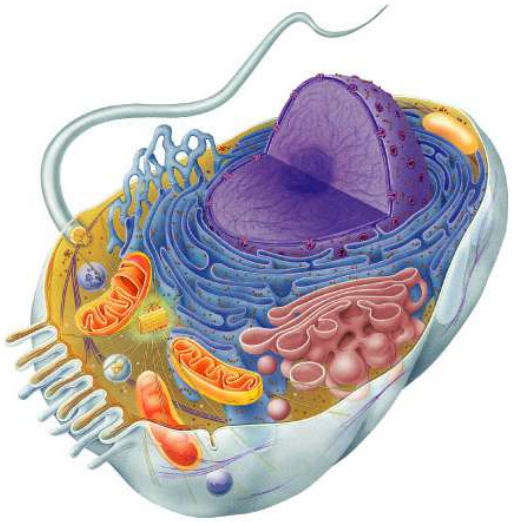
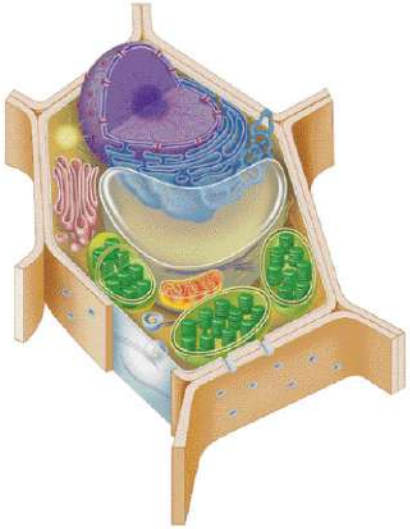


Cells & Cell Organelles

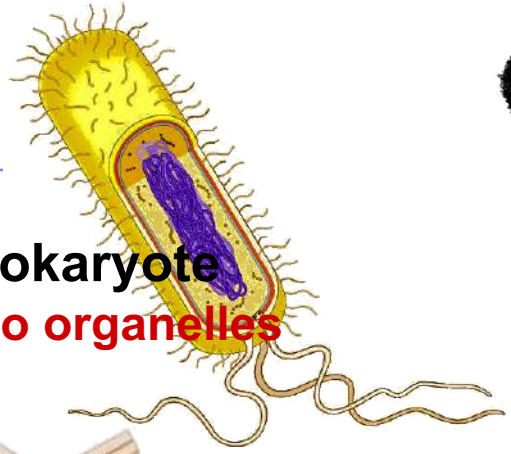
Doing Life's Work



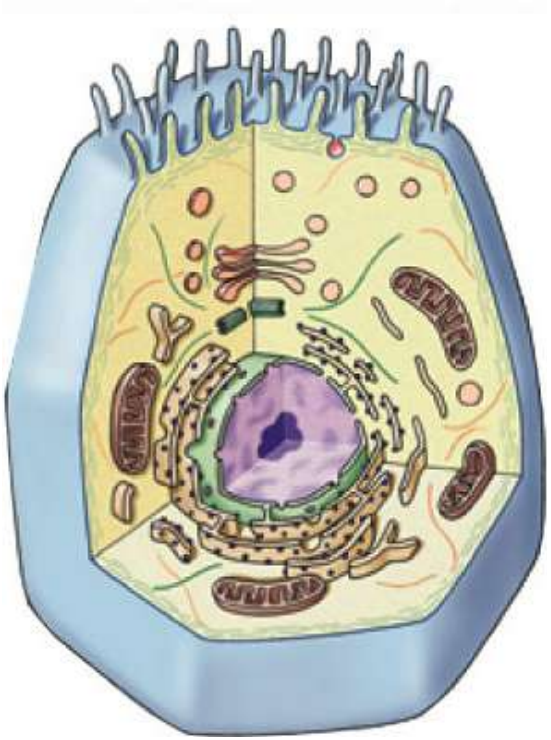
2009-2010

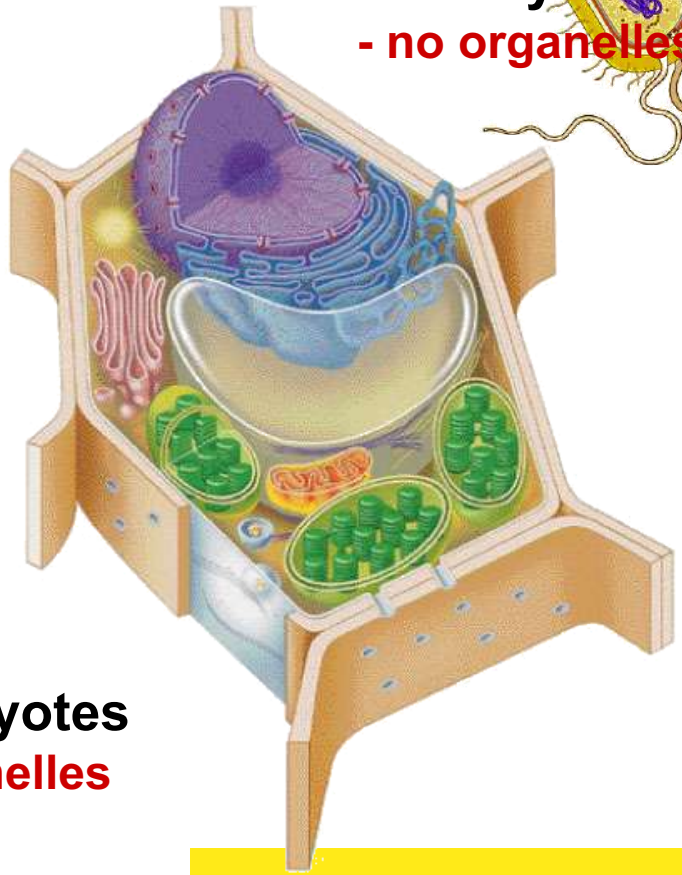
Types of cells

bacteria cells



Prokaryote
- no organelles



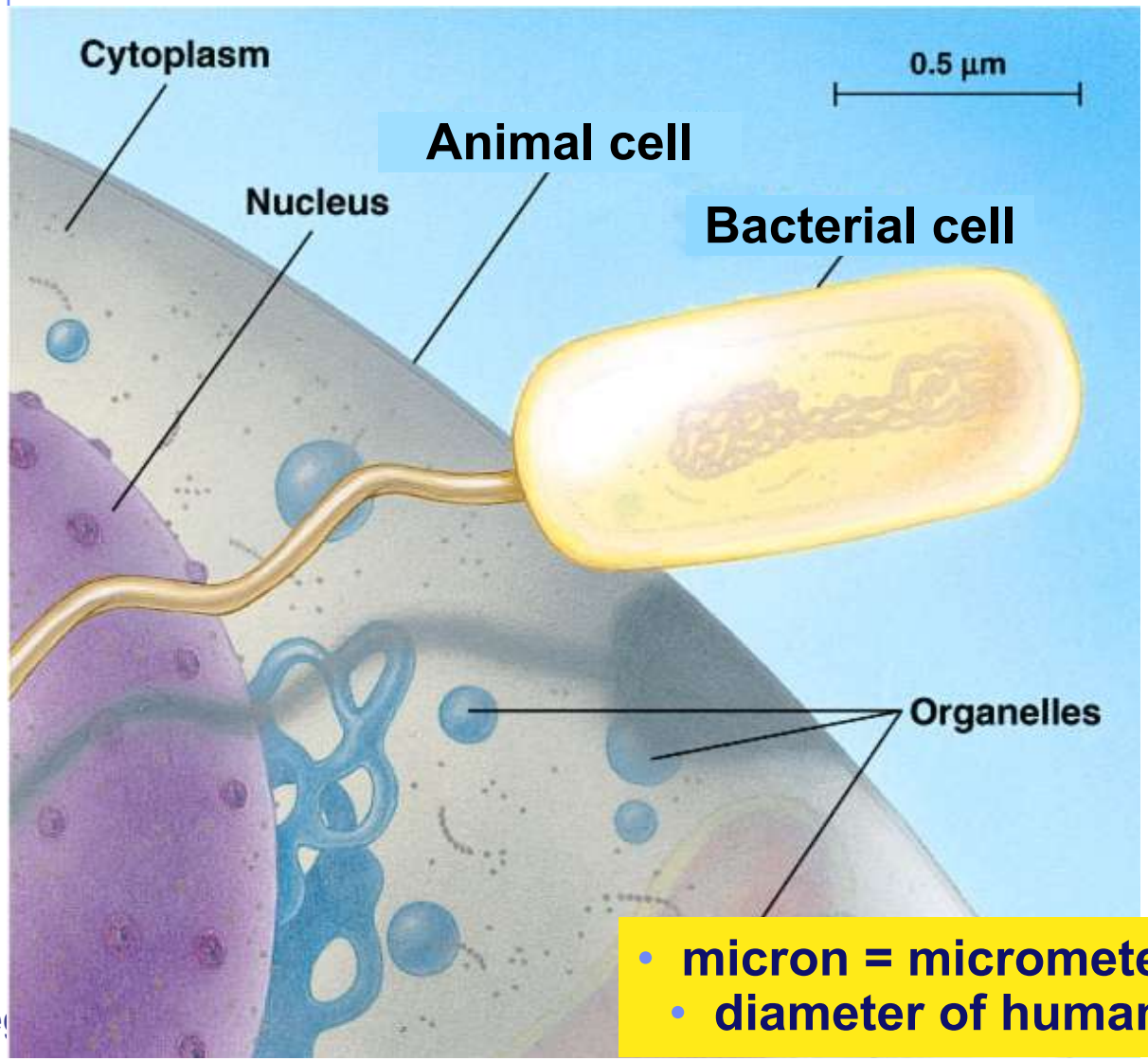


Eukaryotes
- organelles

animal cells

plant cells

Cell size comparison



most bacteria

§ 1-10 microns

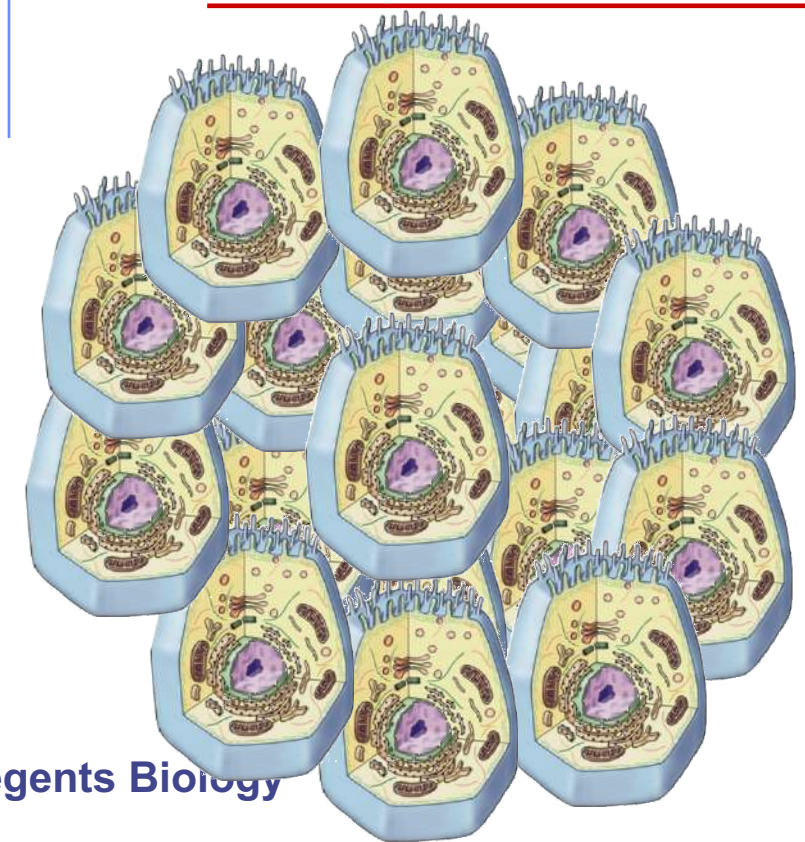
eukaryotic cells

§ **10-100 microns**

- **micron = micrometer = 1/1,000,000 meter**
- **diameter of human hair = ~20 microns**

Why study cells?

