Cell – The fundamental unit of life

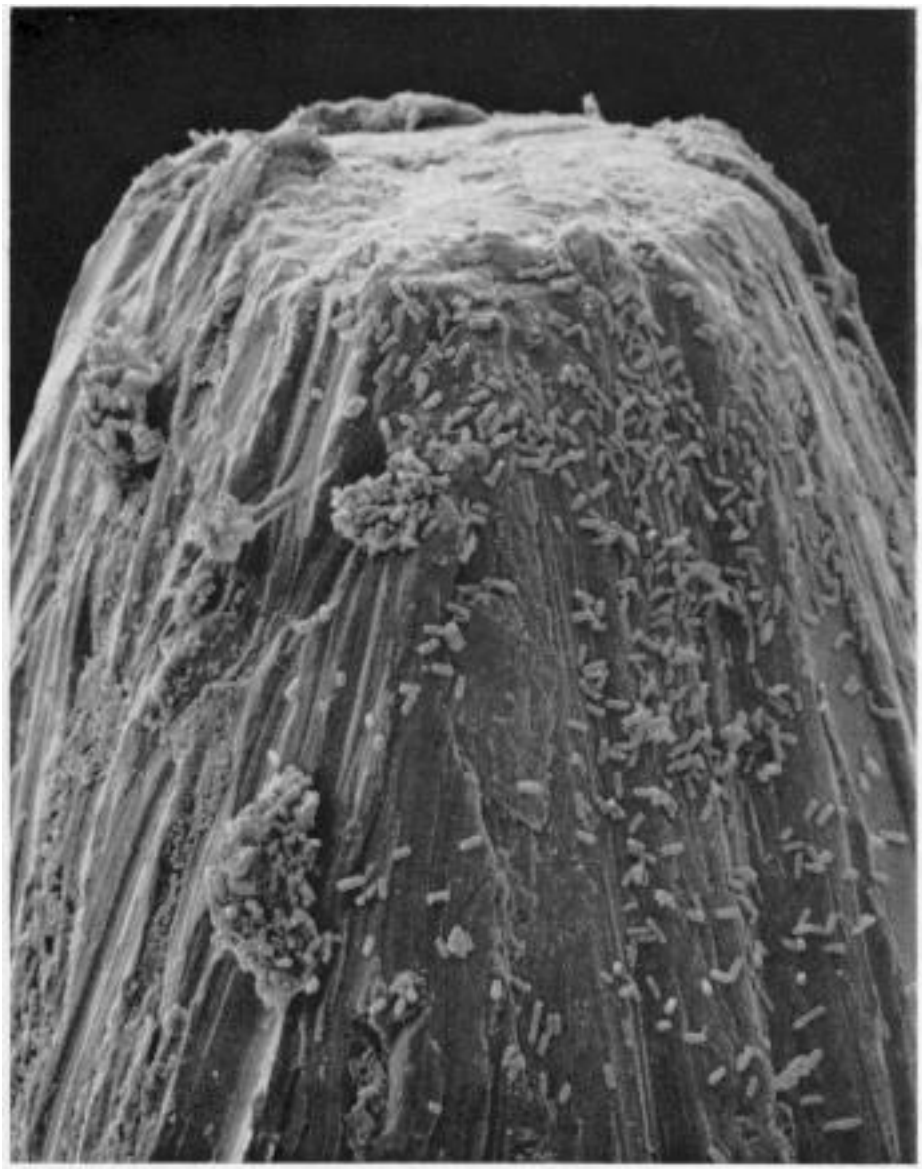
Cells: Prokaryote vs Eukaryote

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 prokar
yote
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

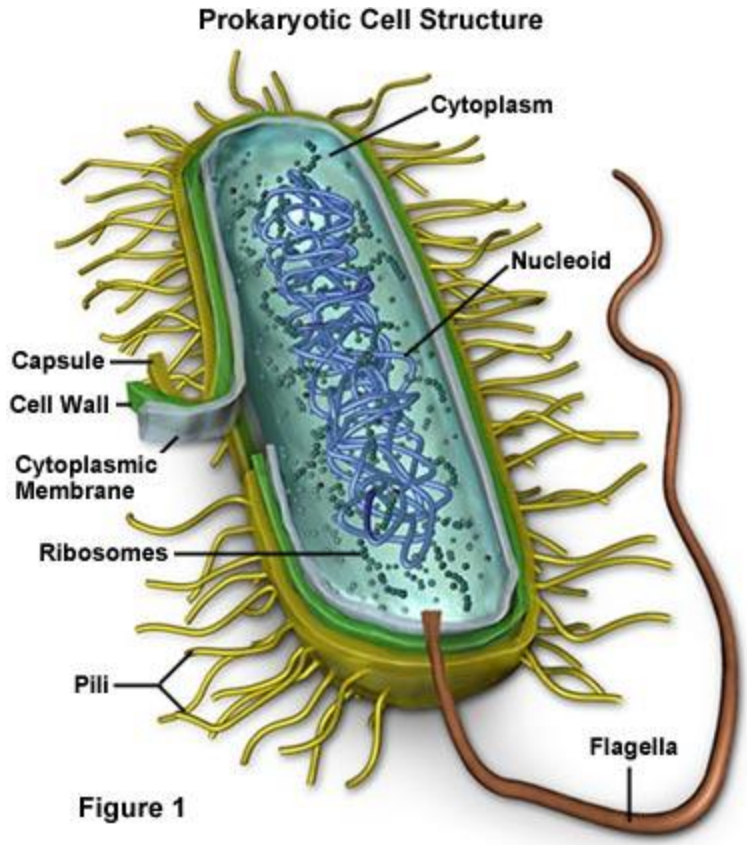
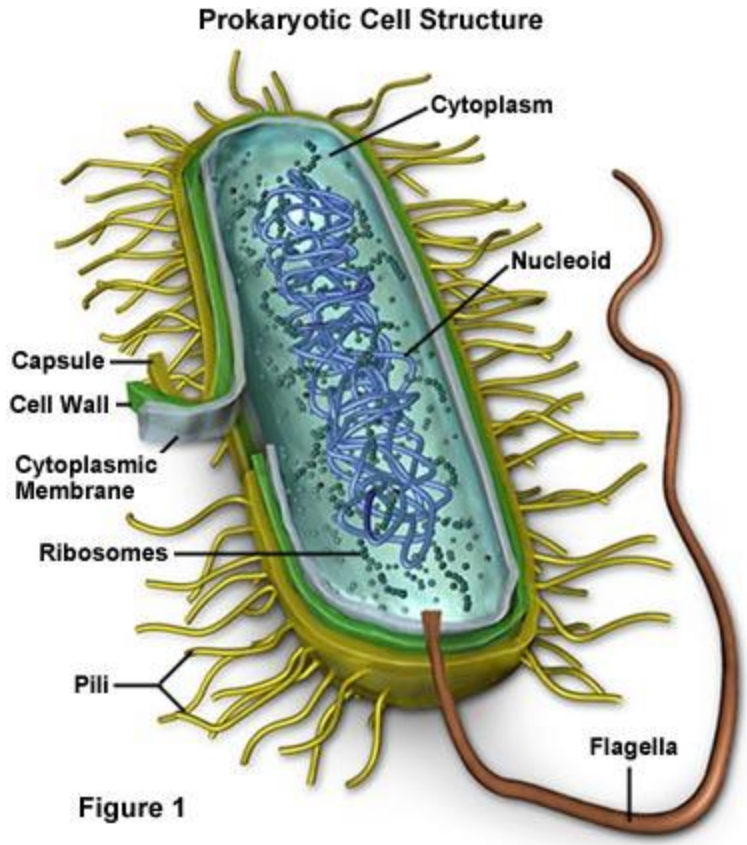


Figure 1

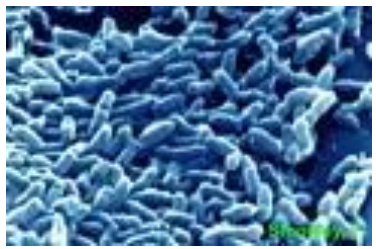
Prokaryote cells are simply built (example: E. coli)

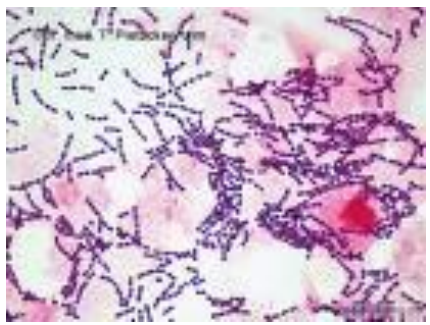
- cytoplasm: inner liquid filling
- DNA in one big loop
- pilli: for sticking to things
- flagella: for swimming
- ribosomes: for building proteins



