cilia (Primary Cilium)

– proteins on it transmit molecular signals to interior of cell

– An "Antenna"

Motile cilia & flagella

"9+2" pattern

– nine doublet microtubules in a ring with 2 single microtubules in the middle

Non-motile cilia & flagella

"9+0" pattern

– missing the 2 in the middle

Basal Body – Anchors cilia/flagella to cell – "9+0"

Dyneins – motor proteins
– responsible for the bending movements

MICROFILAMENTS

– thin, solid rods
– made of **ACTIN** (globular protein)
– twisted double chain of **ACTIN** subunits
– bear tension; help support shape

ACTIN Filaments + Myosin (MOTOR PROTEIN) cause CONTRACTION of Muscle Cells

↳ plus:
1) Amoeboid movement of cells (WBC's)
2) Cytoplasmic streaming in plant cells.

Intermediate Filaments

- diverse group
- ★ more permanent than microtubules or microfilaments.
  - ↳ nuclear lamina

EXTRACELLULAR COMPONENTS

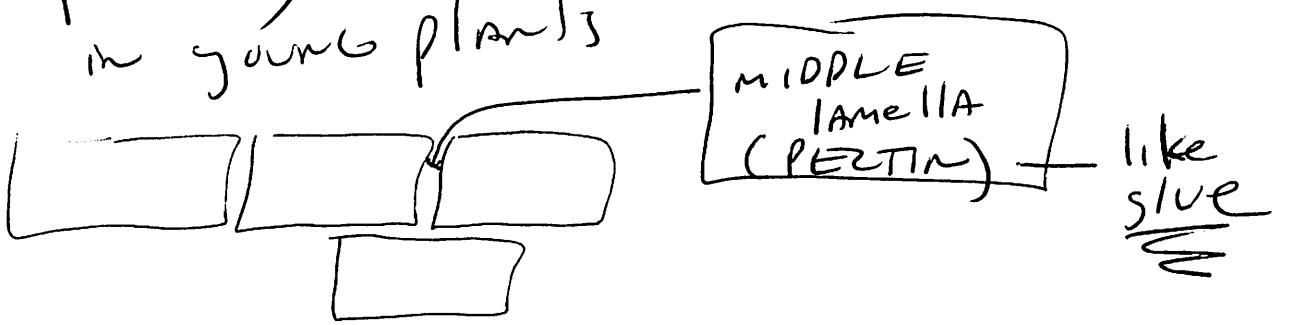
(1) Cell wall (plants)

- prokaryotes, fungi, and some protists also sometimes have a cell wall

⇒ microfibrils made of cellulose synthesized by cellulose synthase

⇒ secreted to extracellular space and embed in a matrix of polysaccharides and proteins

★ primary cell wall comes first in young plants



⇒ secondary cell wall added later (wood)

ECM - Extra-cellular Matrix

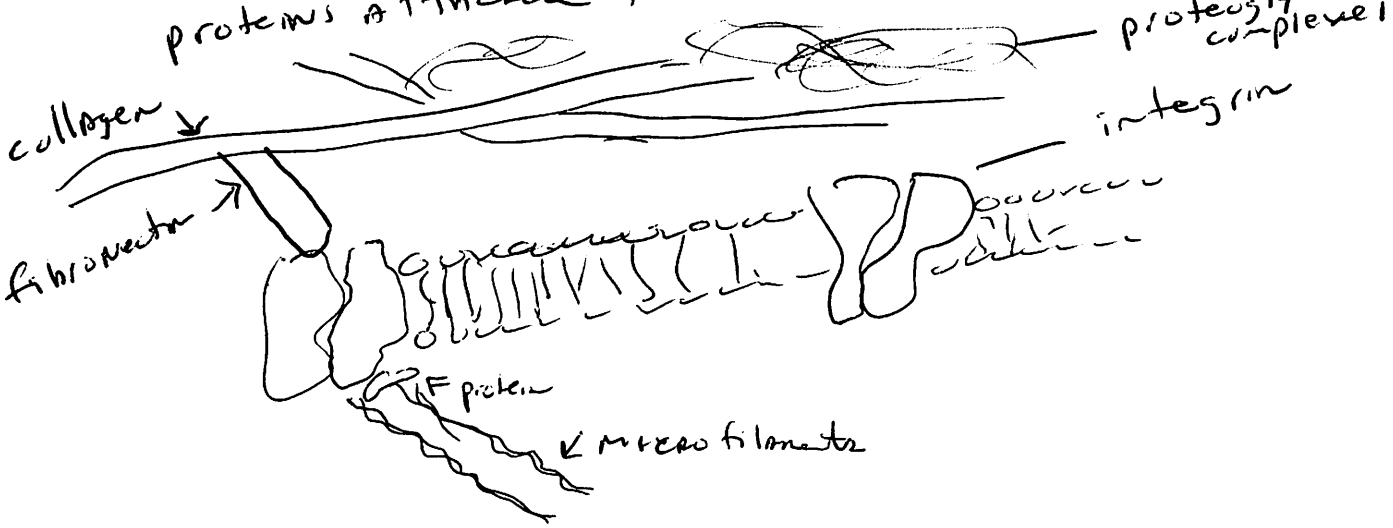
- mostly Glycoproteins like COLLAGEN (40% of total protein in humans)

⇒ collagen fibers are embedded in a network of PROTEOGLYCANS (A small protein with up to 95% attached carbohydrates)

- FIBRONECTIN attaches the whole complex to INTEGRIN embedded in the plasma membrane

INTEGRINS

- membrane protein
- 2 subunits
- bind to ECM on outside and to proteins attached to filaments on INSIDE



INTEGRINS

- the "link" between the cell and the outside world
- SIGNALING Pathways (CH 5) ☺

CELL JUNCTIONS

Plant Cells

→ PLASMODESMATA

- membrane-lined channels with cytosol inside
- connect plant cells

★ water and small solutes pass from cell to cell

Animal Cells

(1) TIGHT JUNCTIONS

(2) DESMOSOMES

(3) GAP JUNCTIONS.

- especially common in epithelial tissue

(1) TIGHT JUNCTIONS
- plasma membrane to plasma membrane - pressing tightly and bound by specific proteins
⇒ i.e. skin cells

(2) Desmosomes (anchoring junctions)
- "rivets"
- intermediate filaments made of KERATIN (STRONG!)
- Attach muscle cells - i.e. "muscle tear" is ruptured desmosomes

(3) GAP JUNCTIONS (COMMUNICATING JUNCTIONS)
- cytoplasmic channels from one cell to the next
- similar to plasmodesmata
- membrane proteins which surround a pore and form a channel (but with no cytosol inside)
- ions, SUGARS, AA's can pass through.