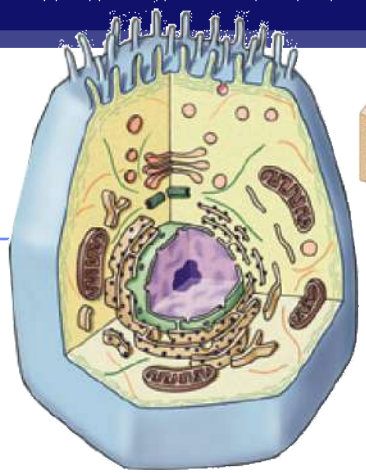
- Cells → Tissues → Organs → Bodies
  - bodies are made up of cells
  - cells do all the work of life!

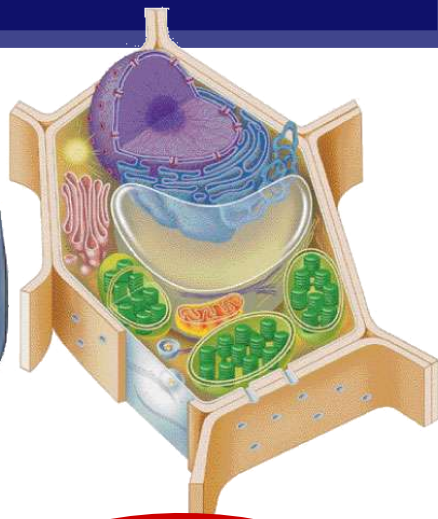


The Work of Life

- What jobs do cells have to do for an organism to live…
  - "breathe"
    - gas exchange: O_2 in vs. CO_2 out
  - eat
    - take in & digest food
  - make energy
    - ATP
  - build molecules
    - proteins, carbohydrates, fats, nucleic acids
  - remove wastes
  - control internal conditions
    - homeostasis
  - respond to external environment
  - build more cells
    - growth, repair, reproduction & development

The Jobs of Cells



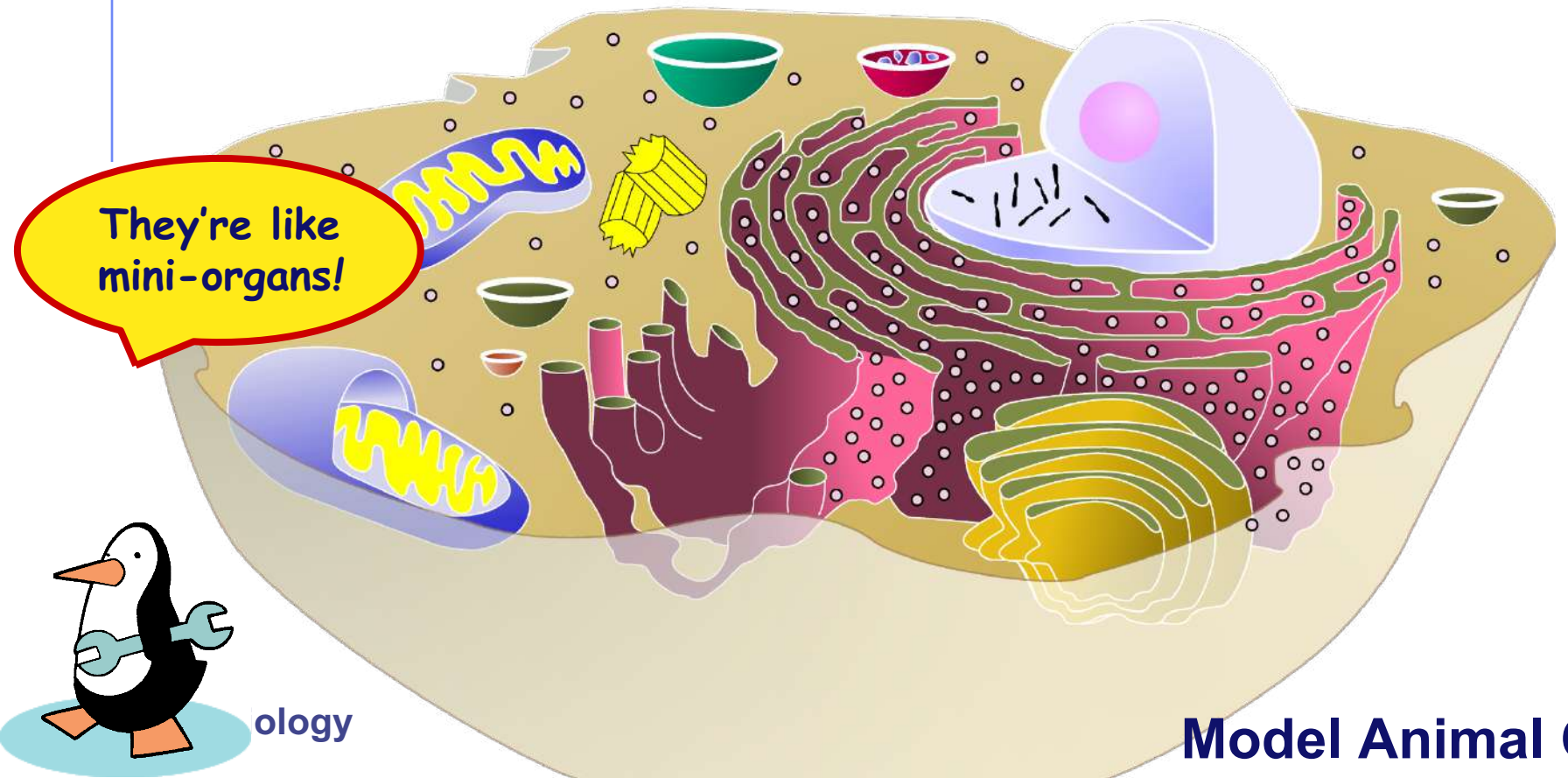


- Cells have 3 main jobs
  - make energy
    - need energy for all activities
    - need to clean up waste produced while making energy
    - make proteins
  - proteins do all the work in a cell, so we need lots of them
    - make more cells
  - for growth
    - to replace damaged or diseased cells

Our organelles do all these jobs!

Organelles

- Organelles do the work of cells
  - each structure has a job to do
    - keeps the cell alive; keeps you alive



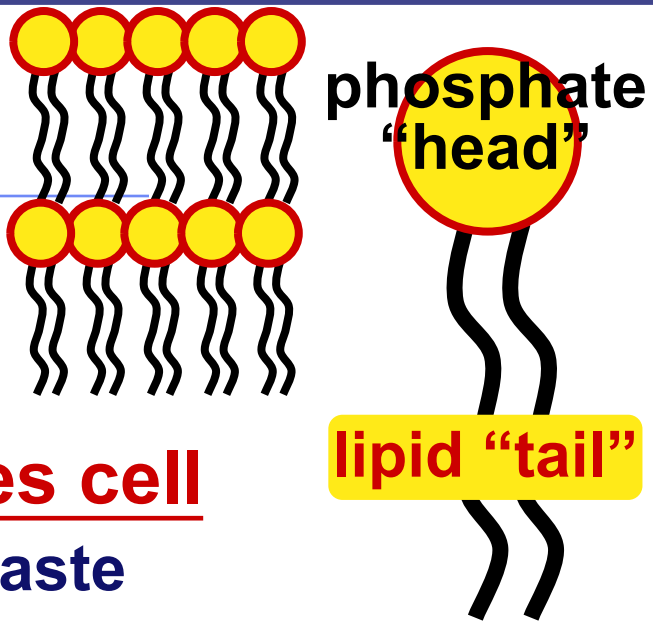
ology

Model Animal Cell

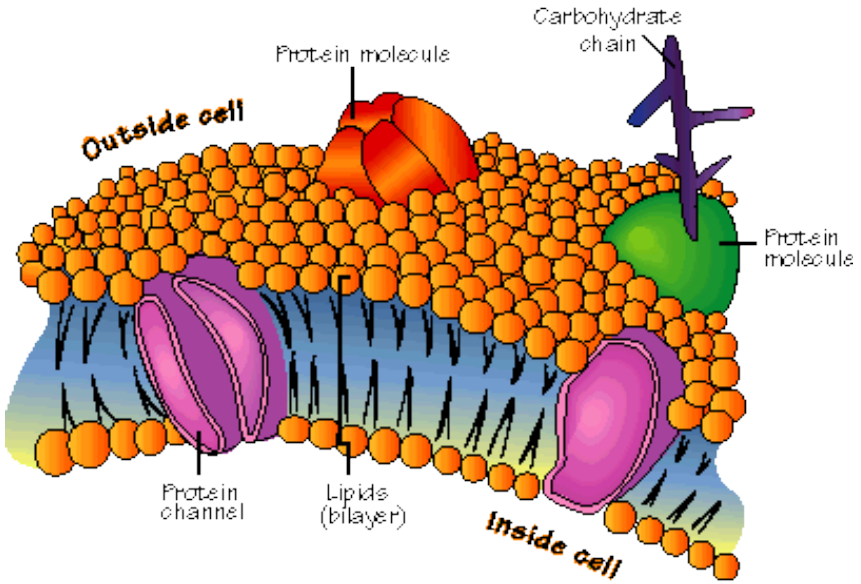
1. Cells need power!