Prokaryote lifestyle

- unicellular: all alone
- colony: forms a film
- filamentous: forms a chain of cells





Prokaryote Feeding

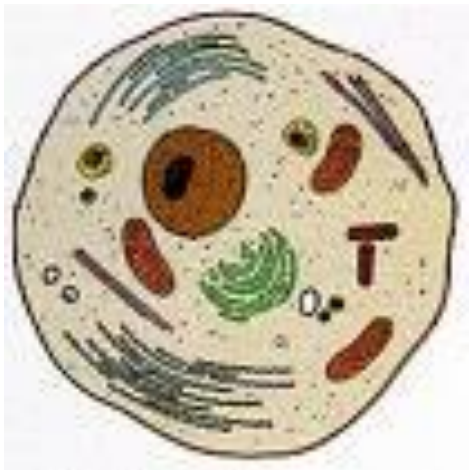
- Photosynthetic: energy from sunlight
- Disease-causing: feed on living things
- Decomposers: feed on dead things

Eukaryotes are bigger and more complicated

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

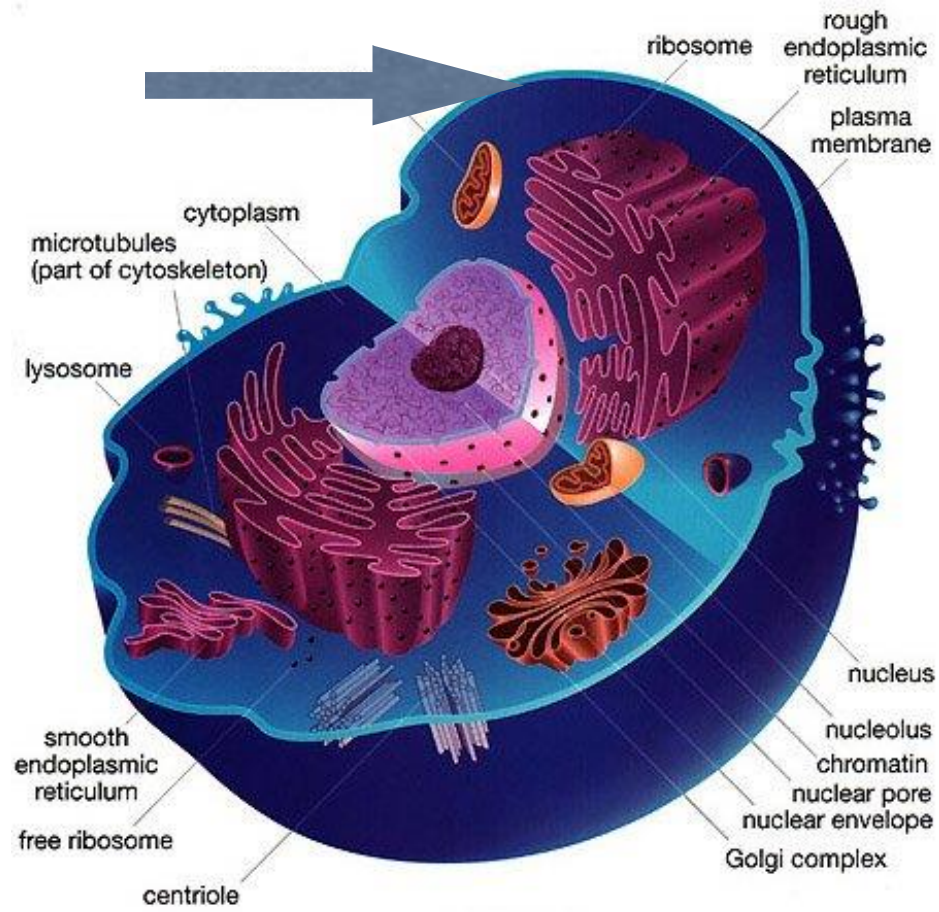
Organelles are membrane-bound cell parts

- Mini “organs” that have un ique structures and functio ns
- Located in cytoplasm

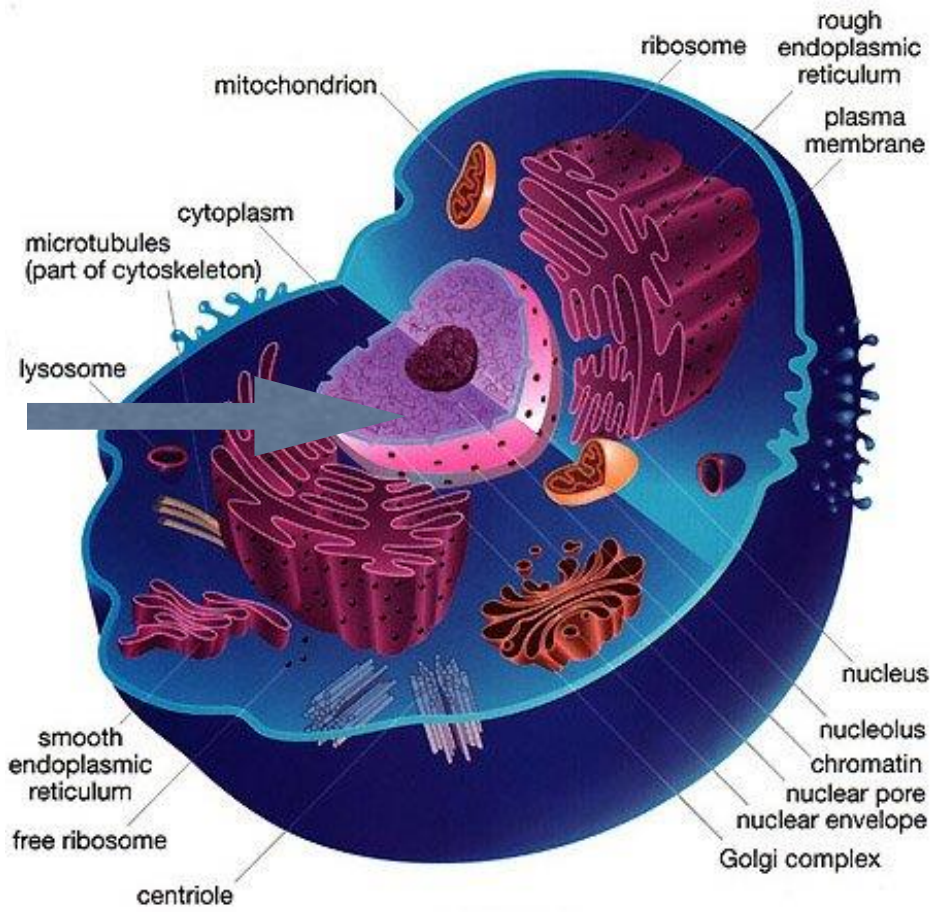


Cell Structures

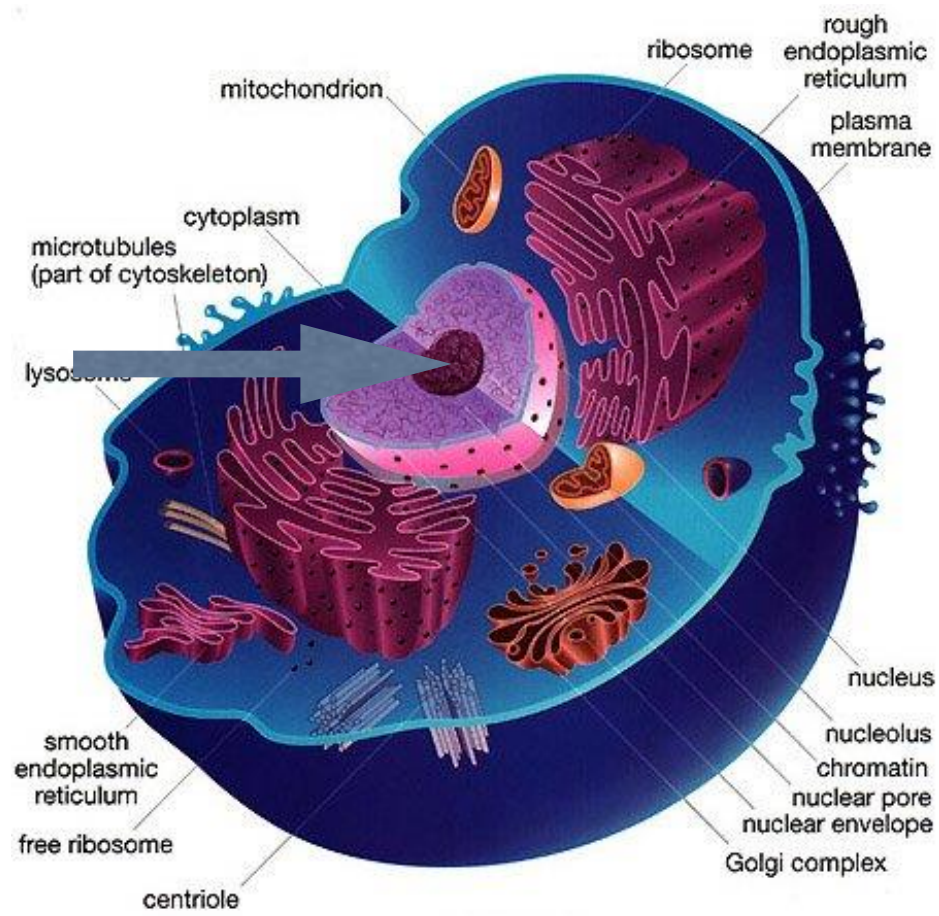
- Cell membrane
  - delicate lipid and protein skin around cytoplasm
  - found in all cells



