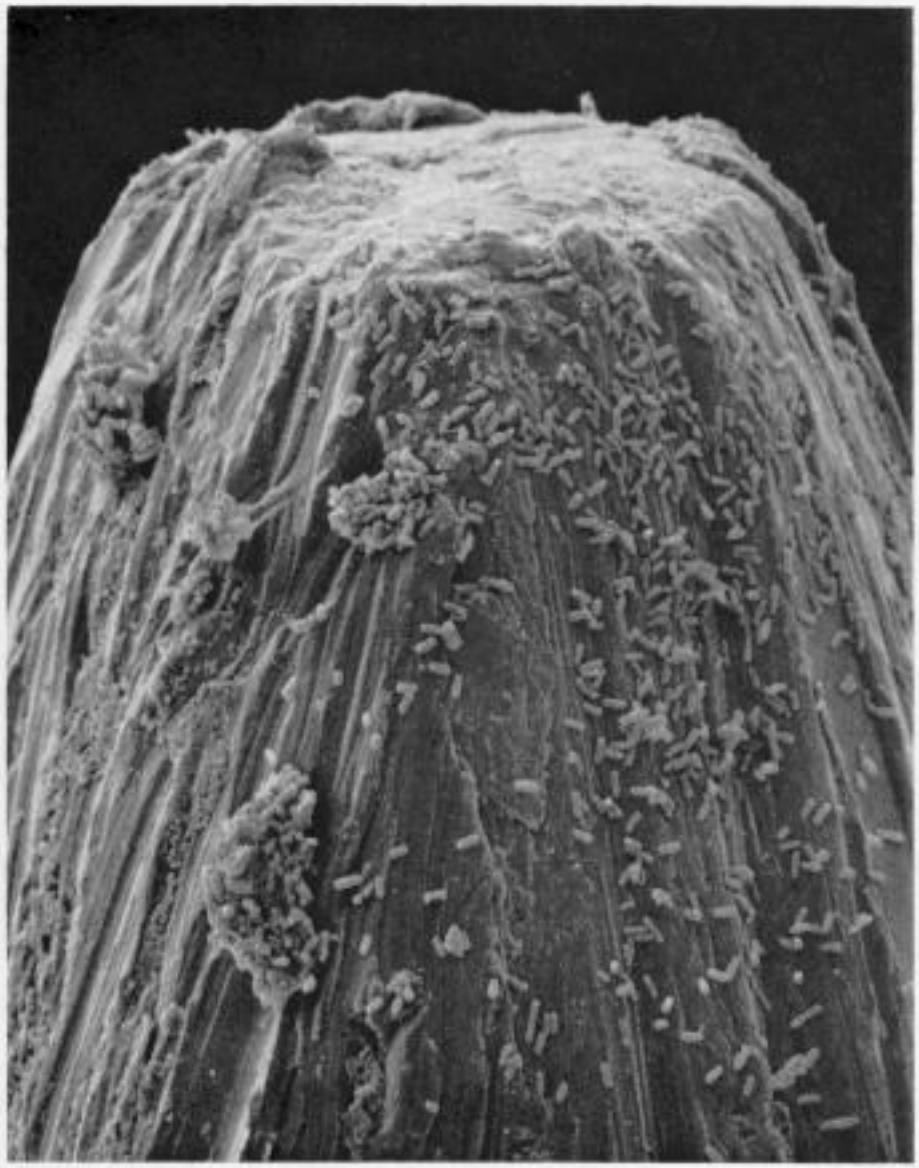
# Cells: Prokaryote vs Eukaryote

# Cells have evolved two different architectures:

- Prokaryote “style”
- Eukaryote “style”

# Prokaryote cells are smaller and simpler

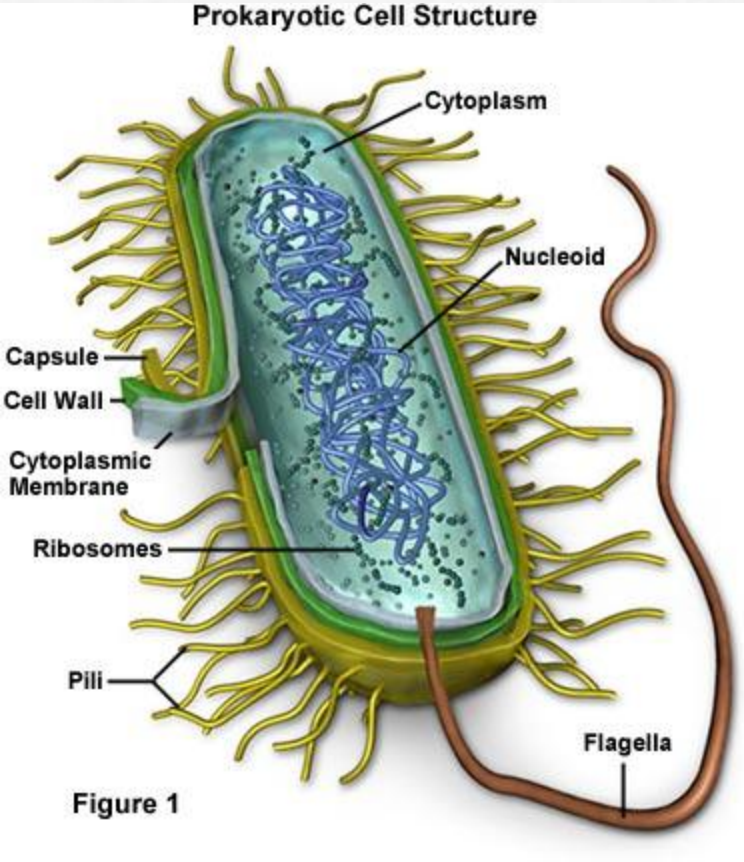
- Commonly known as bacteria
- 10-100 microns in size
- Single-celled(unicellular) or
- Filamentous (strings of single cells)



These are prokaryote E. coli bacteria on the head of a steel pin.

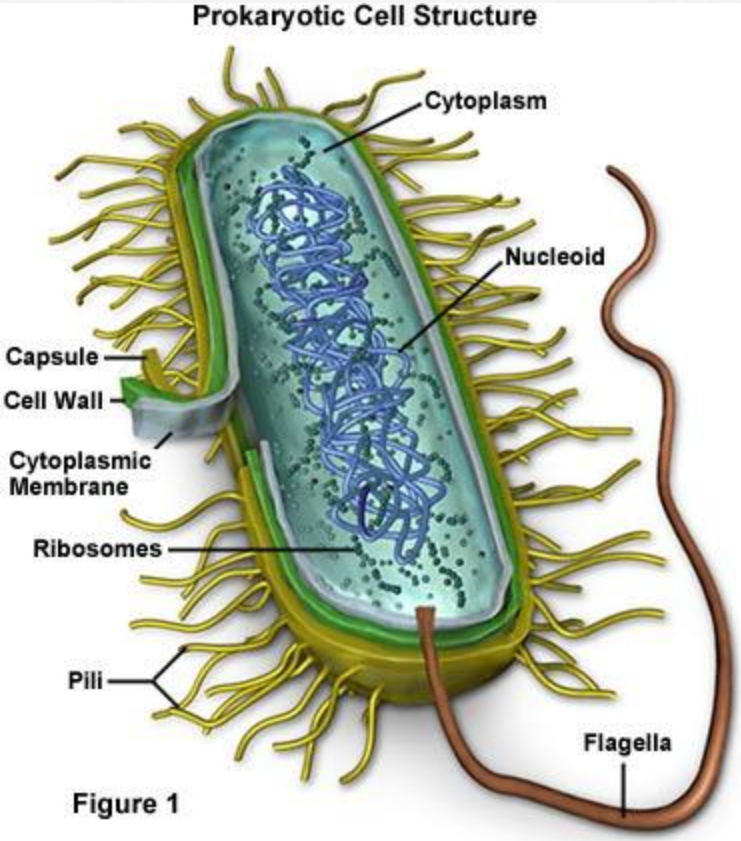
# Prokaryote cells are simply built (example: E. coli)

- capsule: slimy outer coating
- cell wall: tougher middle layer
- cell membrane: delicate inner skin



# Prokaryote cells are simply built (example: E. coli)

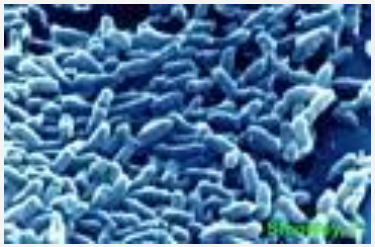
- cytoplasm: inner liquid filling
- DNA in one big loop
- pilli: for sticking to things
- flagella: for swimming
- ribosomes: for building proteins