- Making energy
  - to fuel daily life & growth, the cell must…
    - take in food & digest it
    - take in oxygen (O_2)
    - make ATP
    - remove waste
  - organelles that do this work…
    - cell membrane
    - lysosomes
    - vacuoles & vesicles
    - mitochondria

Cell membrane

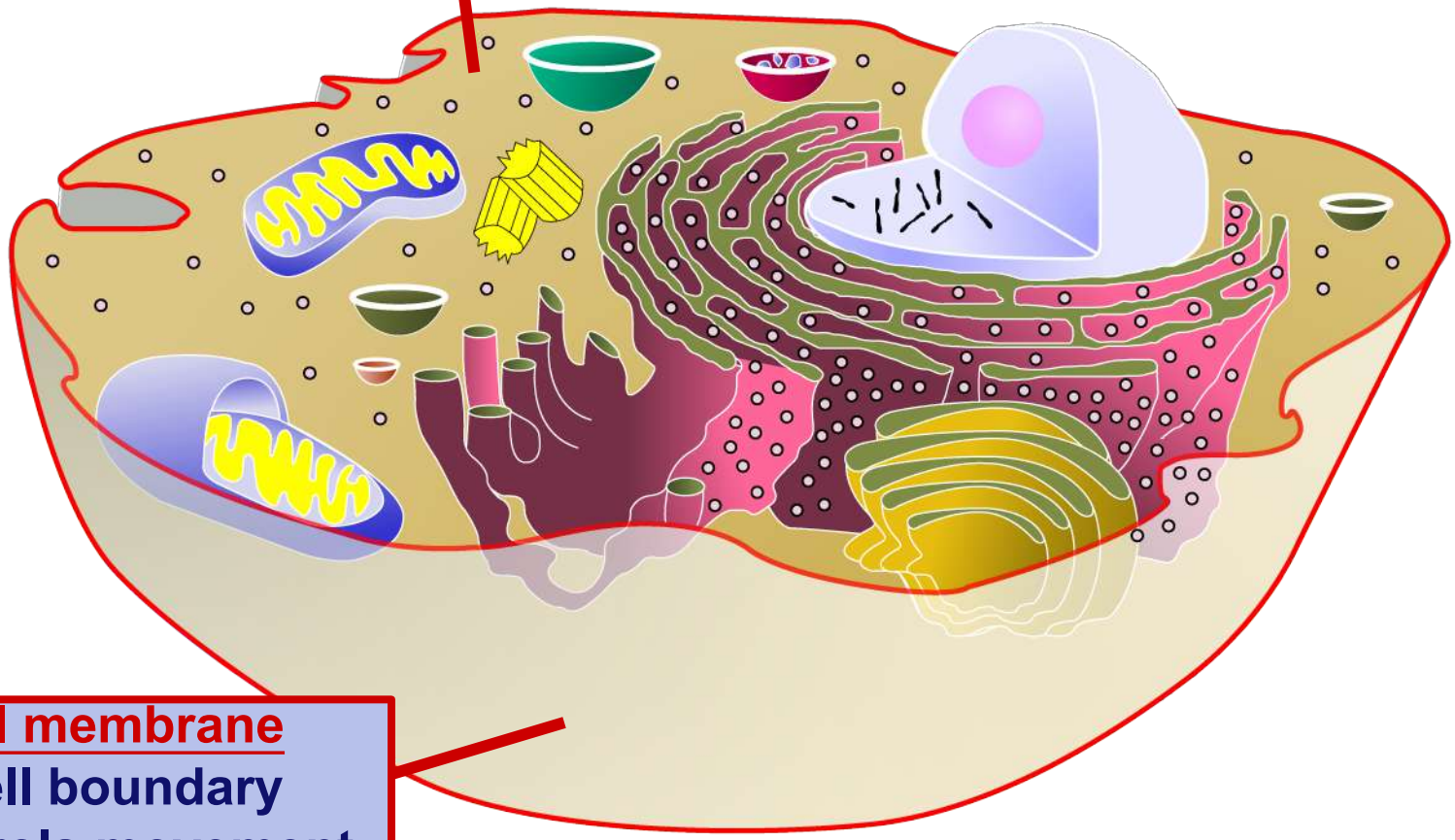


- **Function**
  - separates cell from outside
  - controls what enters or leaves cell
    - O_2, CO_2, food, H_2O, nutrients, waste
  - recognizes signals from other cells
    - allows communication between cells
- **Structure**
  - double layer of fat
    - phospholipid bilayer
  - receptor molecules
    - proteins



cytoplasm

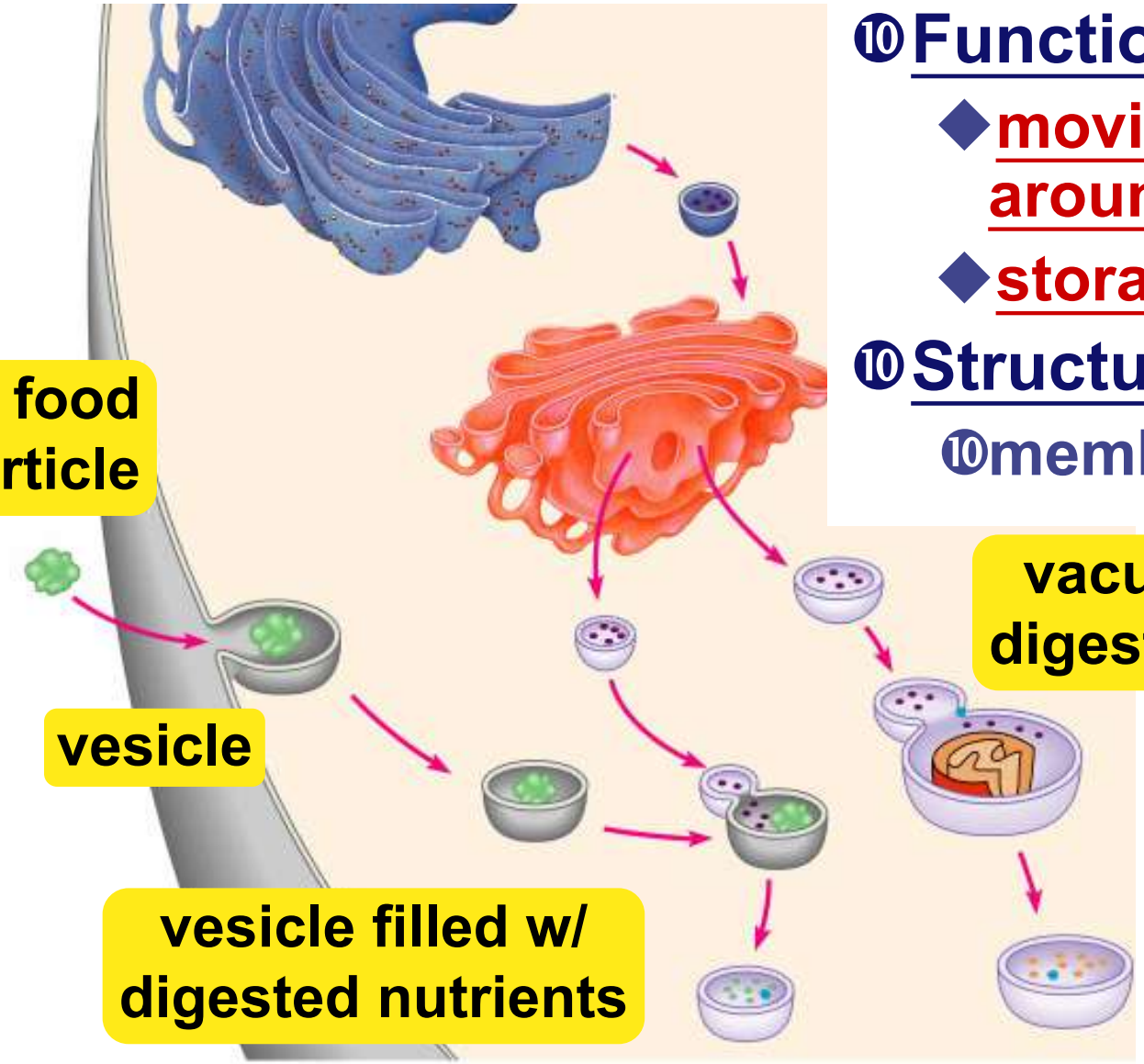
- jelly-like material holding organelles in place



cell membrane

- cell boundary
- controls movement of materials in & out
- recognizes signals

Vacuoles & vesicles

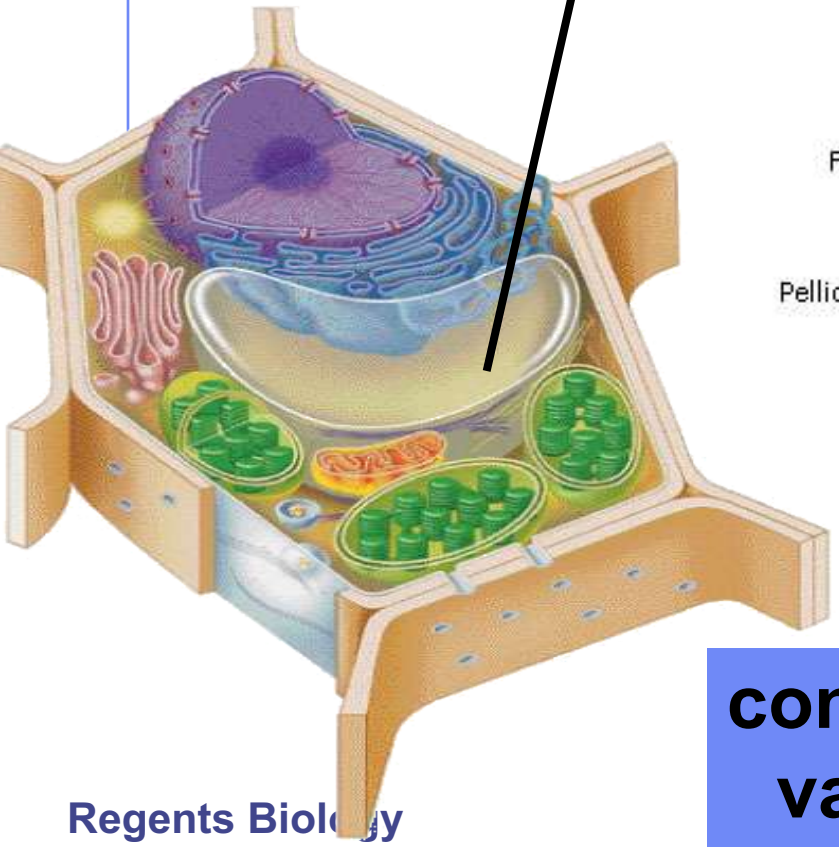


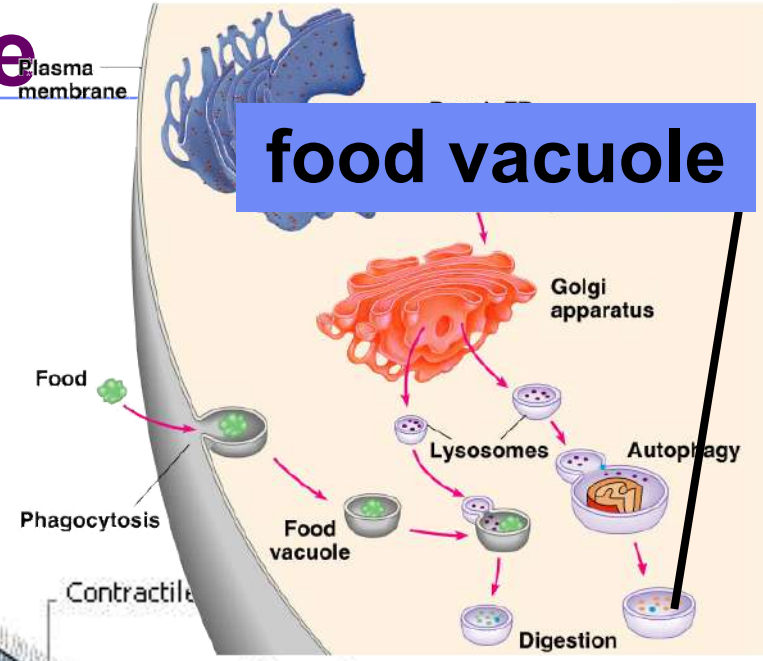
- **Function**
  - moving material around cell
  - storage
- **Structure**
  - membrane sac