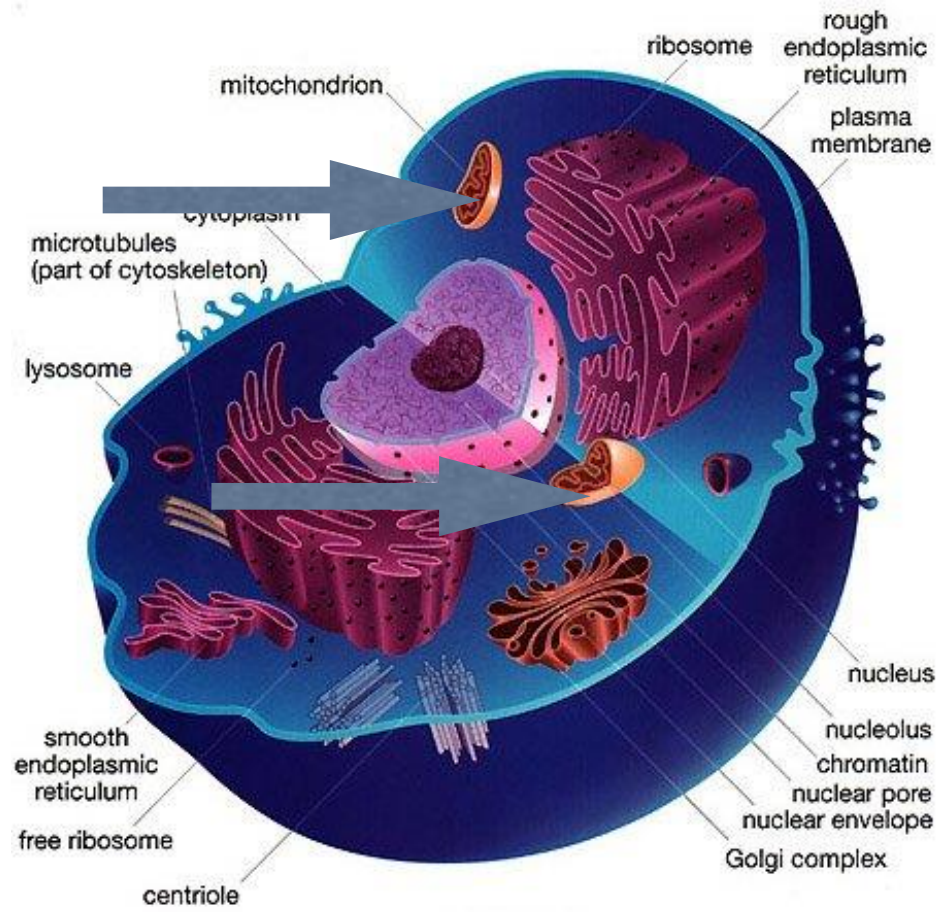
- Nucleus
  - a membrane-bound sac evolved to store the cell's chromosomes(DNA)
  - has pores: holes



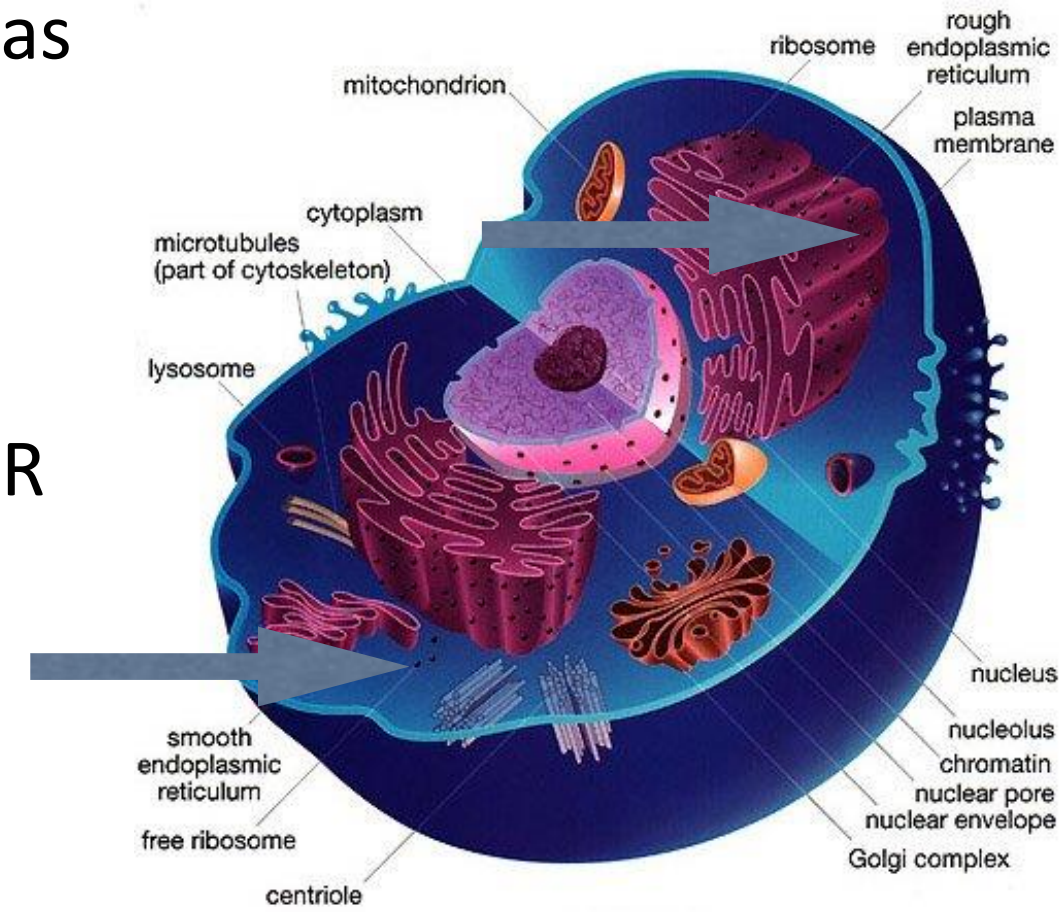
- Nucleolus
  - inside nucleus
  - location of riboso me factory
  - made or RNA