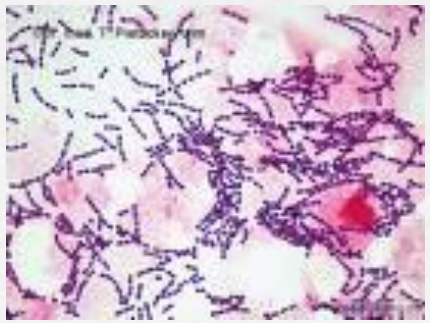
# Prokaryote lifestyle

- unicellular: all alone

- colony: forms a film



- filamentous: forms a chain of cells



# Prokaryote Feeding

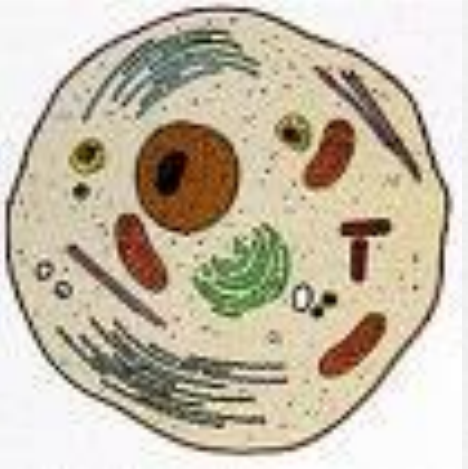
- Photosynthetic: energy from sunlight
- Disease-causing: feed on living things
- Decomposers: feed on dead things

# Eukaryotes are bigger and more complicated

- Have organelles
- Have chromosomes
- can be multicellular
- include animal and plant cells

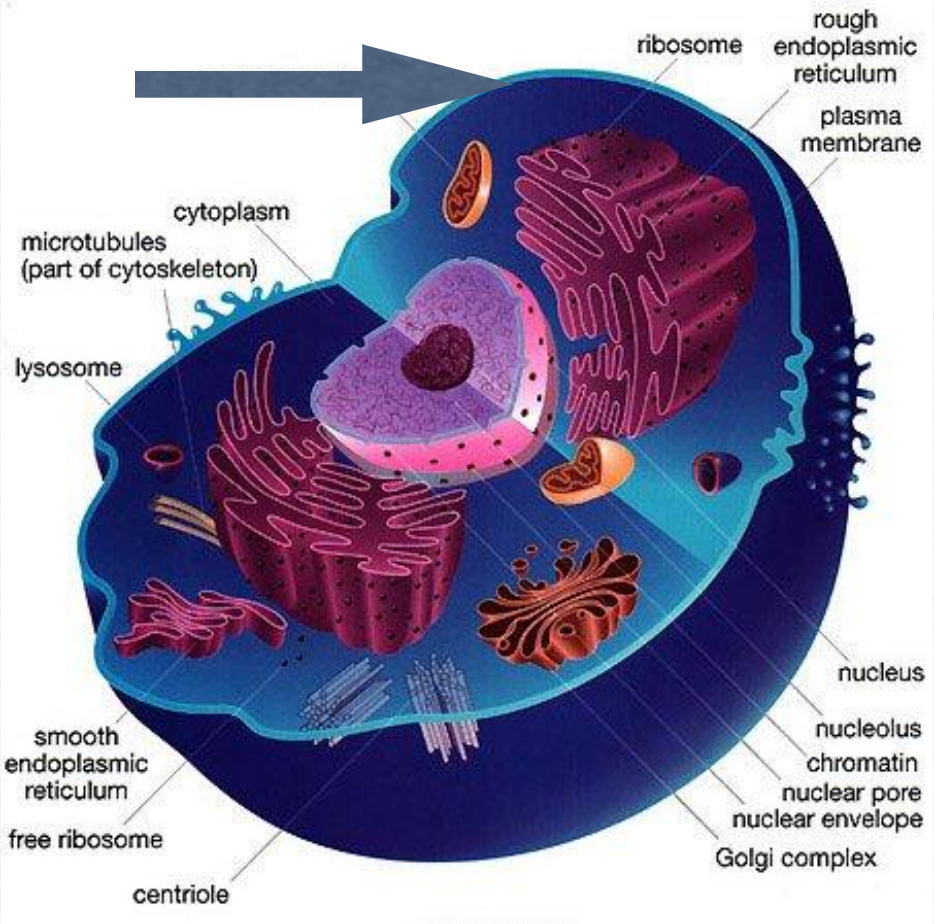
# Organelles are membrane-bound cell parts

- Mini “organs” that have unique structures and functions
- Located in cytoplasm

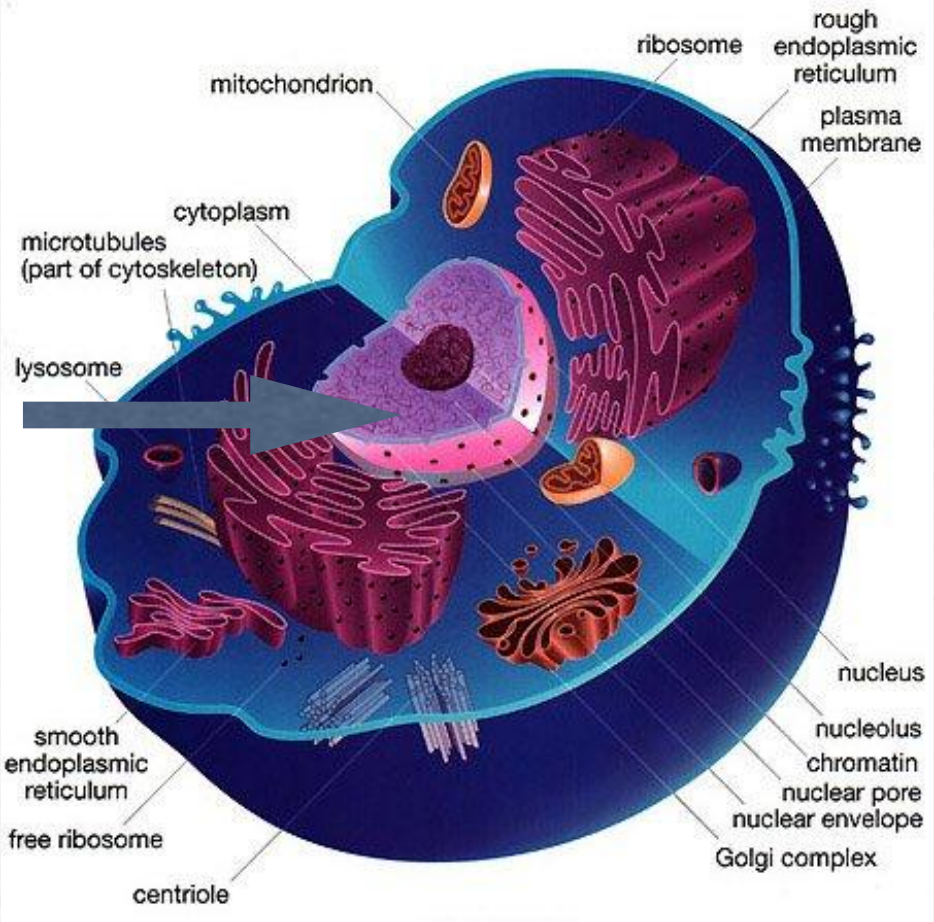


# Cell Structures

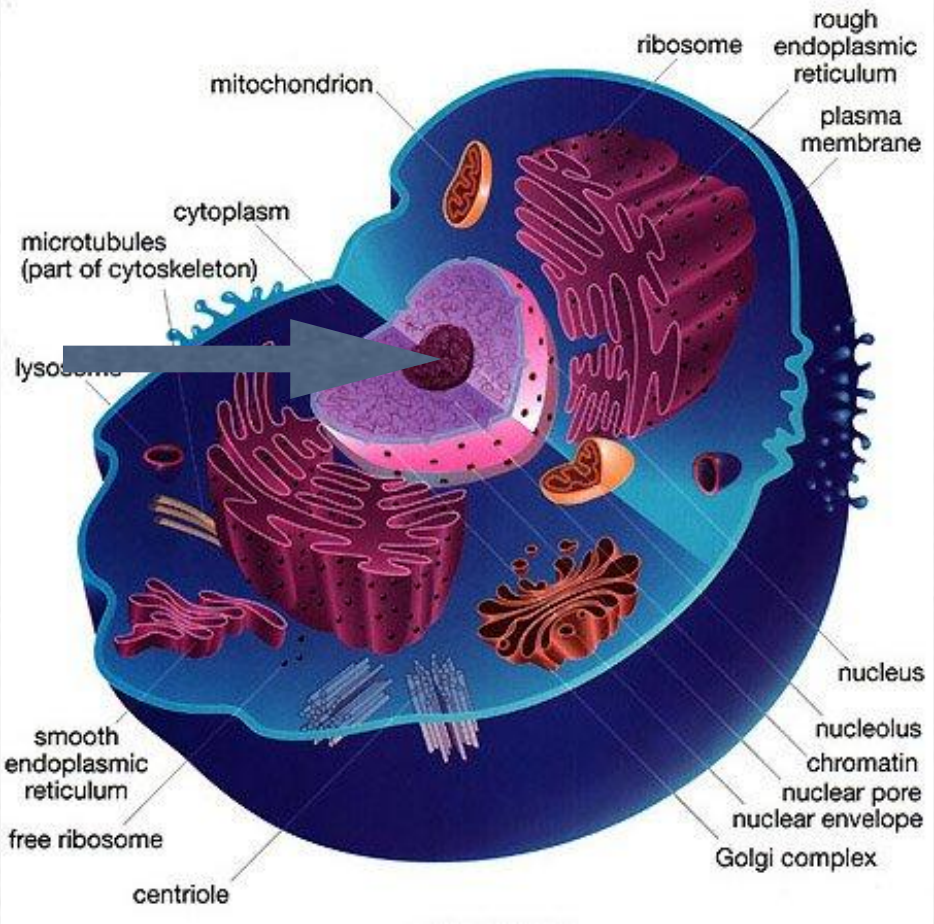
- Cell membrane
  - Surrounds cell; controls what enters/leaves the cell; maintains homeostasis
  - found in <u>all</u> cells