Food & water storage

plant cells

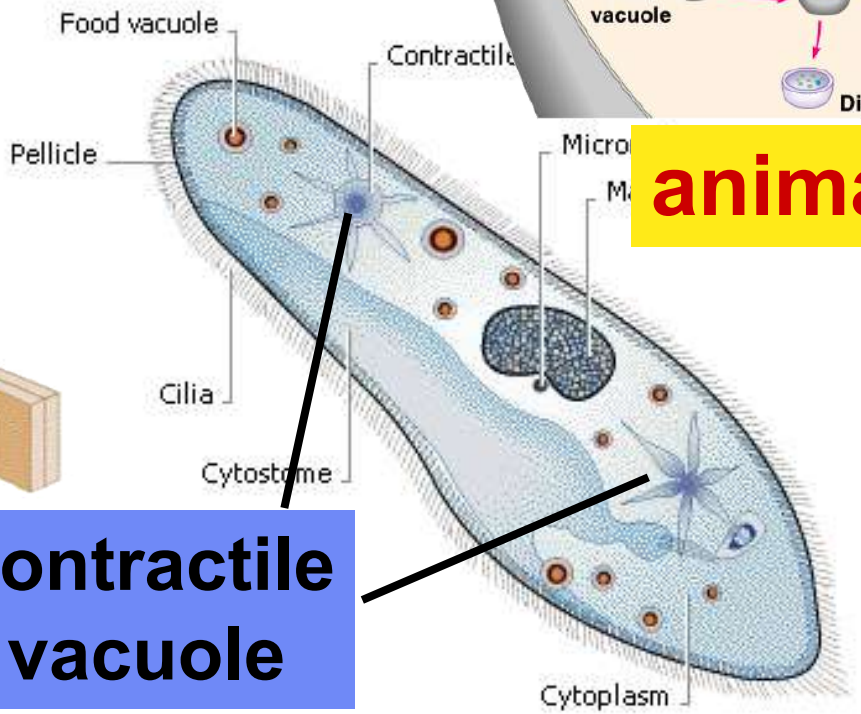
central vacuole





food vacuole

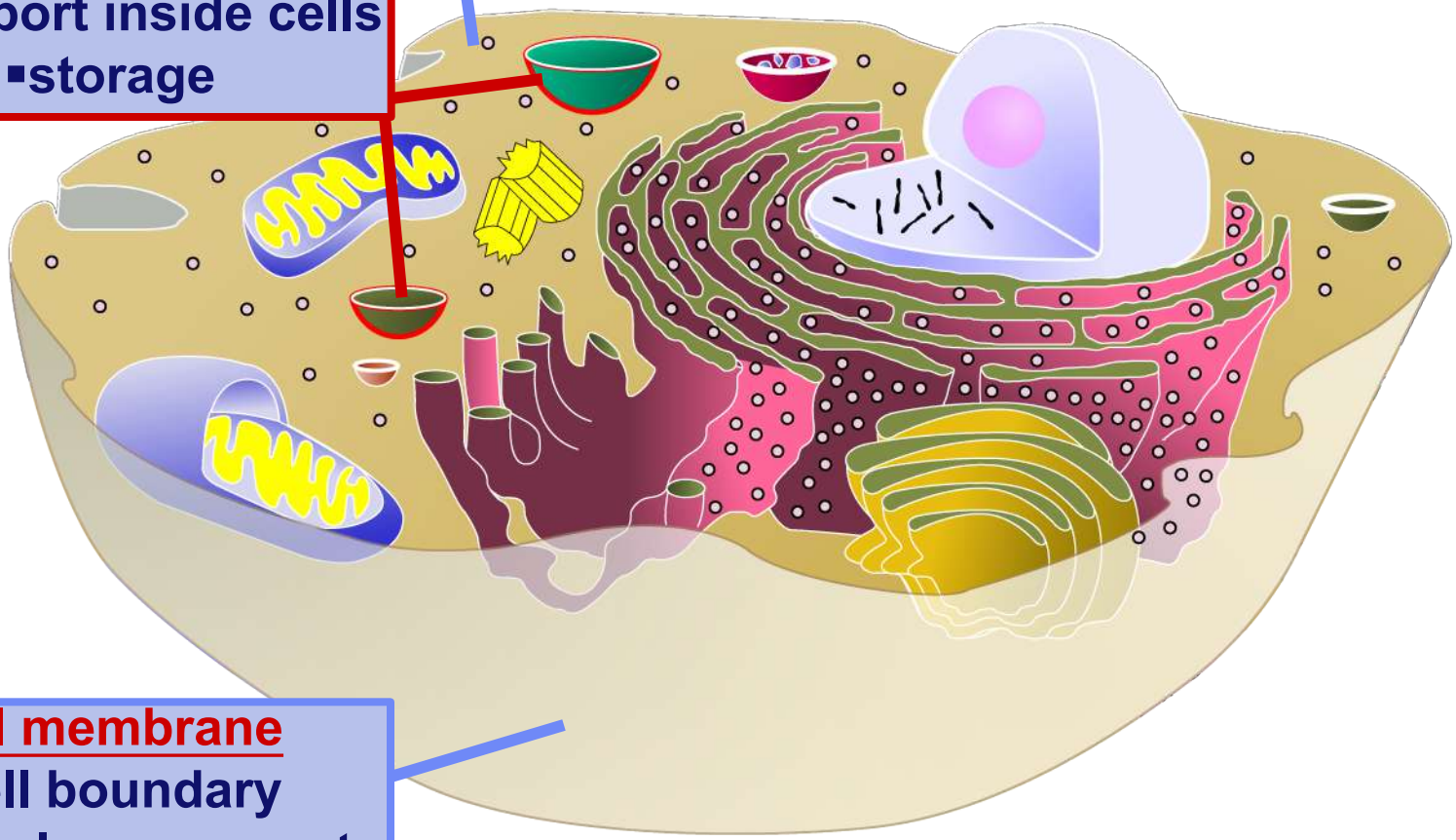
animal cells



contractile vacuole

cytoplasm
- jelly-like material holding organelles in place

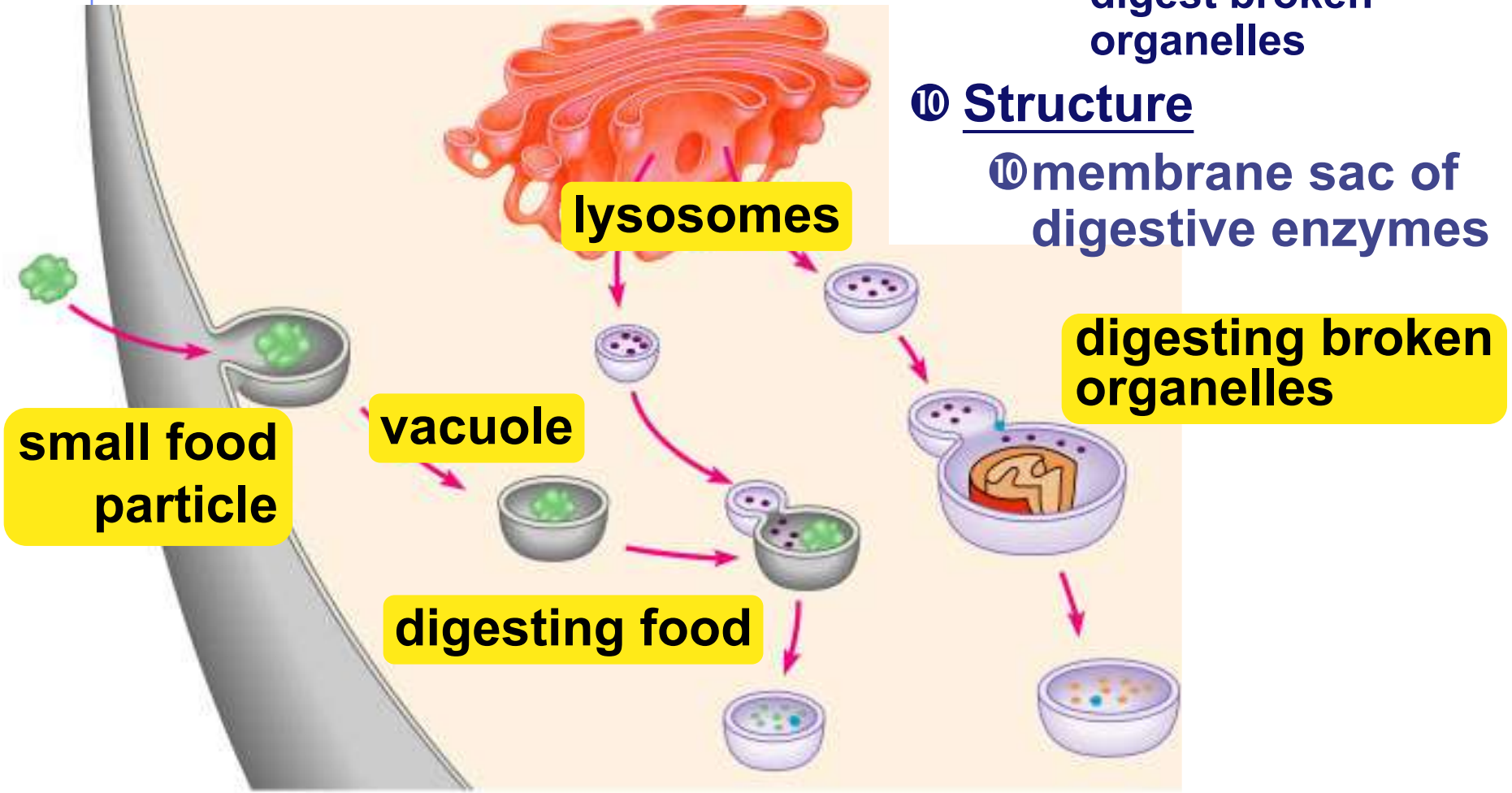
vacuole & vesicles
- transport inside cells
- storage