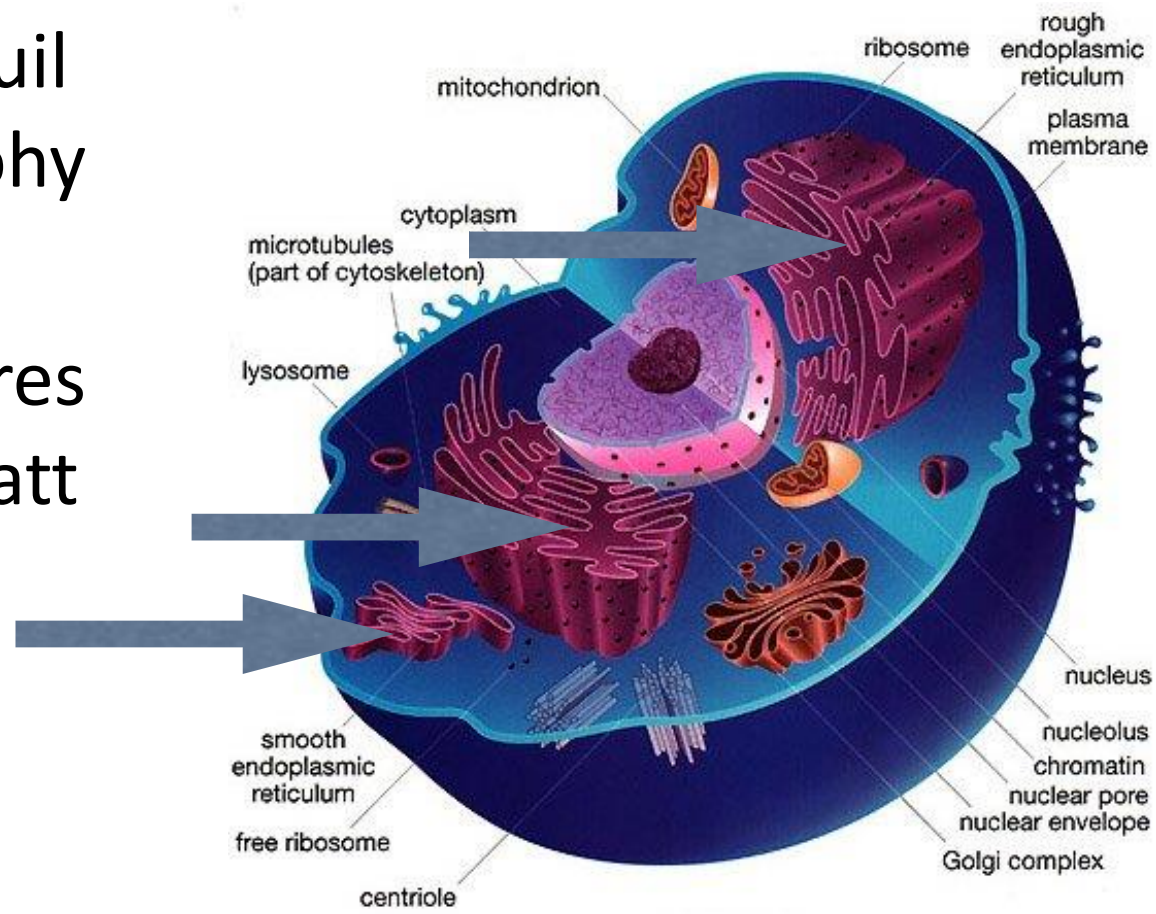
- mitochondrion
  - makes the cell's ene rgy
  - the more energy the cell needs, the more mitochondria it has



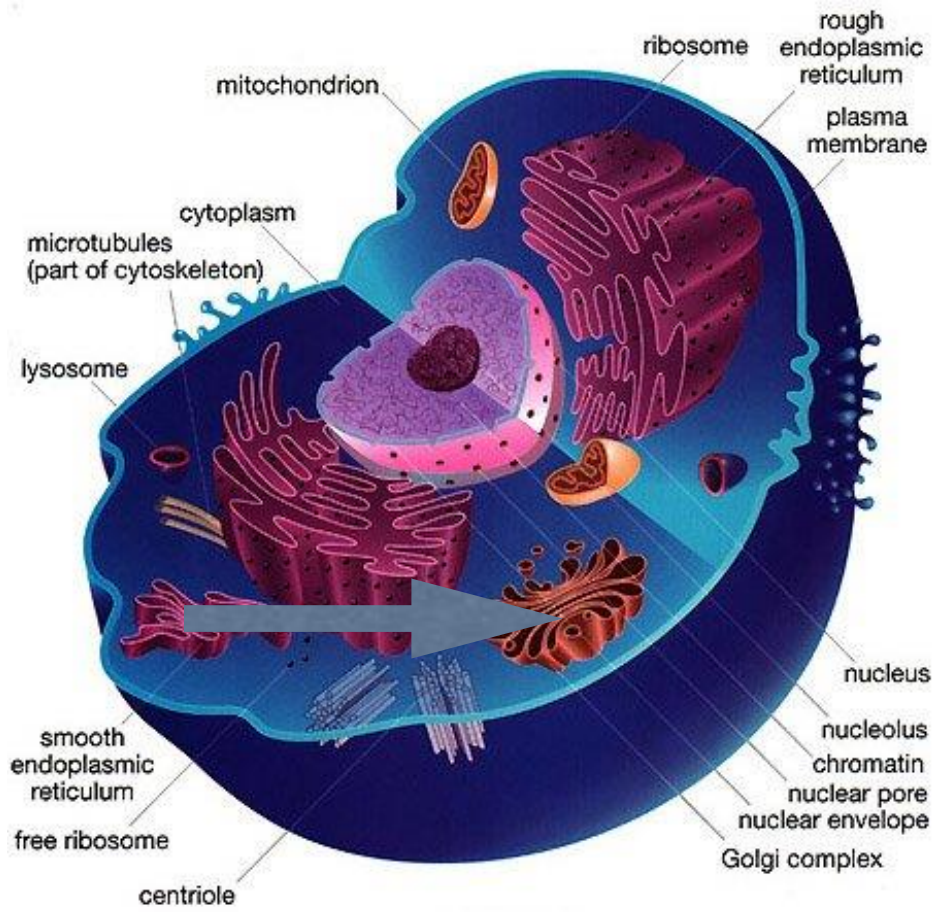
- Ribosomes
  - build proteins from amino acids in cytoplasm
  - may be free-floating, or
  - may be attached to ER
  - made of RNA



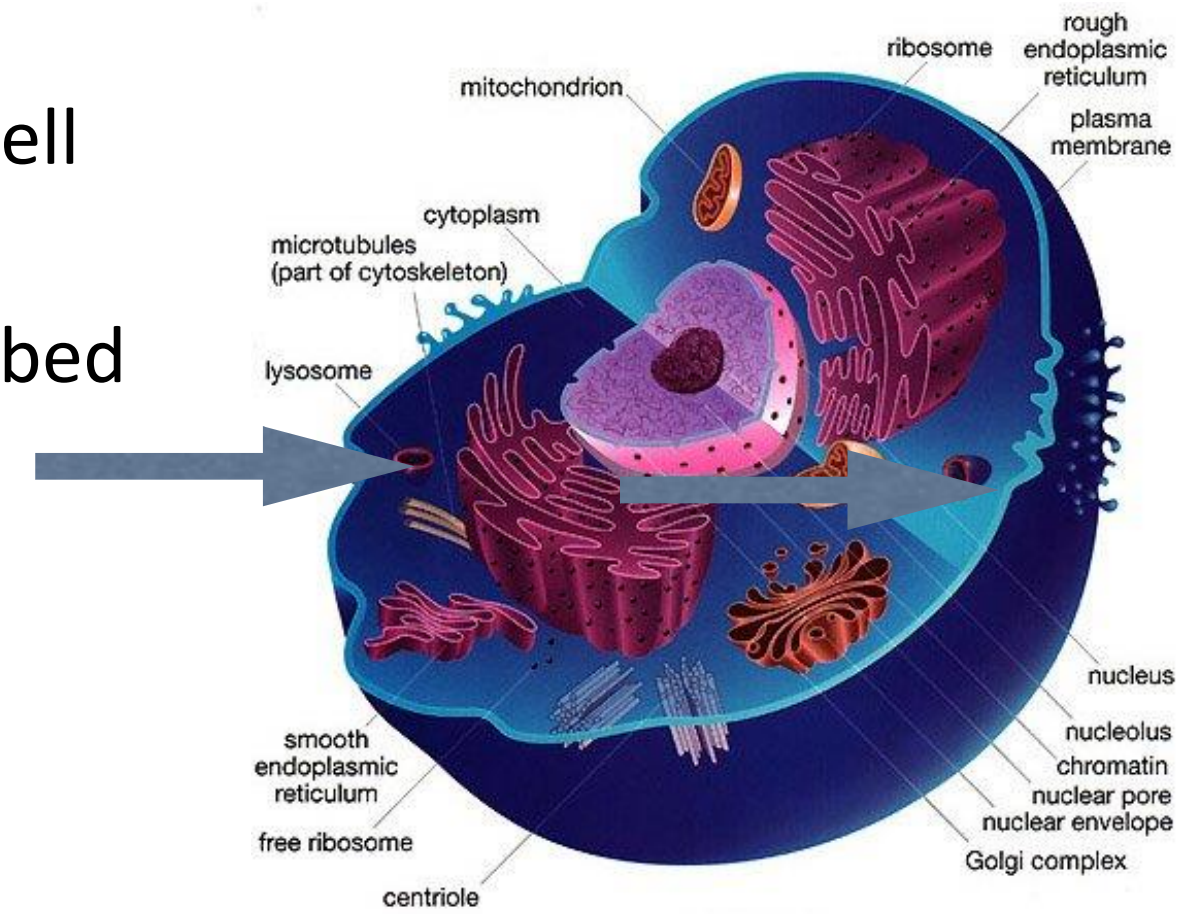
- Endoplasmic reticulum
  - may be smooth: builds lipids and carbohydrates
  - may be rough: stores proteins made by attached ribosomes