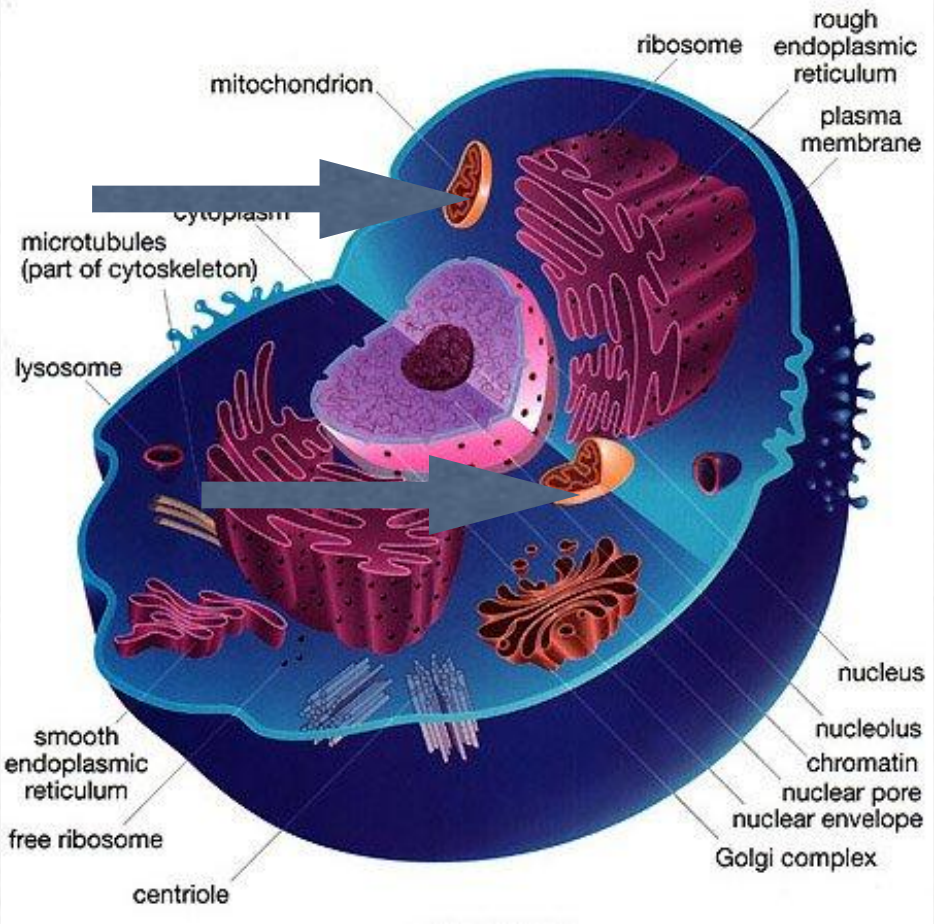
- Nucleus
  - Controls the cell's activities; contains chromosomes made of DNA
  - has pores: holes



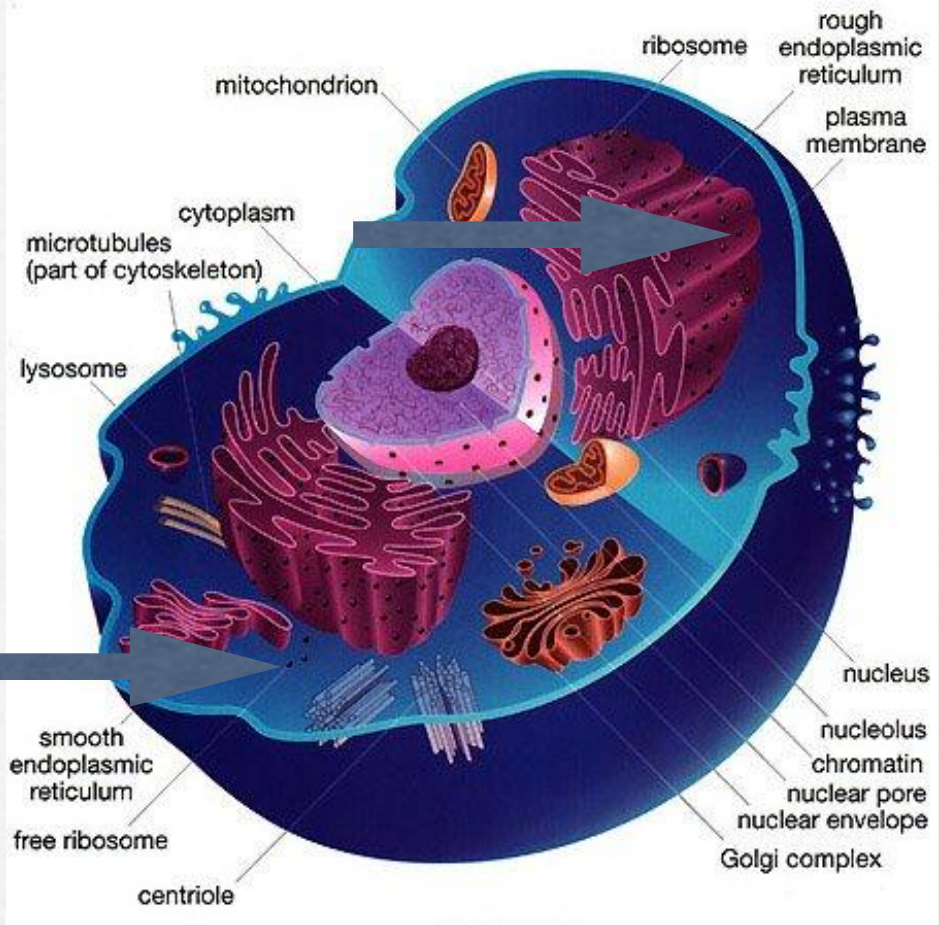
- Nucleolus
  - inside nucleus
  - location of ribosome factory
  - made of RNA



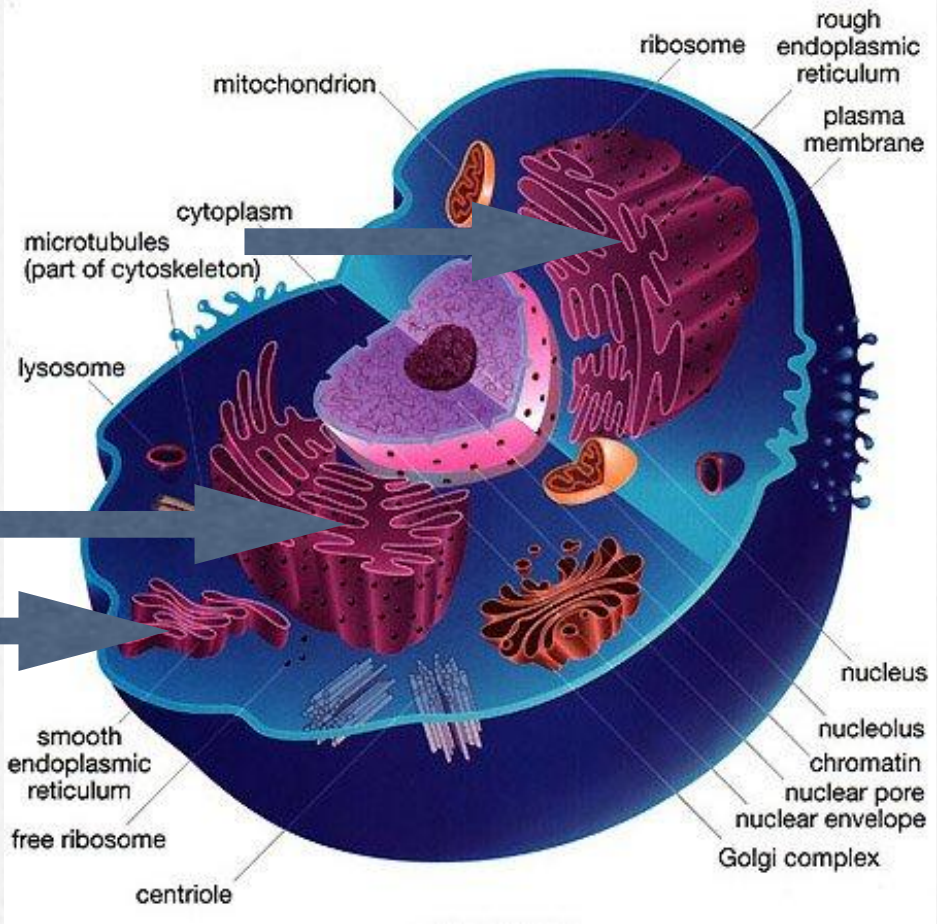
- mitochondrion
  - breaks down food to release energy
  - the more energy the cell needs, the more mitochondria it has