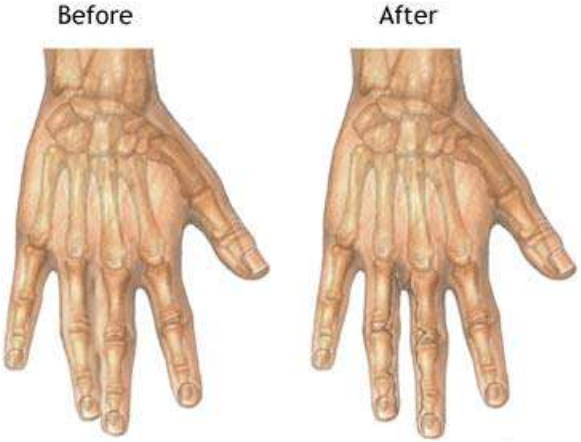
cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

Lysosomes

- **Function**
  - **digest food**
    - used to make energy
  - **clean up & recycle**
    - digest broken organelles
- **Structure**
  - membrane sac of digestive enzymes



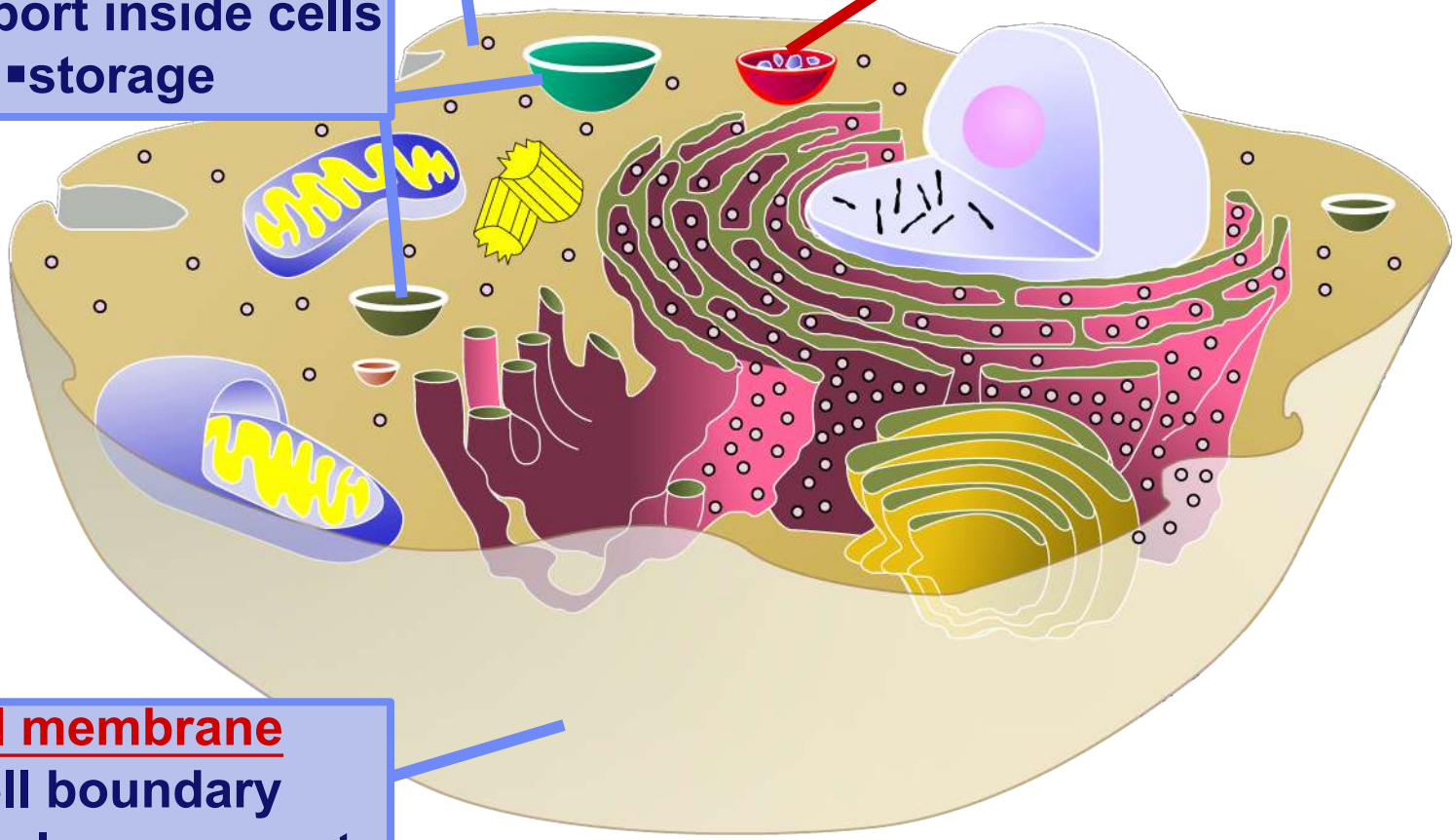
A Job for Lysosomes



cytoplasm
- jelly-like material holding organelles in place

lysosome
- food digestion
- garbage disposal & recycling

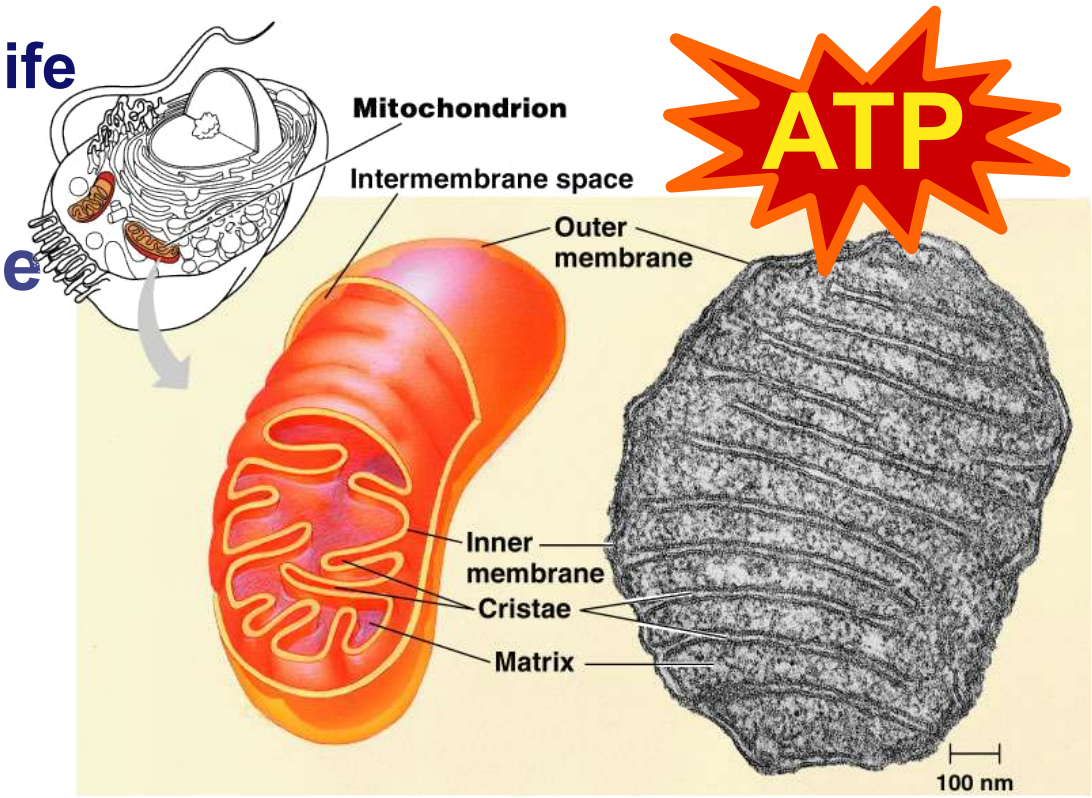
vacuole & vesicles
- transport inside cells
- storage



cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

Mitochondria

- **Function**
  - **make ATP energy from cellular respiration**
    - sugar + $O_2 \rightarrow$ ATP
    - fuels the work of life
- **Structure**
  - double membrane