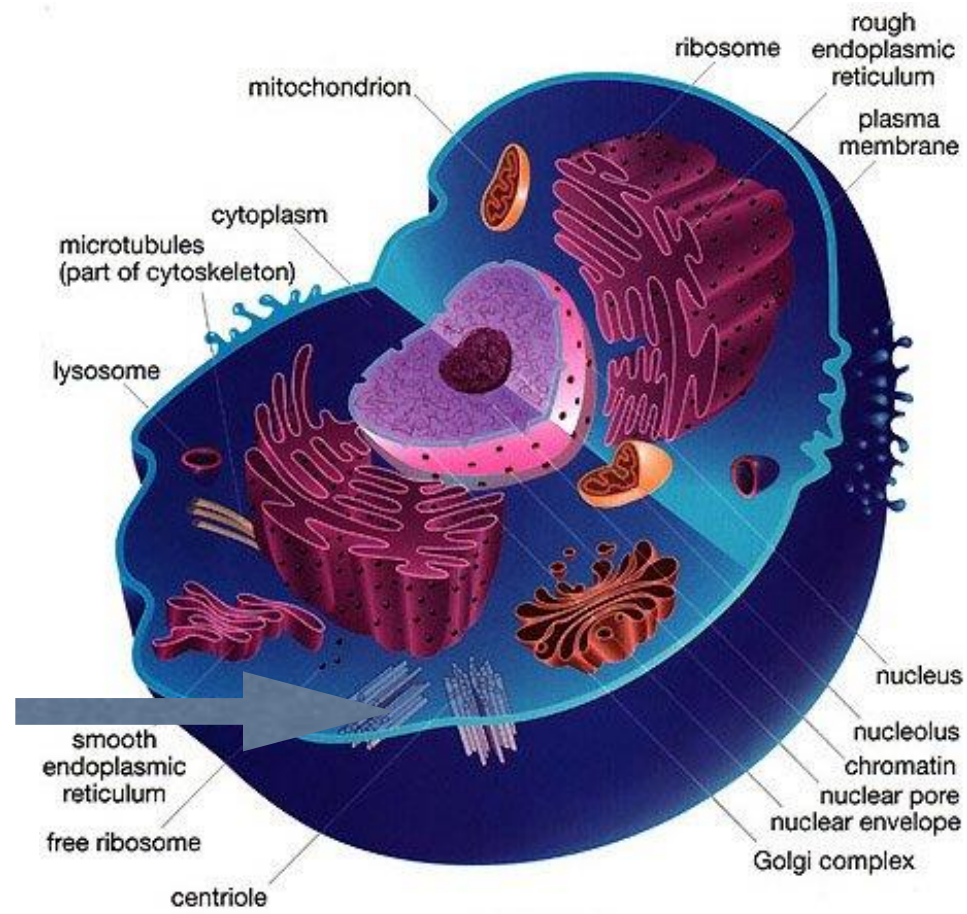
- Golgi Complex
  - takes in sacs of raw material from ER
  - sends out sacs con taining finished cell products