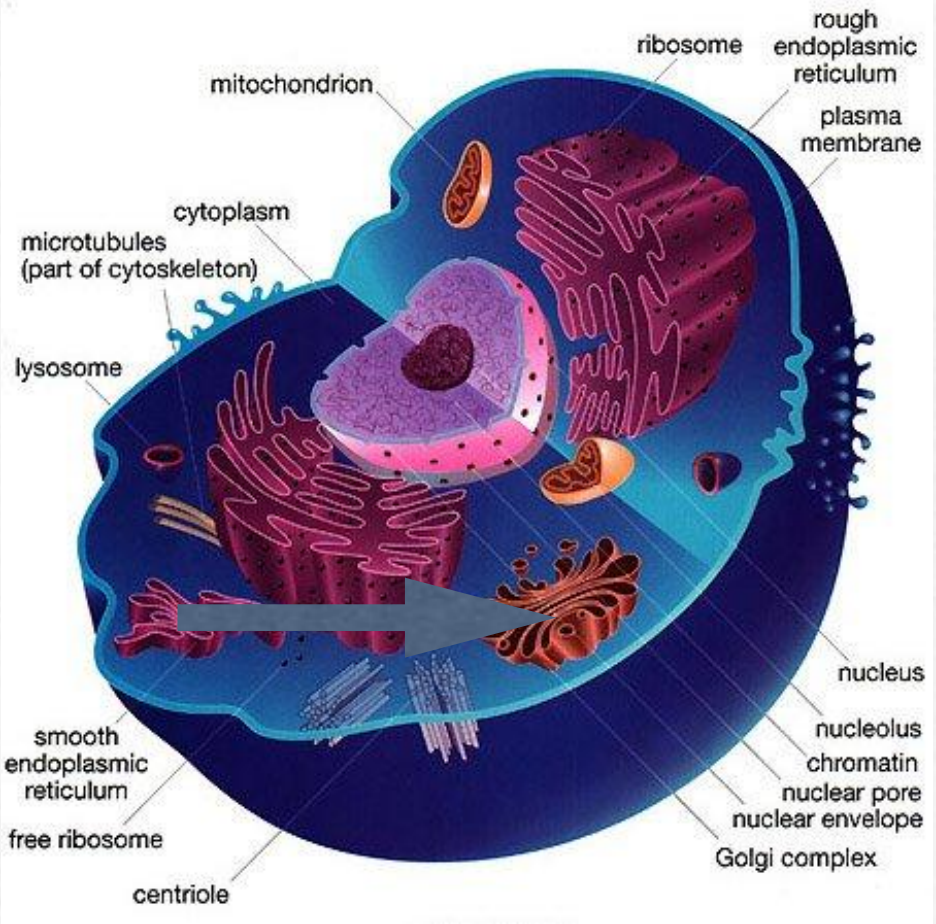
- Ribosomes
  - build proteins from amino acids in cytoplasm
  - may be free-floating, or
  - may be attached to ER
  - made of RNA



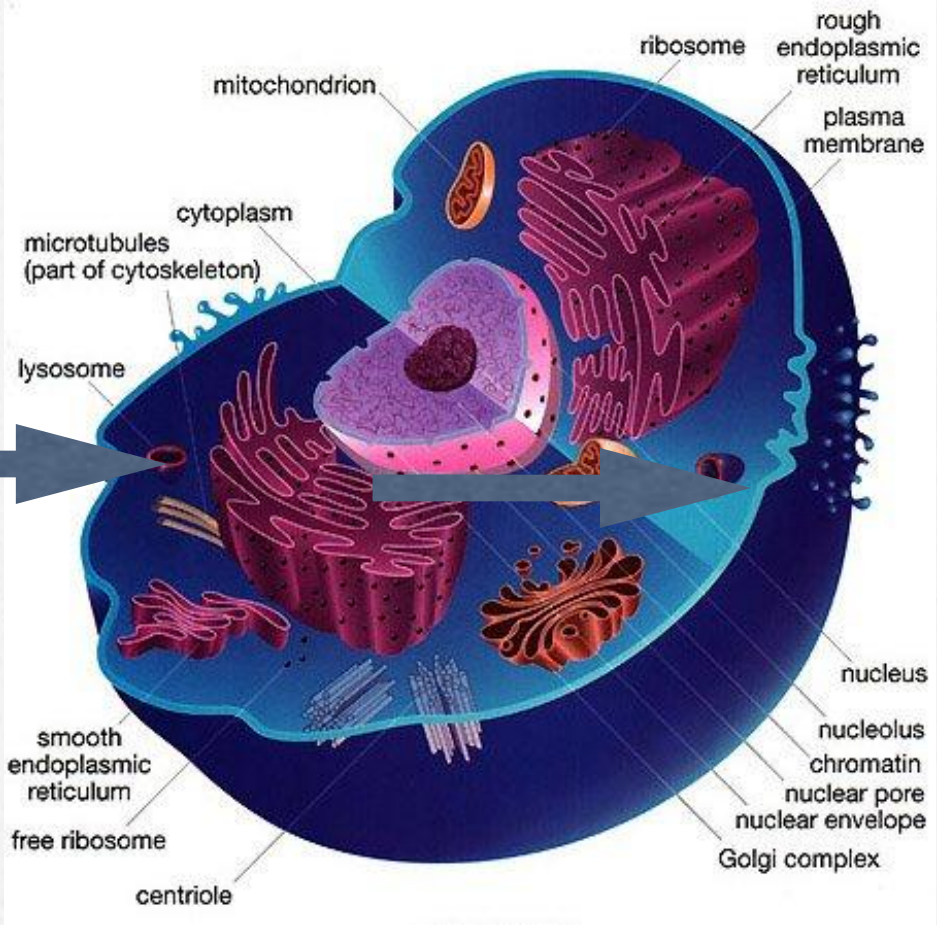
- Endoplasmic reticulum
  - may be smooth: builds lipids and carbohydrates
  - may be rough: stores proteins made by attached ribosomes



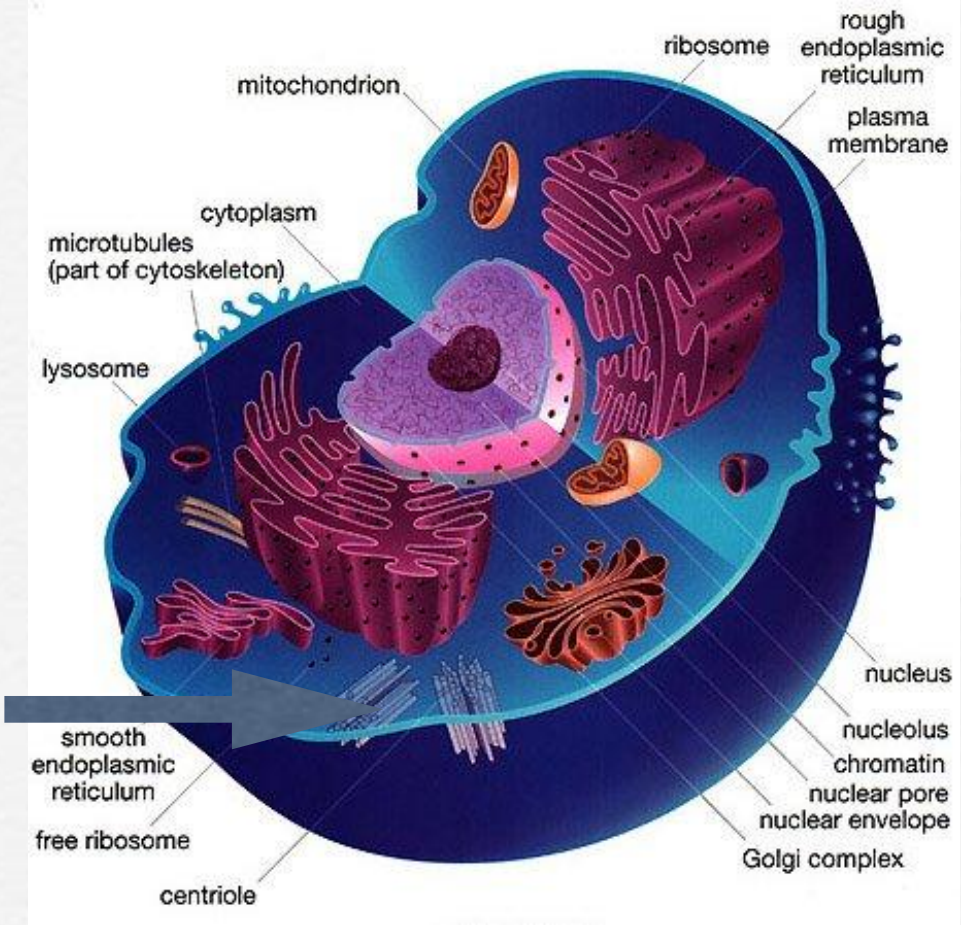
- Golgi Complex
  - Changes and packages cell products