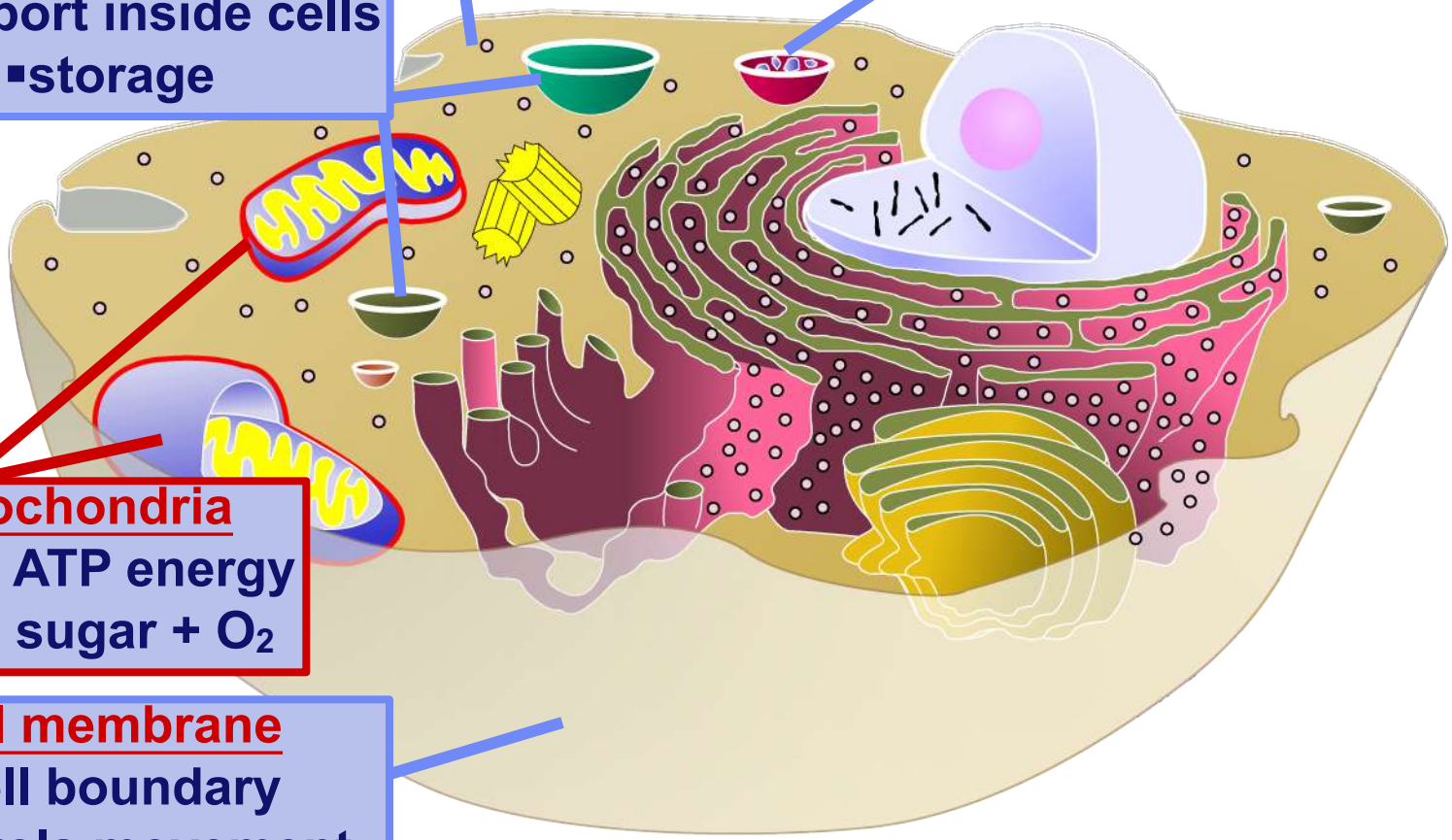


in both animal & plant cells

cytoplasm
- jelly-like material holding organelles in place

lysosome
- food digestion
- garbage disposal & recycling

vacuole & vesicles
- transport inside cells
- storage

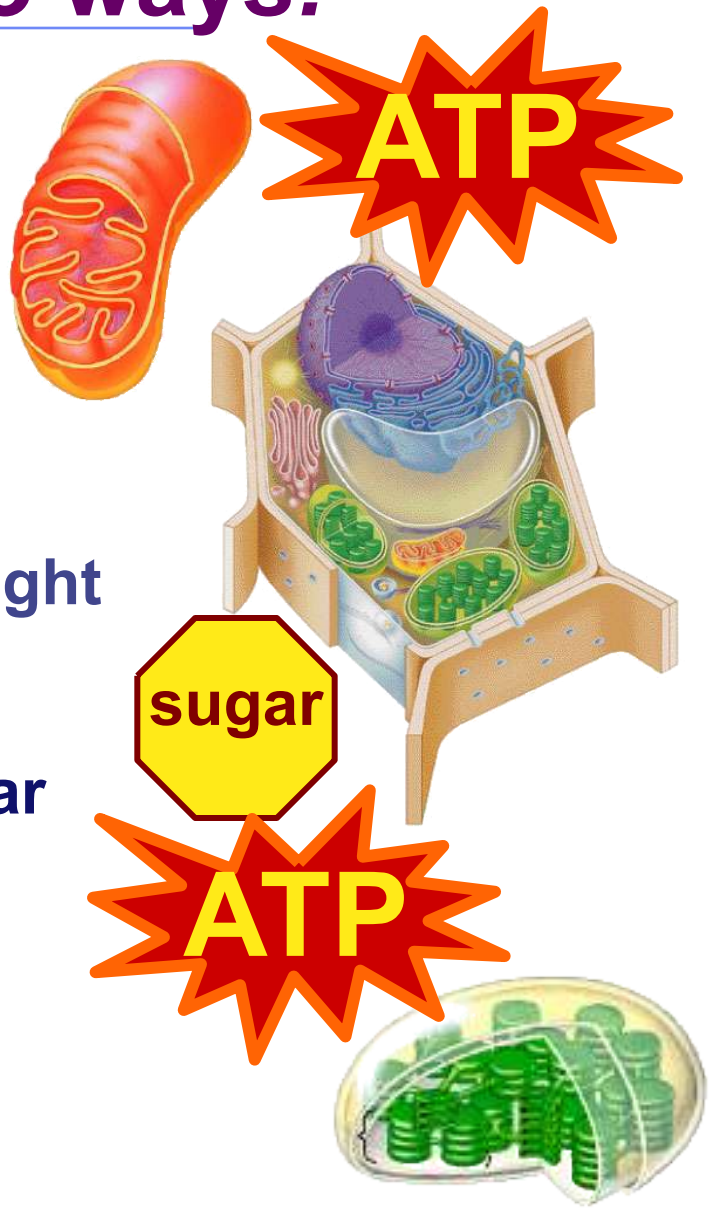


mitochondria
- make ATP energy from sugar + O_2

cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

Plants make energy two ways!

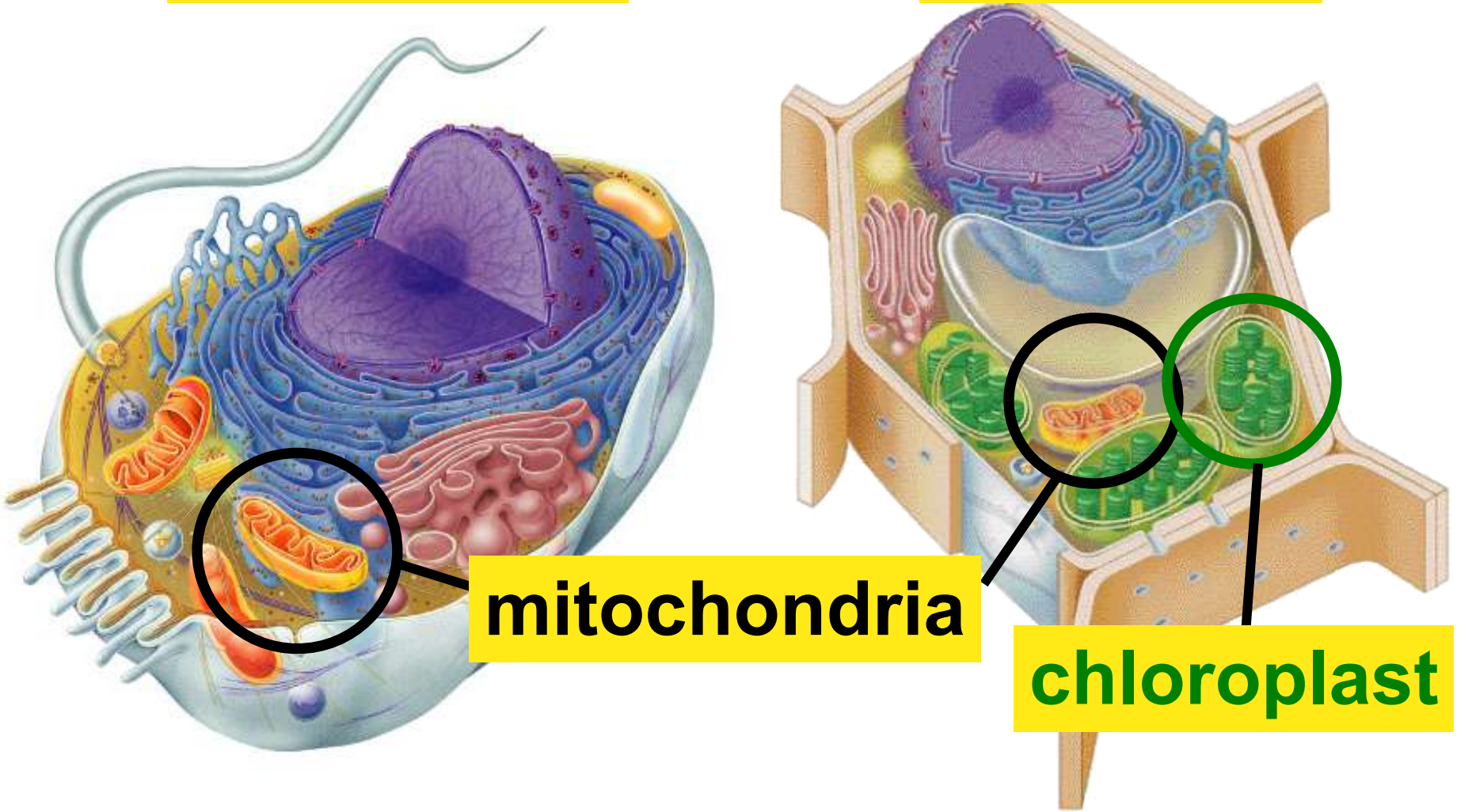
- **Mitochondria**
  - make energy from sugar + O_2
    - **cellular respiration**
    - sugar + $O_2 \rightarrow$ ATP
- **Chloroplasts**
  - make energy + sugar from sunlight
    - **photosynthesis**
    - sunlight + $CO_2 \rightarrow$ ATP & sugar
      - ATP = active energy
      - sugar = stored energy
        - build leaves & roots & fruit out of the sugars