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

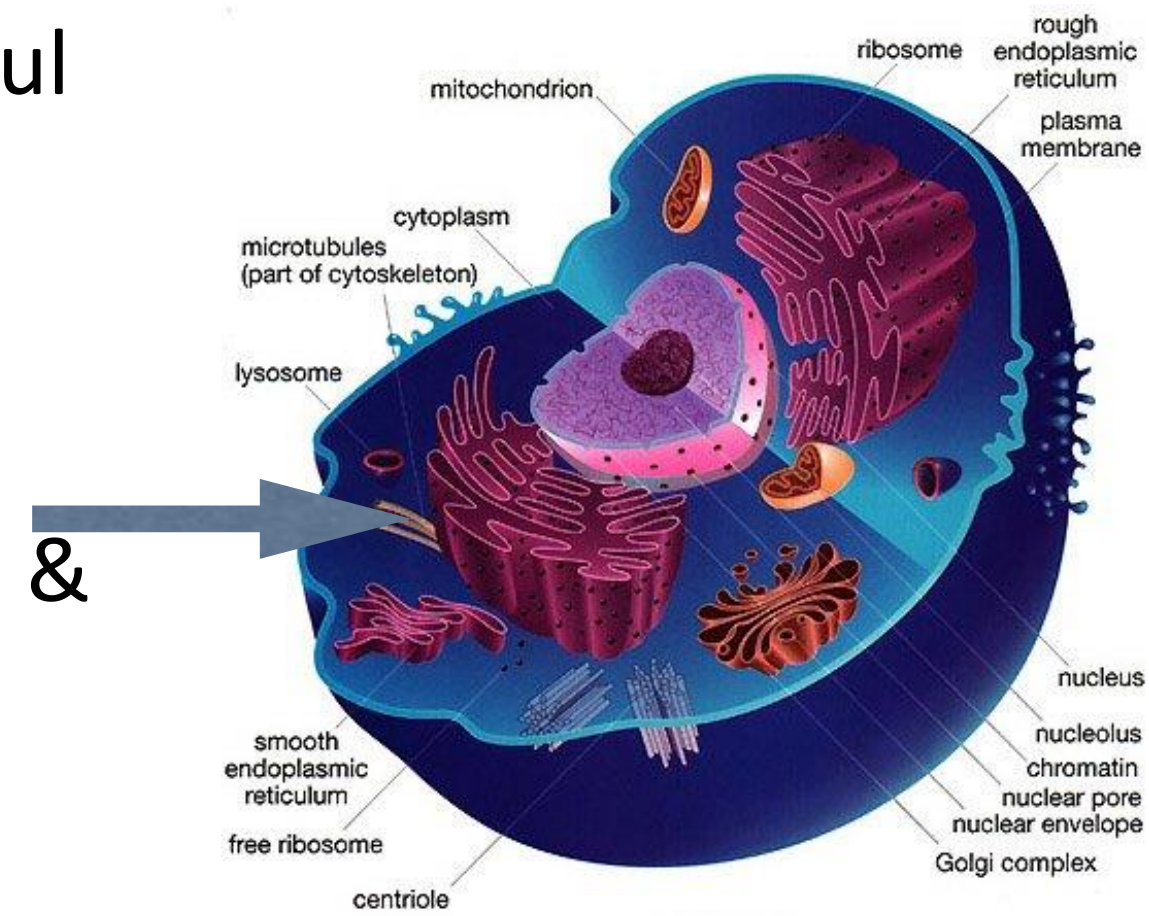


- Centrioles
  - pair of bundled tubes
  - organize cell division



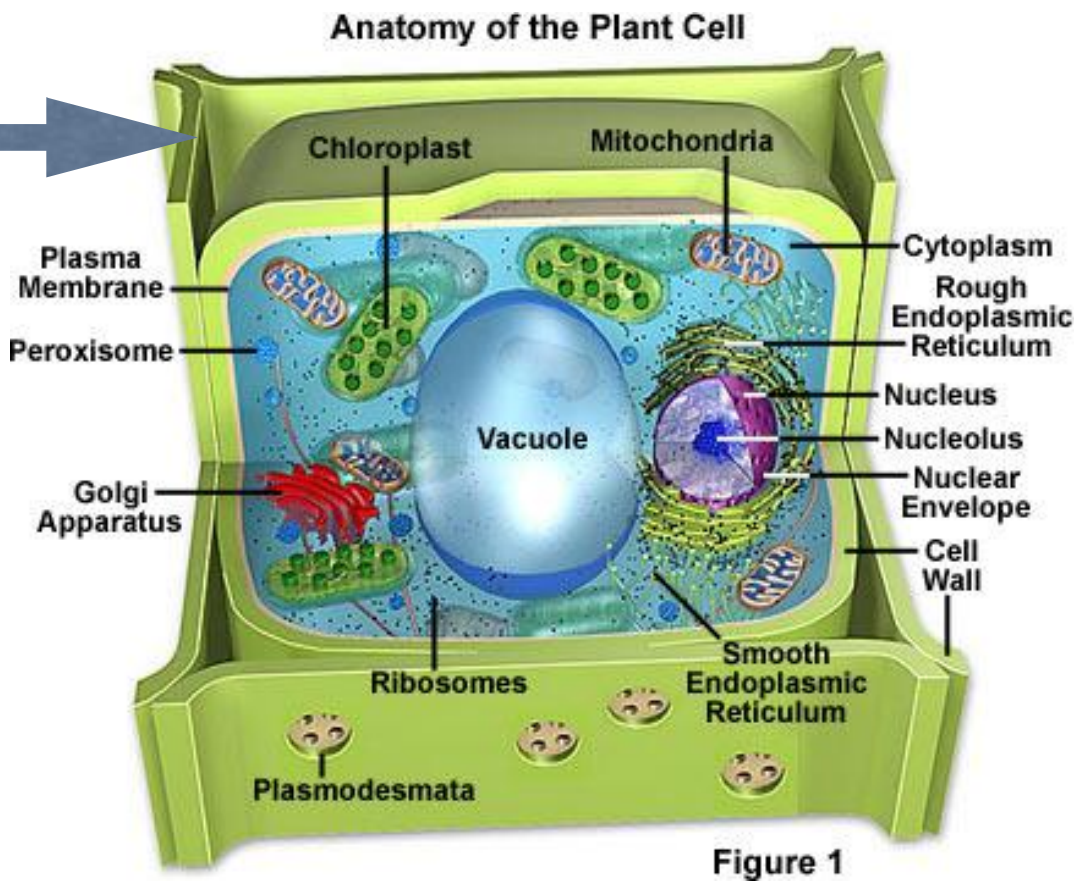
Cytoskeleton

- made of microtubul es
- 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 pressuri zed
  - stores starch

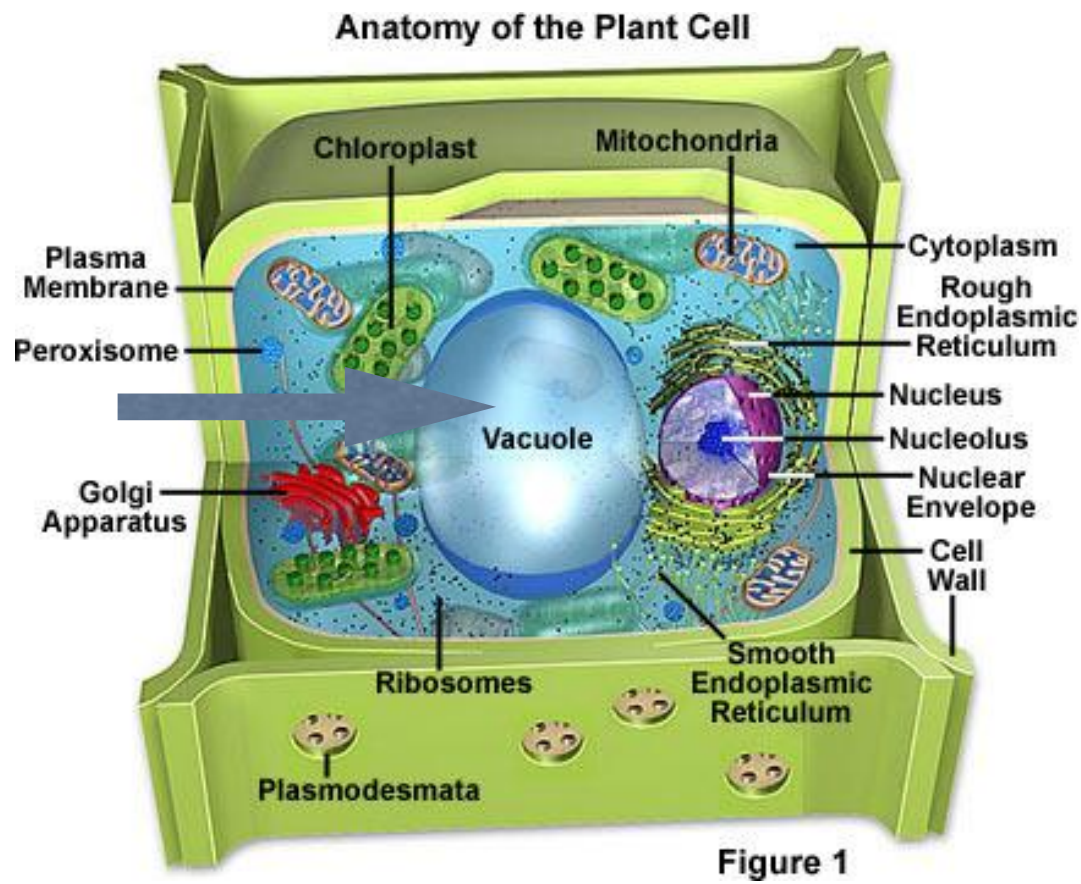


Figure 1

- Chloroplasts
  - filled with chloro phyll
  - turn solar energy into food energy

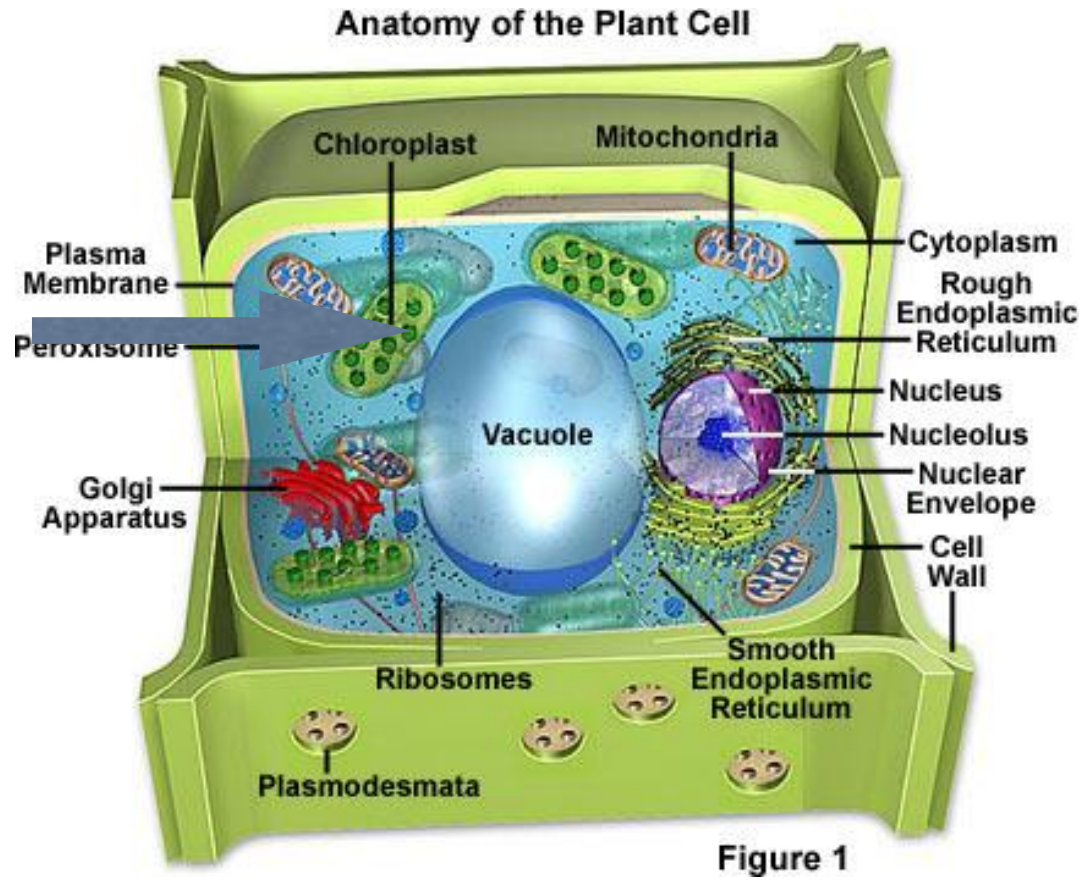
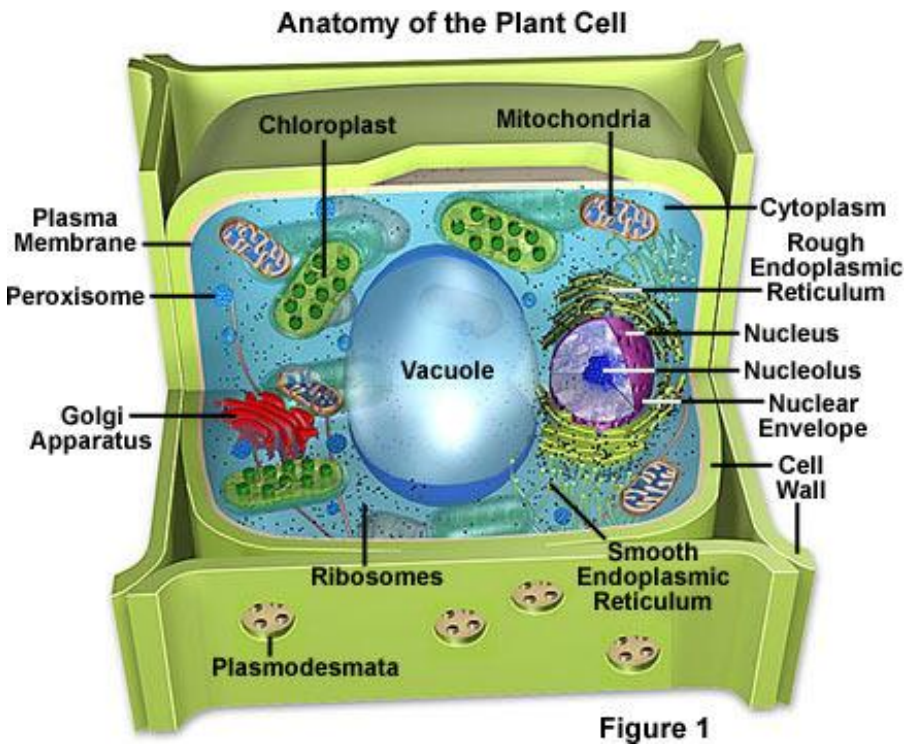
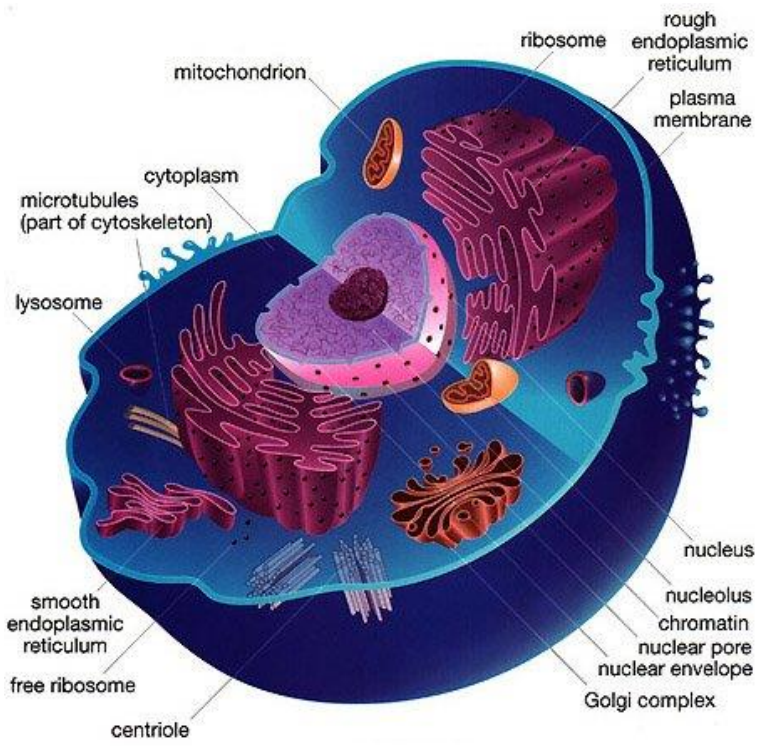