- Lysosomes
  - sacs filled with digestive enzymes
  - digest worn out cell parts
  - digest food absorbed by cell

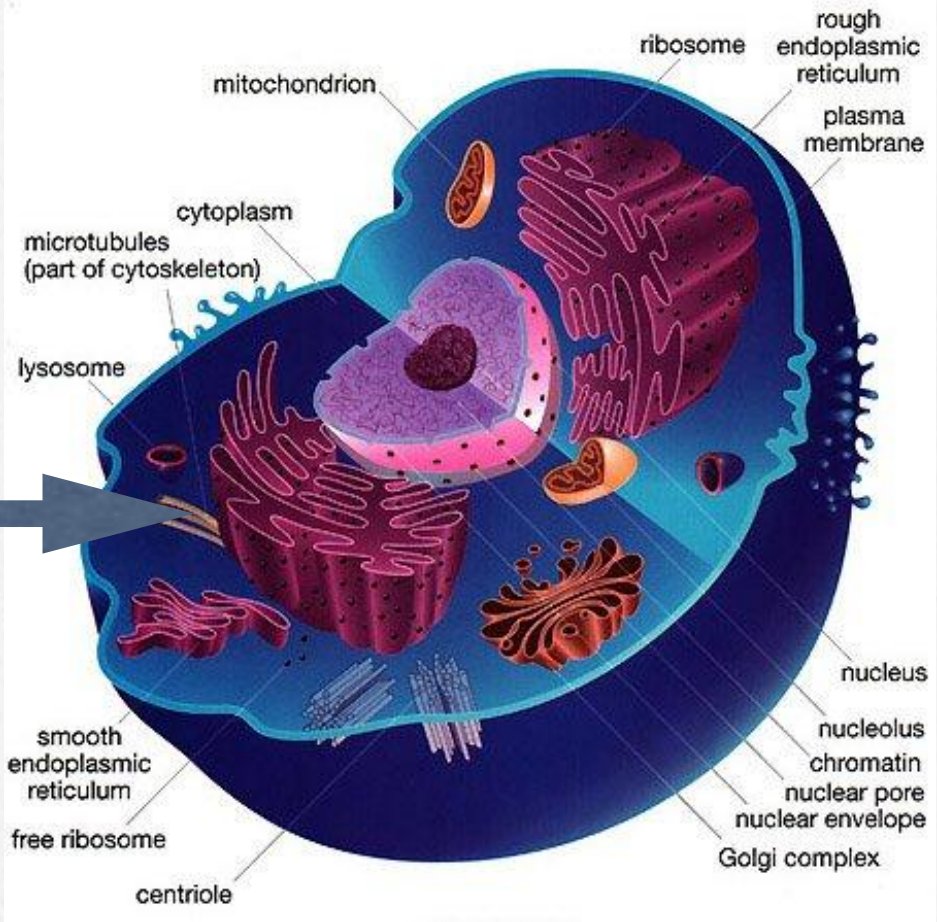


- Centrioles
  - organize cell division
  - pair of bundled tubes



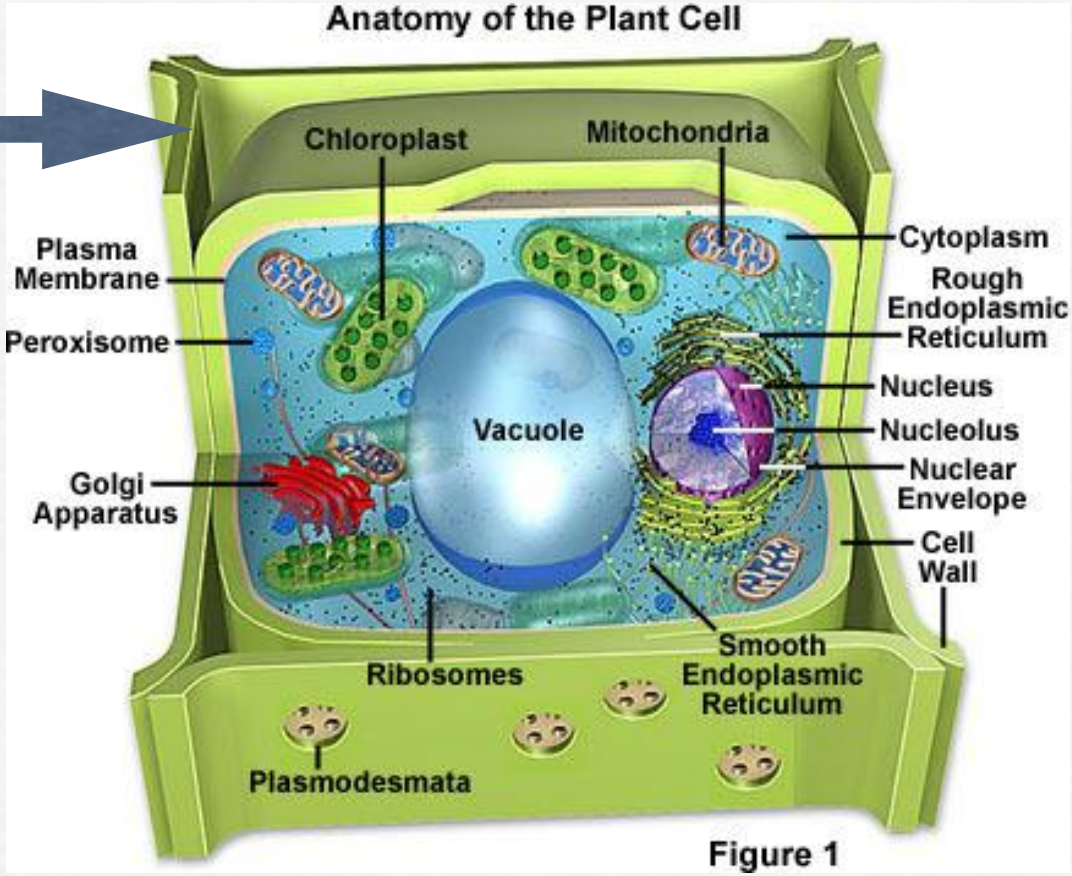
# Cytoskeleton

- made of microtubules
- found throughout cytoplasm
- gives shape to cell & moves organelles around inside.