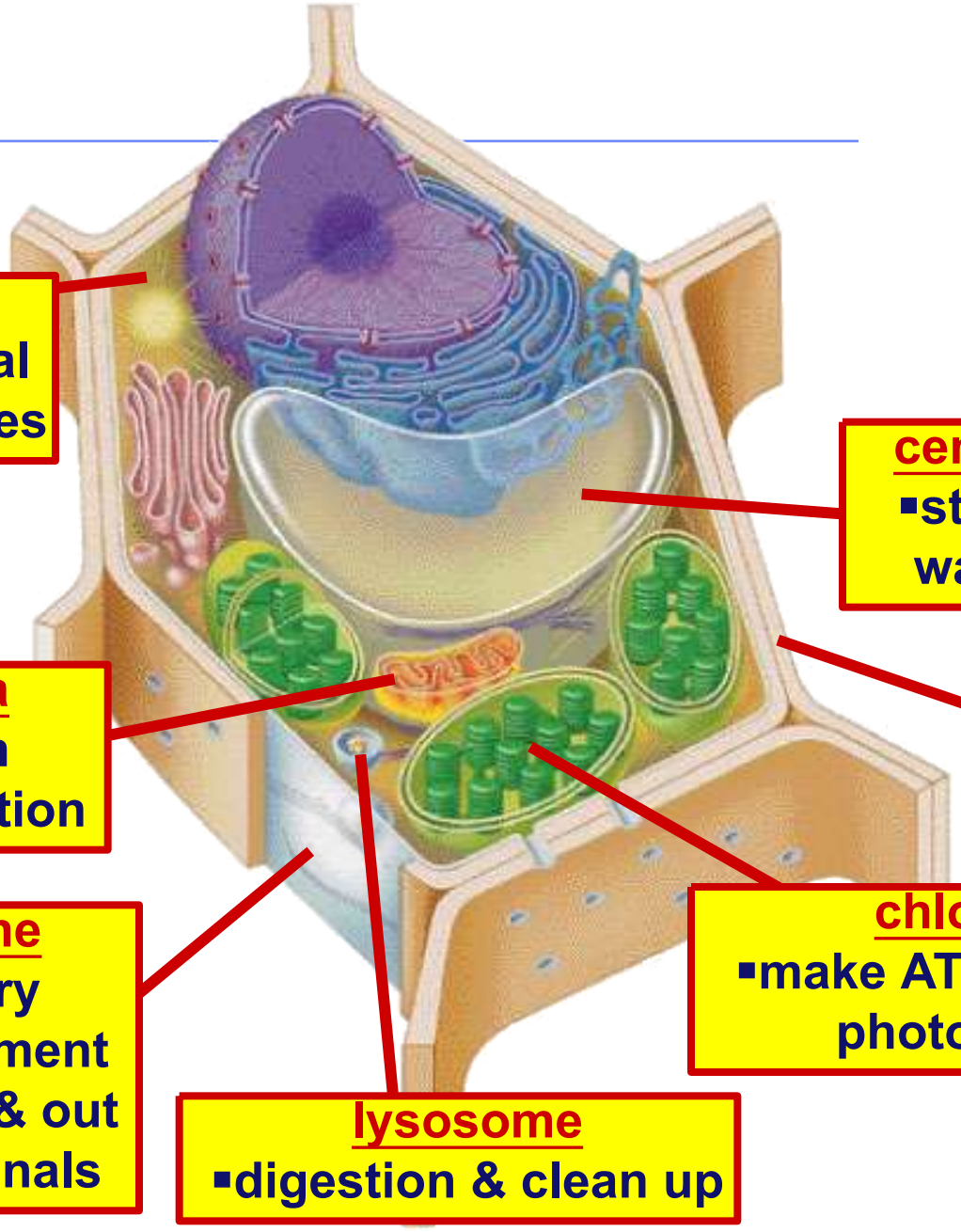


Mitochondria are in both cells*!!*

animal cells

plant cells





cytoplasm
- jelly-like material around organelles

central vacuole
- storage: food, water or waste

mitochondria
- make ATP in cellular respiration

cell wall
- support

cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

chloroplast
- make ATP & sugars in photosynthesis

lysosome
- digestion & clean up

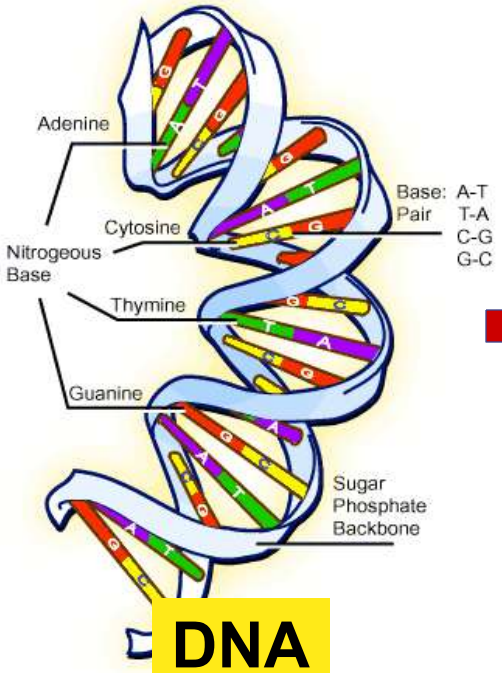
2. Cells need workers = proteins!

- **Making proteins**
  - to run daily life & growth, the cell must…
    - read genes (DNA)
    - build proteins
      - structural proteins (muscle fibers, hair, skin, claws)
      - enzymes (speed up chemical reactions)
      - signals (hormones) & receptors
  - organelles that do this work…
    - nucleus
    - ribosomes
    - endoplasmic reticulum (ER)
    - Golgi apparatus

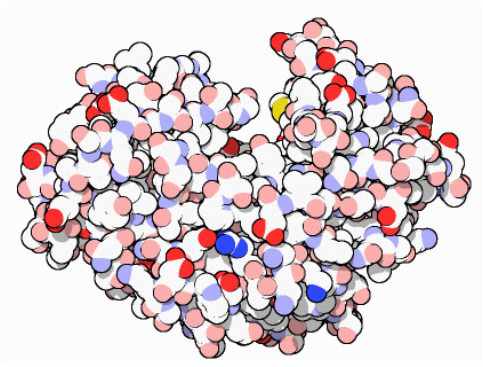
Proteins do all the work!

one of the major job of cells is to make proteins, because…

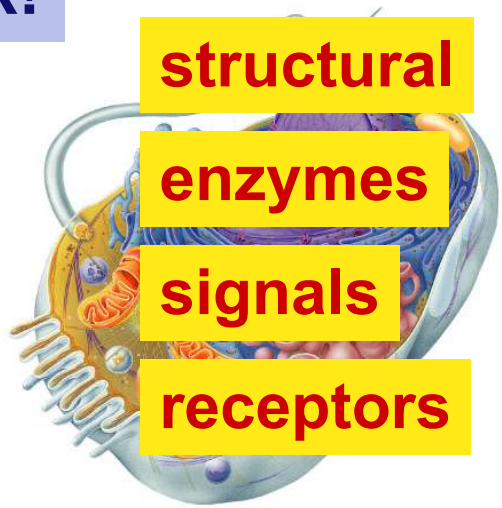
proteins do all the work!



DNA



proteins



structural

enzymes

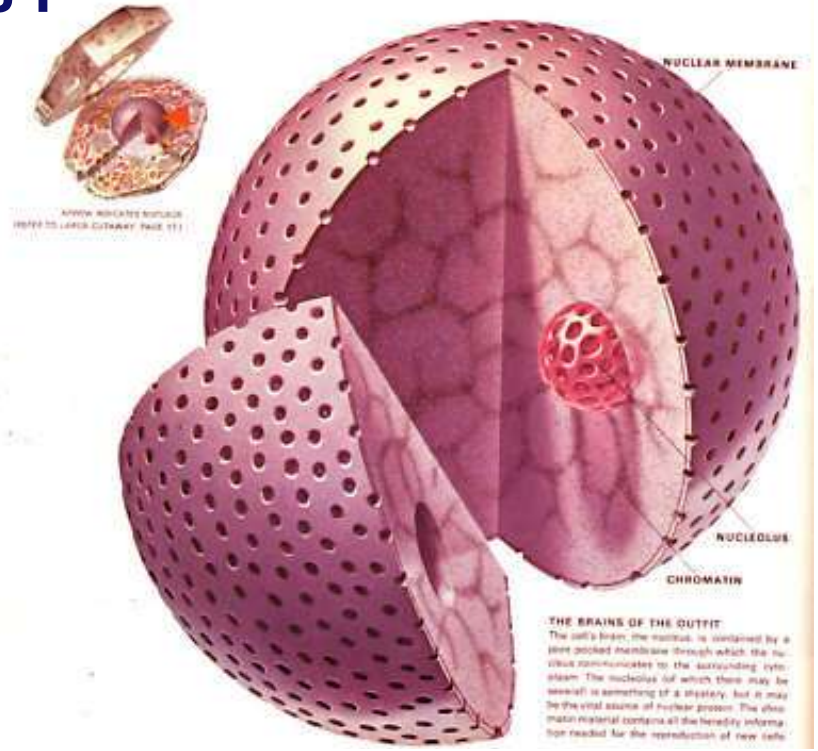
signals

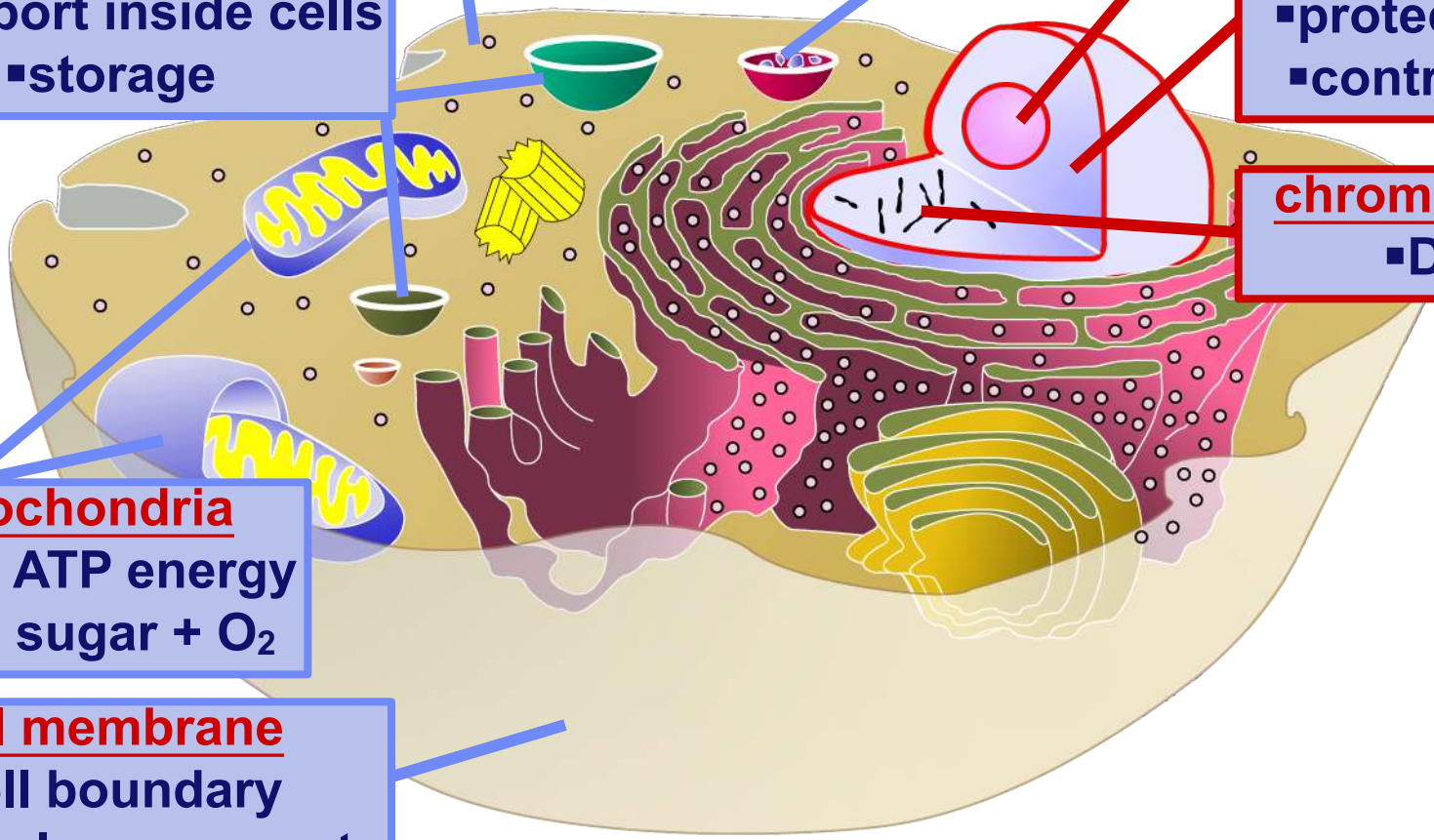
receptors

cells

Nucleus

- **Function**
  - control center of cell
  - protects DNA
    - instructions for building proteins
- **Structure**
  - nuclear membrane
  - nucleolus
    - ribosome factory
  - chromosomes
    - DNA