Figure 1

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

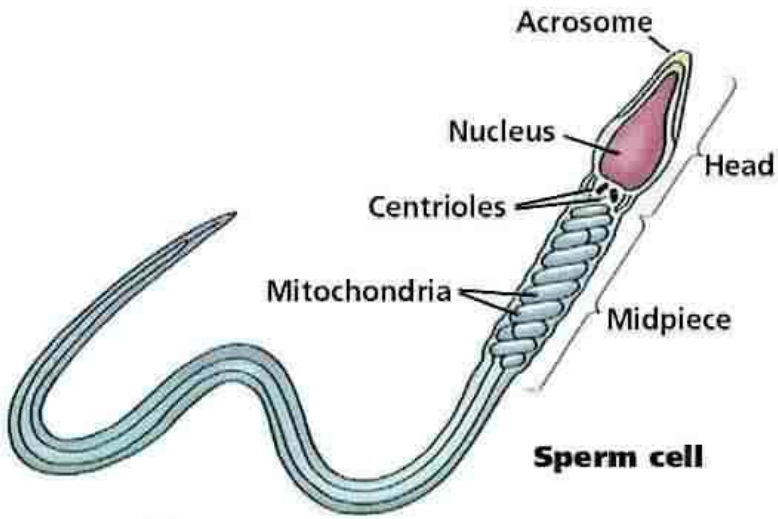
Advantages of each kind of cell architecture

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

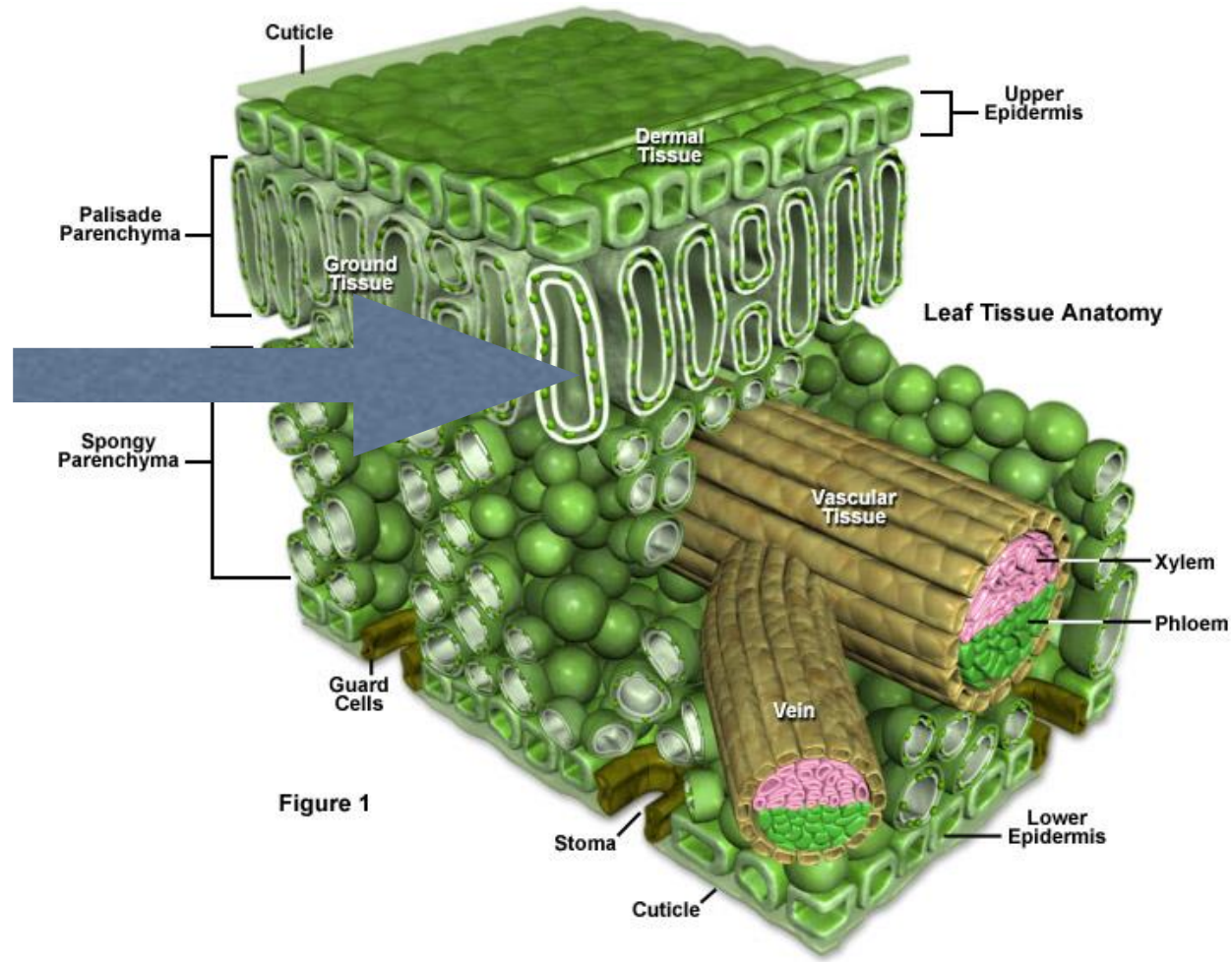
Examples of specialized euk. cells

- 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 m uch light as possible
  - inside a leaf