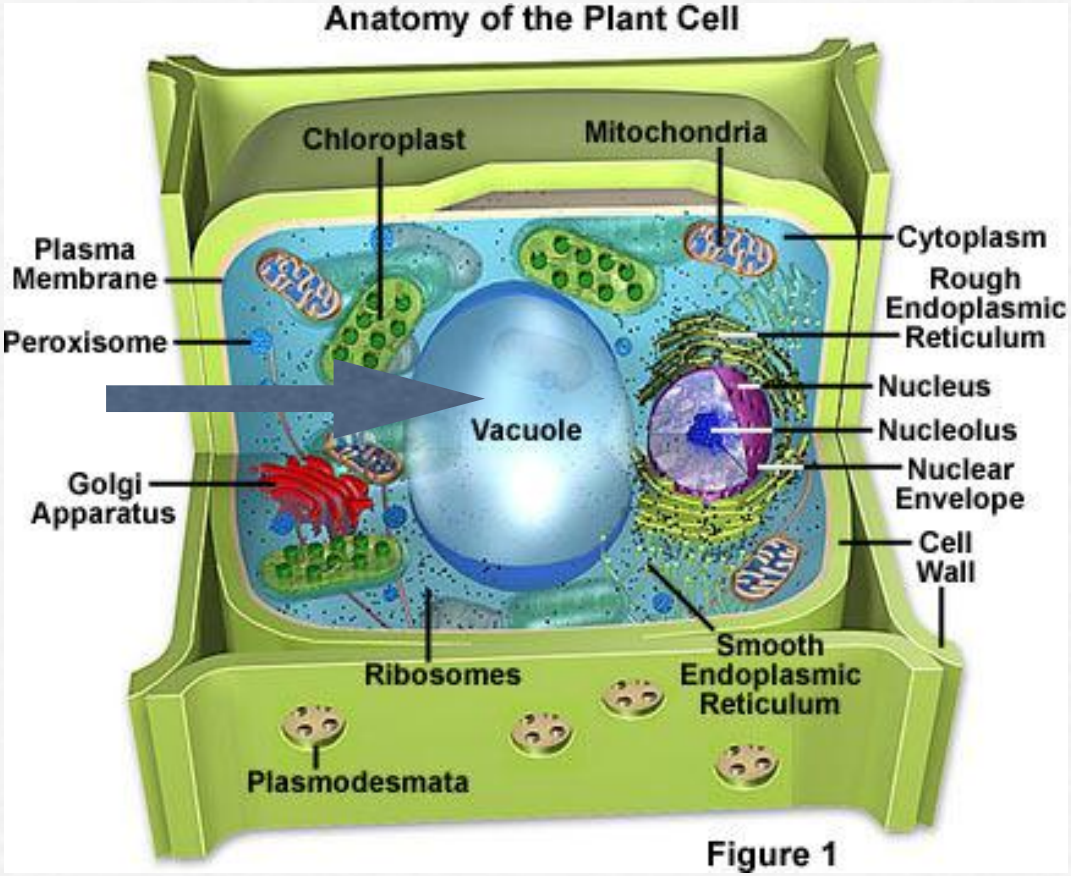


# Structures found in plant cells

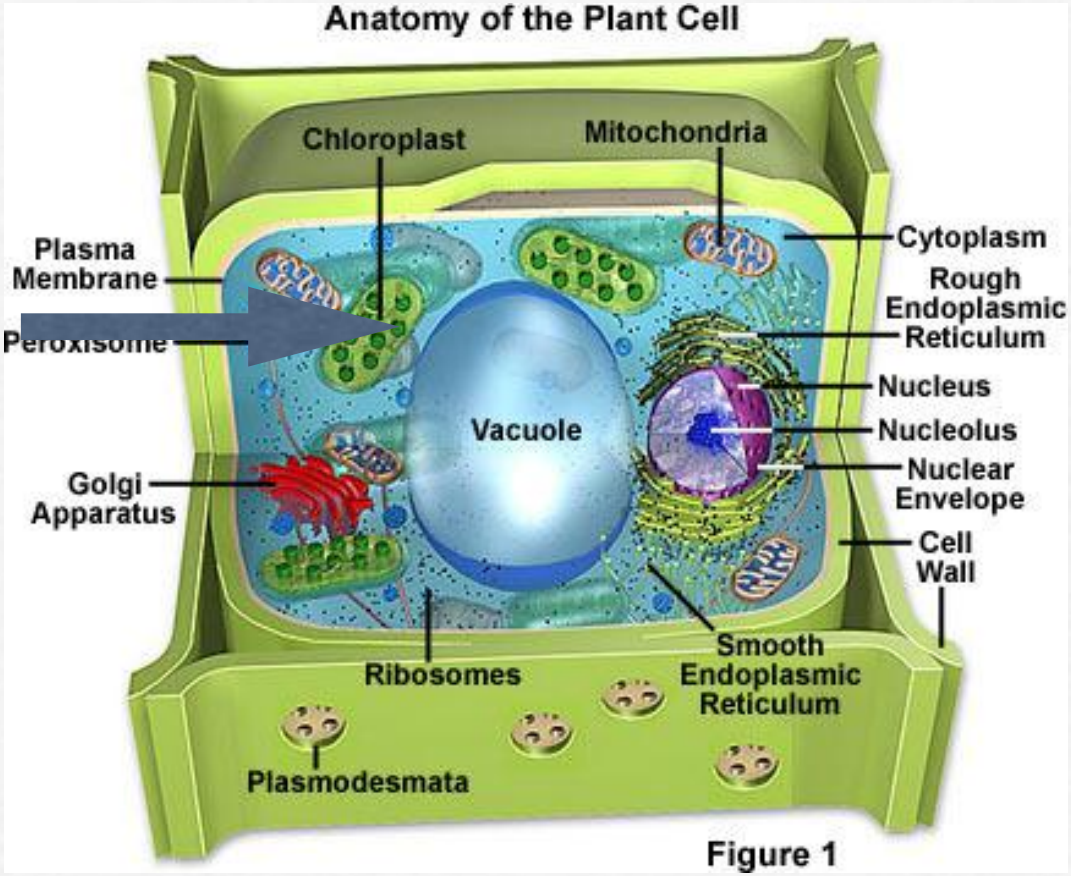
- Cell wall
  - very strong
  - made of cellulose
  - protects cell from rupturing
  - glued to other cells next door



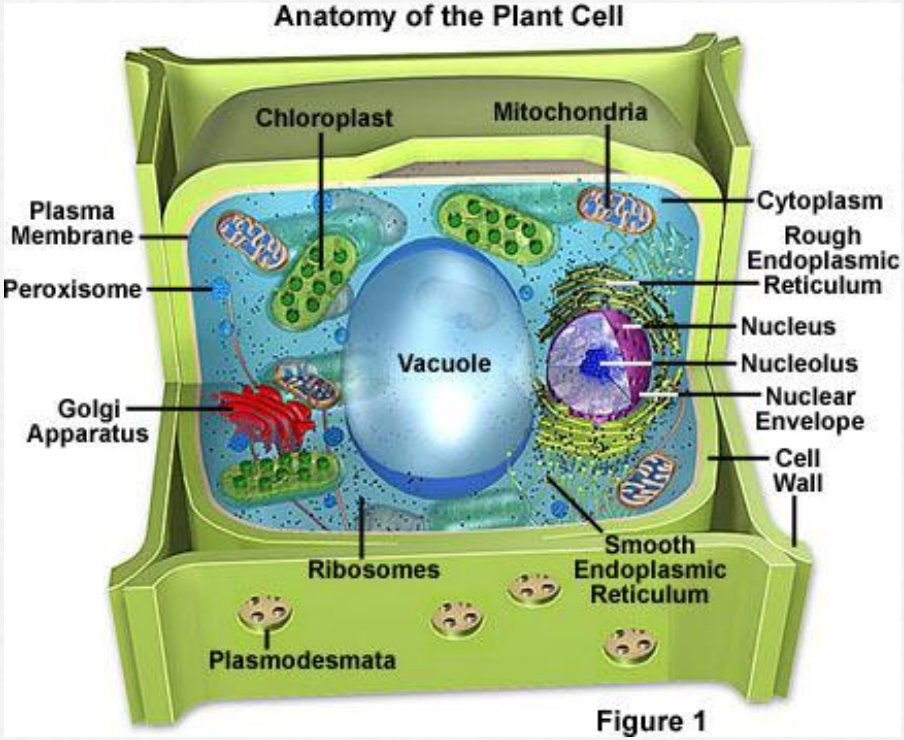
- Vacuole
  - huge water-filled sac
  - keeps cell pressurized
  - stores starch

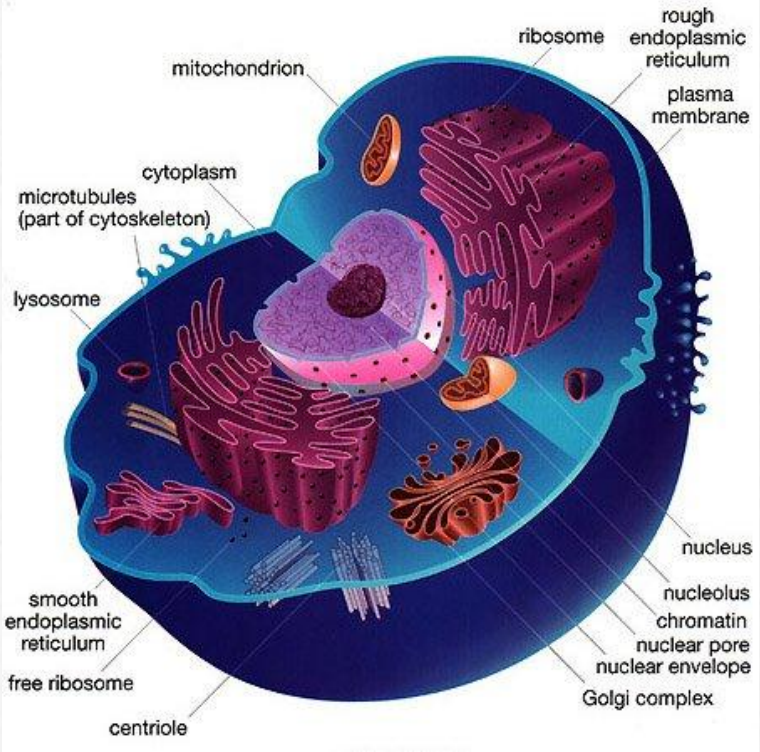


- Chloroplasts
  - filled with chlorophyll
  - turn solar energy into food energy (photosynthesis)



# How are plant and animal cells different?



| Structure | Animal cells | Plant cells |
|---|---|---|
| cell membrane | Yes | yes |
| nucleus | Yes | yes |
| nucleolus | yes | yes |
| ribosomes | yes | yes |
| ER | yes | yes |
| Golgi | yes | yes |
| centrioles | yes | no |
| cell wall | no | yes |
| mitochondria | yes | yes |
| cholorplasts | no | yes |
| One big vacuole | no | yes |
| cytoskeleton | yes | Yes |

# Eukaryote cells can be multicellular

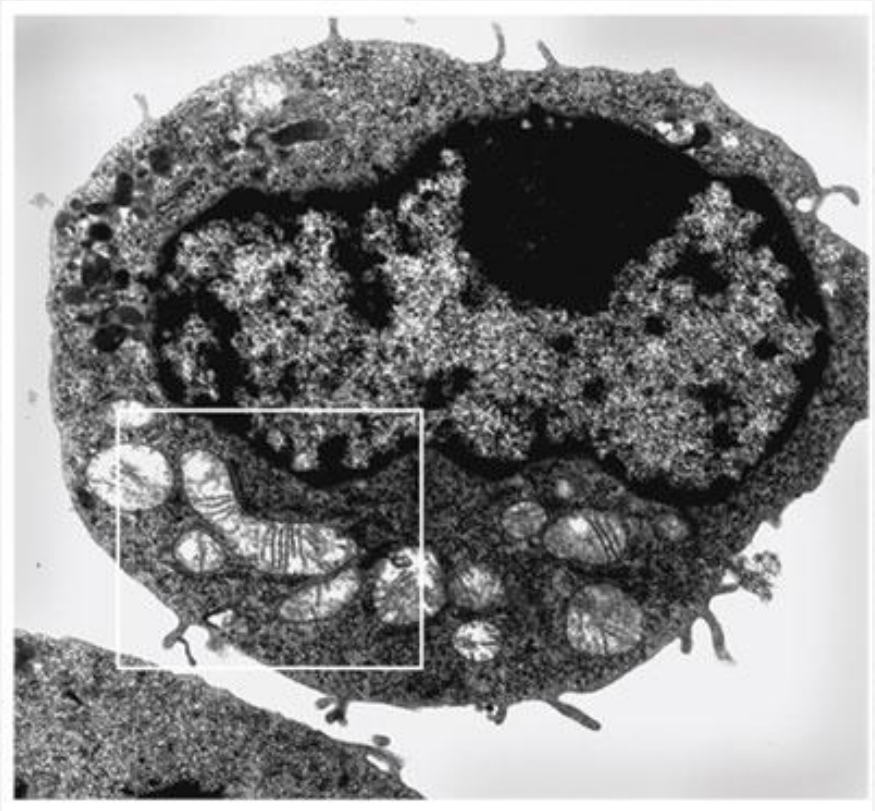
- The whole cell can be specialized for one job
- cells can work together as tissues
- Tissues can work together as organs

# Advantages of each kind of cell architecture

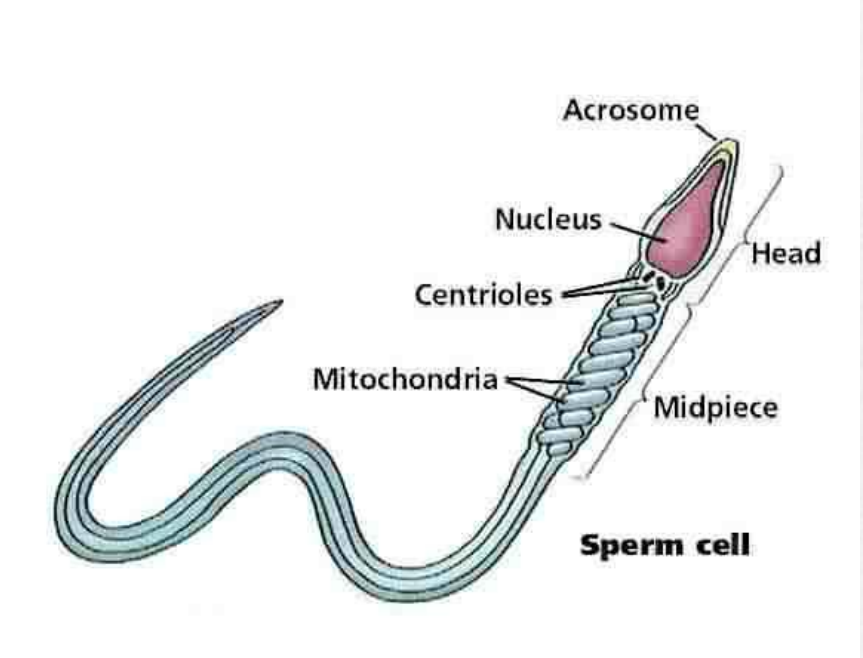
| Prokaryotes | Eukaryotes |
| --- | --- |
| simple and easy to grow | can specialize |
| fast reproduction | multicellularity |
| all the same | can build large bodies |

# Examples of specialized euk. cells

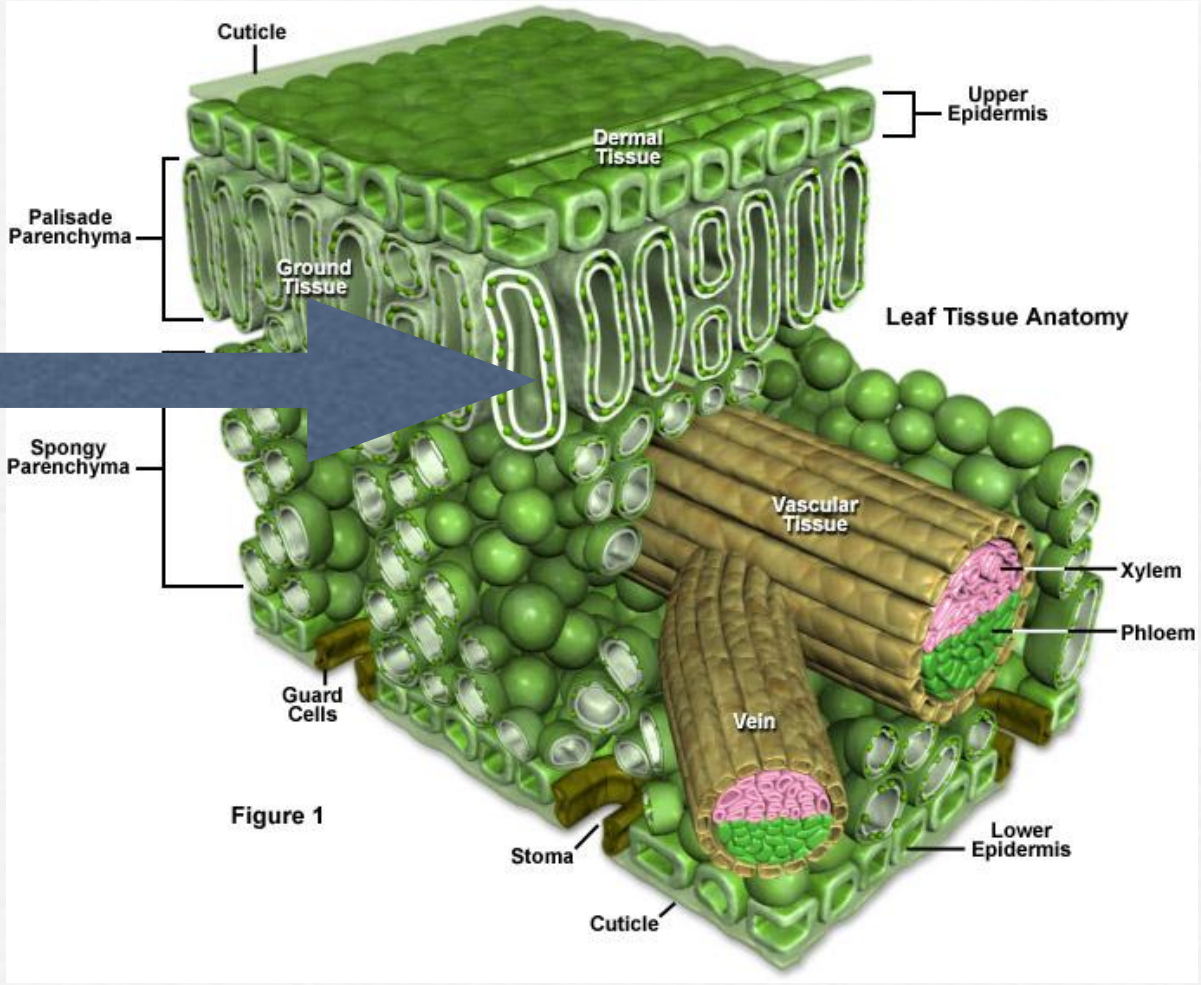
- liver cell: specialized to detoxify blood and store glucose as glycogen.