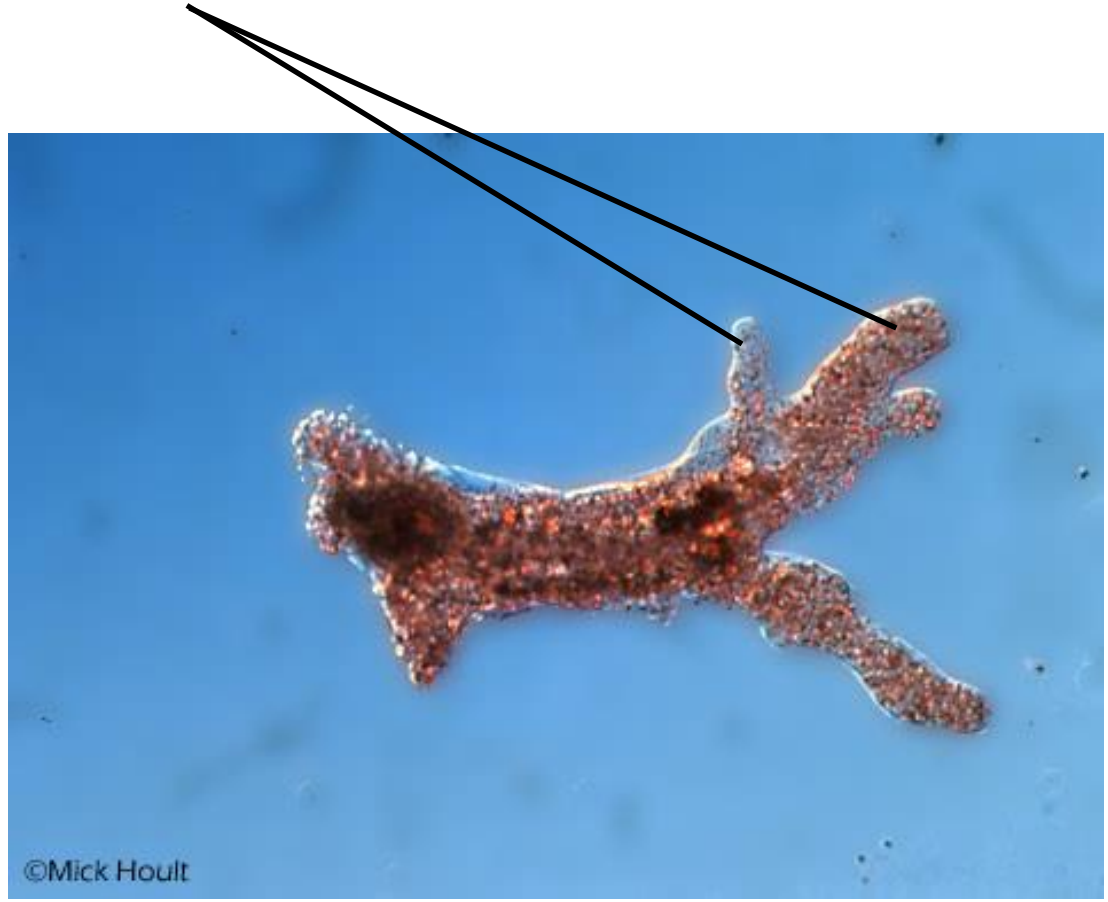


How do animal cells move?

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

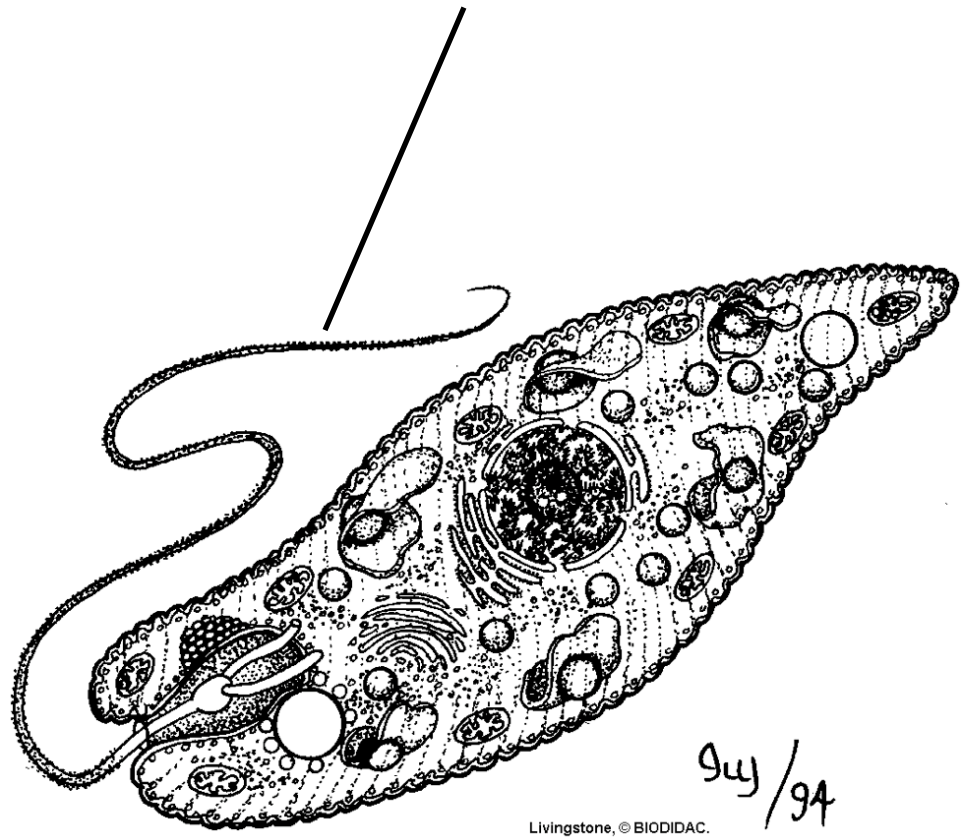
Pseudopods

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



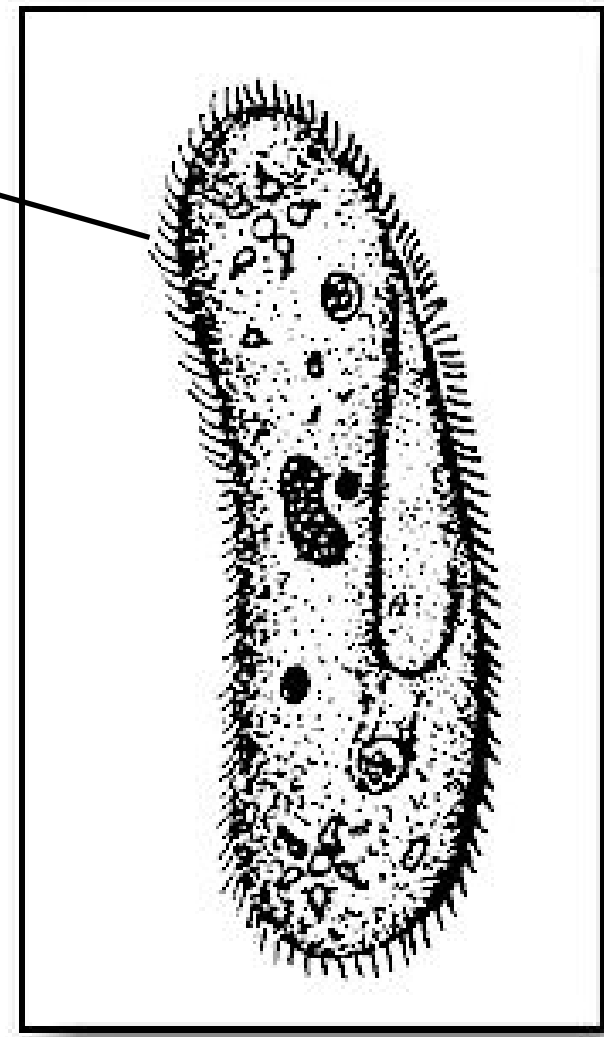
Flagellum/flagella

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



Cilia

- fine, hairlike extensio ns
- attached to cell memb rane
- beat in unison



How did organelles evolve?

- many scientists theorize that eukaryotes evolved from pro karyote ancestors.
- in 1981, Lynn Margulis popul arized 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 photosyn thesis 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 gree n cells that live inside some amoeba... endo symbiosis may still be evolving today!