- sperm cell: specialized to deliver DNA to egg cell



- Mesophyll cell
  - specialized to capture as much light as possible
  - inside a leaf

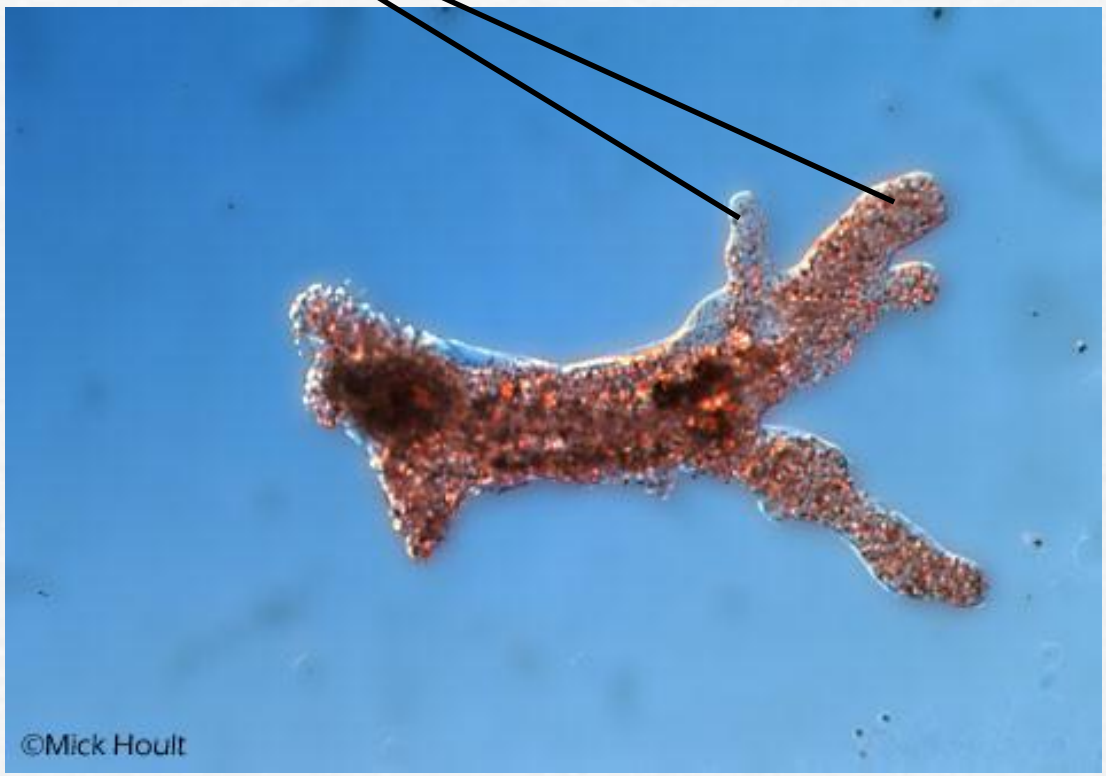


# How do animal cells move?

- Some can crawl with pseudopods
- Some can swim with a flagellum
- Some can swim very fast with cilia

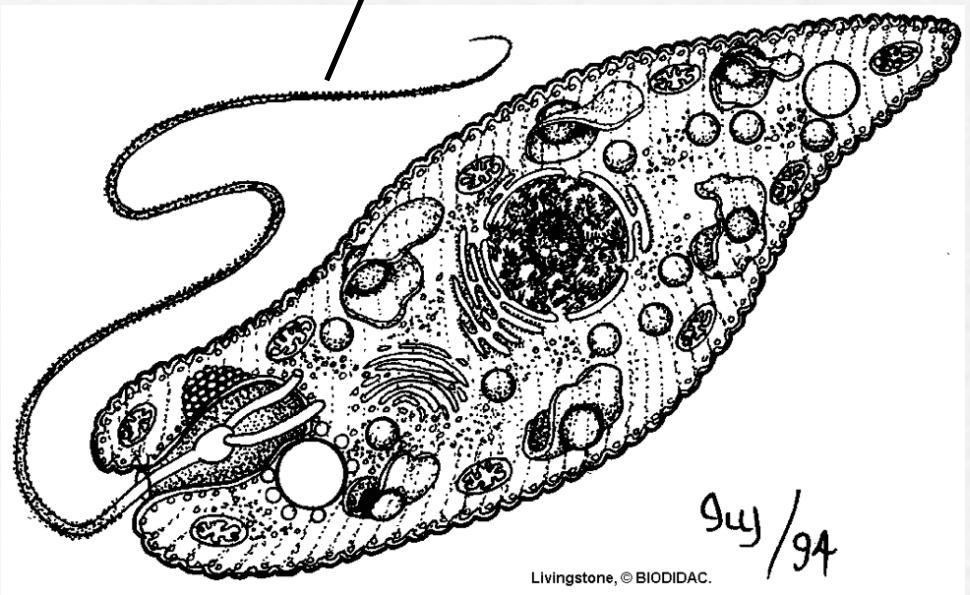
# Pseudopods

- means “fake feet”
- extensions of cell membrane
- example: ameoba



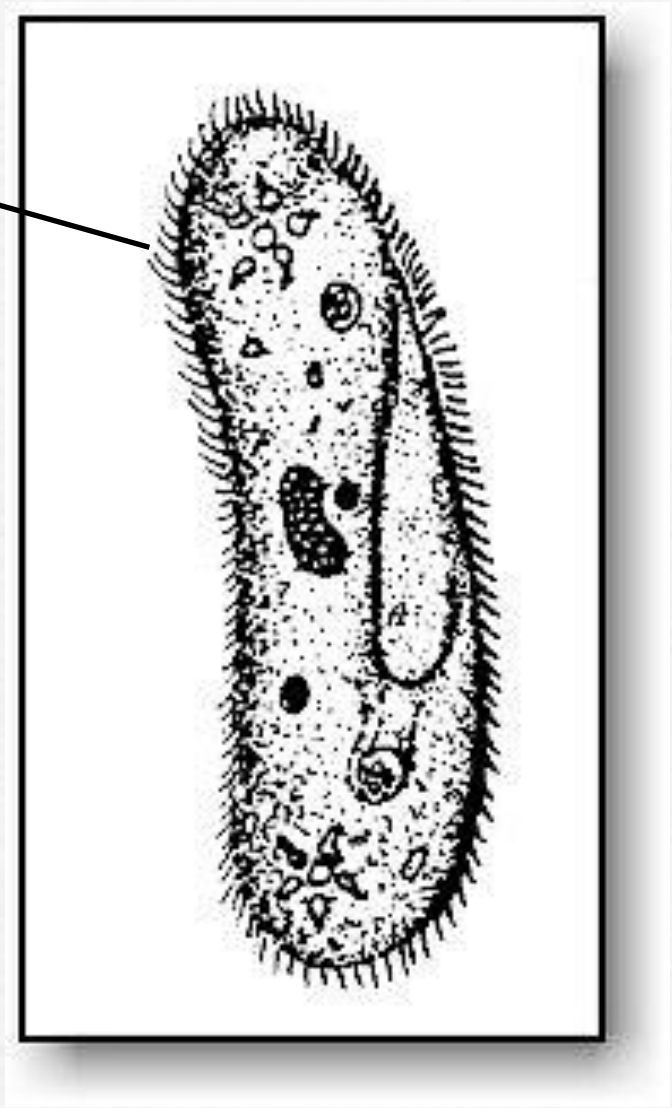
# Flagellum/flagella

- large whiplike tail
- pushes or pulls cell through water
- can be single, or a pair



# Cilia

- fine, hairlike extensions
- attached to cell membrane
- beat in unison



# How did organelles evolve?

- many scientists theorize that eukaryotes evolved from prokaryote ancestors.
- in 1981, Lynn Margulis popularized the “endosymbiont theory.”

# Endosymbiont theory:

- a prokaryote ancestor “eats” a smaller prokaryote
- the smaller prokaryote evolves a way to avoid being digested, and lives inside its new “host” cell kind of like a pet.

Endo = inside

Symbiont = friend

- the small prokaryotes that can do photosynthesis evolve into chloroplasts, and “pay” their host with glucose.
- The smaller prokaryotes that can do aerobic respiration evolve into mitochondria, and convert the glucose into energy the cell can use.
- Both the host and the symbiont benefit from the relationship

- Chlorella are tiny green cells that live inside some amoeba... endosymbiosis may still be evolving today!