cytoplasm
- jelly-like material holding organelles in place

lysosome
- food digestion
- garbage disposal & recycling

nucleolus
- produces ribosomes

vacuole & vesicles
- transport inside cells
- storage

nucleus
- protects DNA
- controls cell

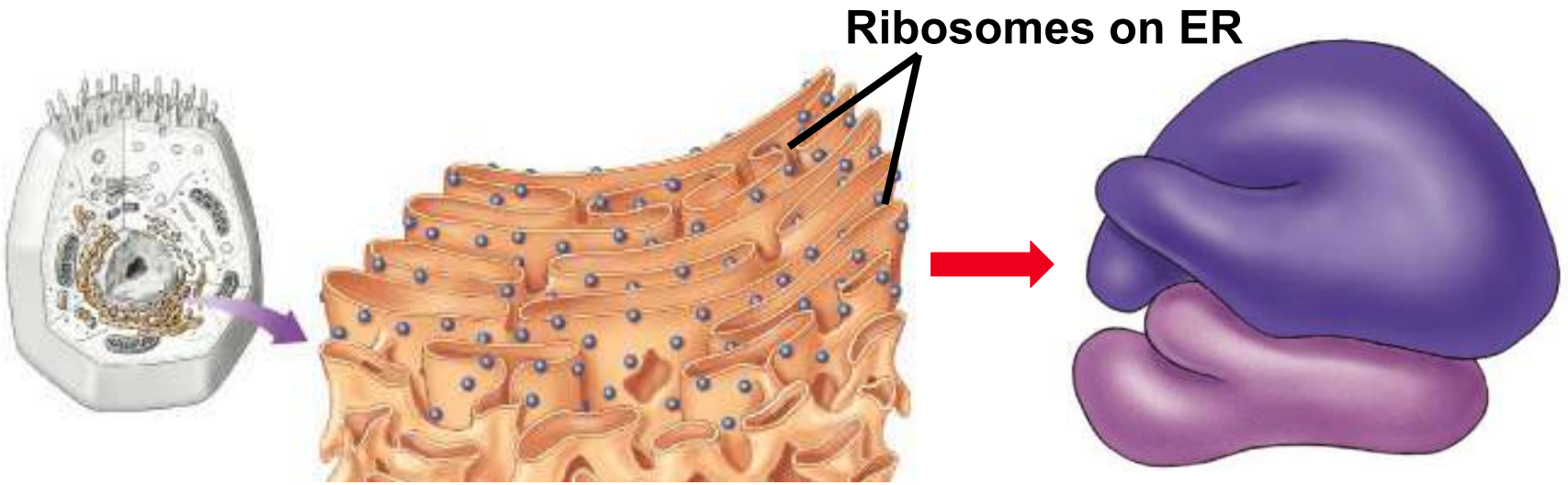
chromosomes
- DNA

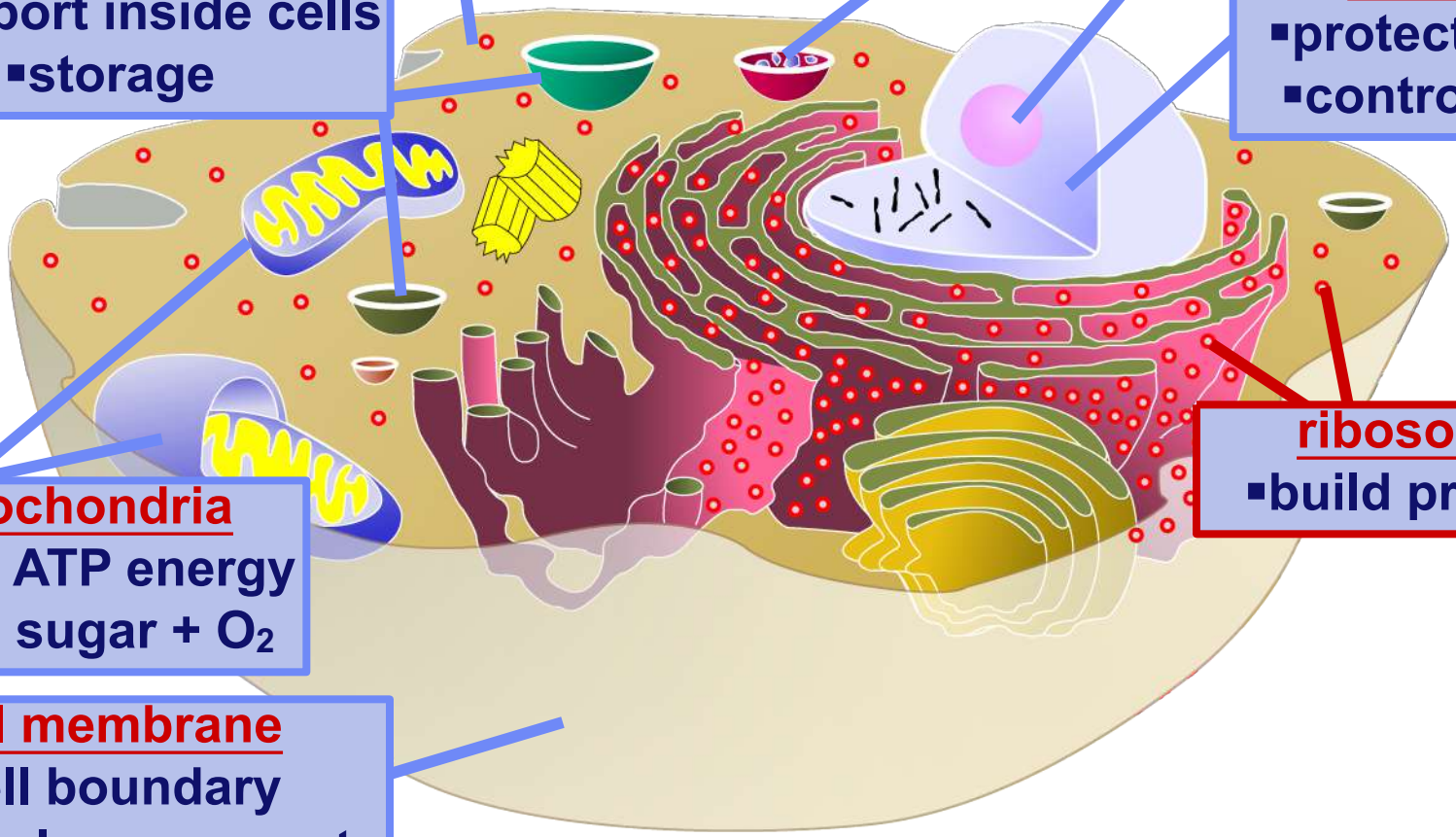
mitochondria
- make ATP energy from sugar + O_2

cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

Ribosomes

- **Function**
  - **protein factories**
  - read instructions to build proteins from DNA
- **Structure**
  - **some free in cytoplasm**
  - **some attached to ER**





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ribosomes
- build proteins

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- make ATP energy from sugar + O_2

cell membrane
- cell boundary
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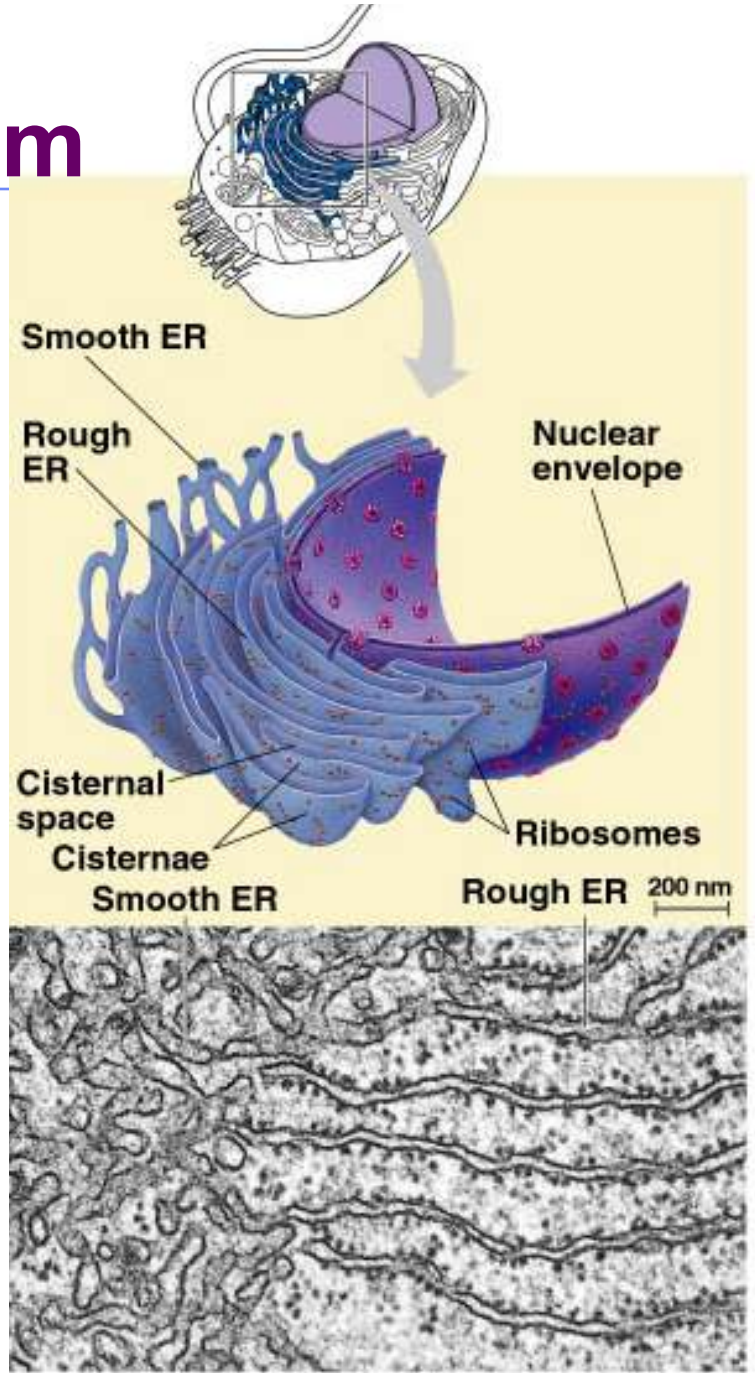
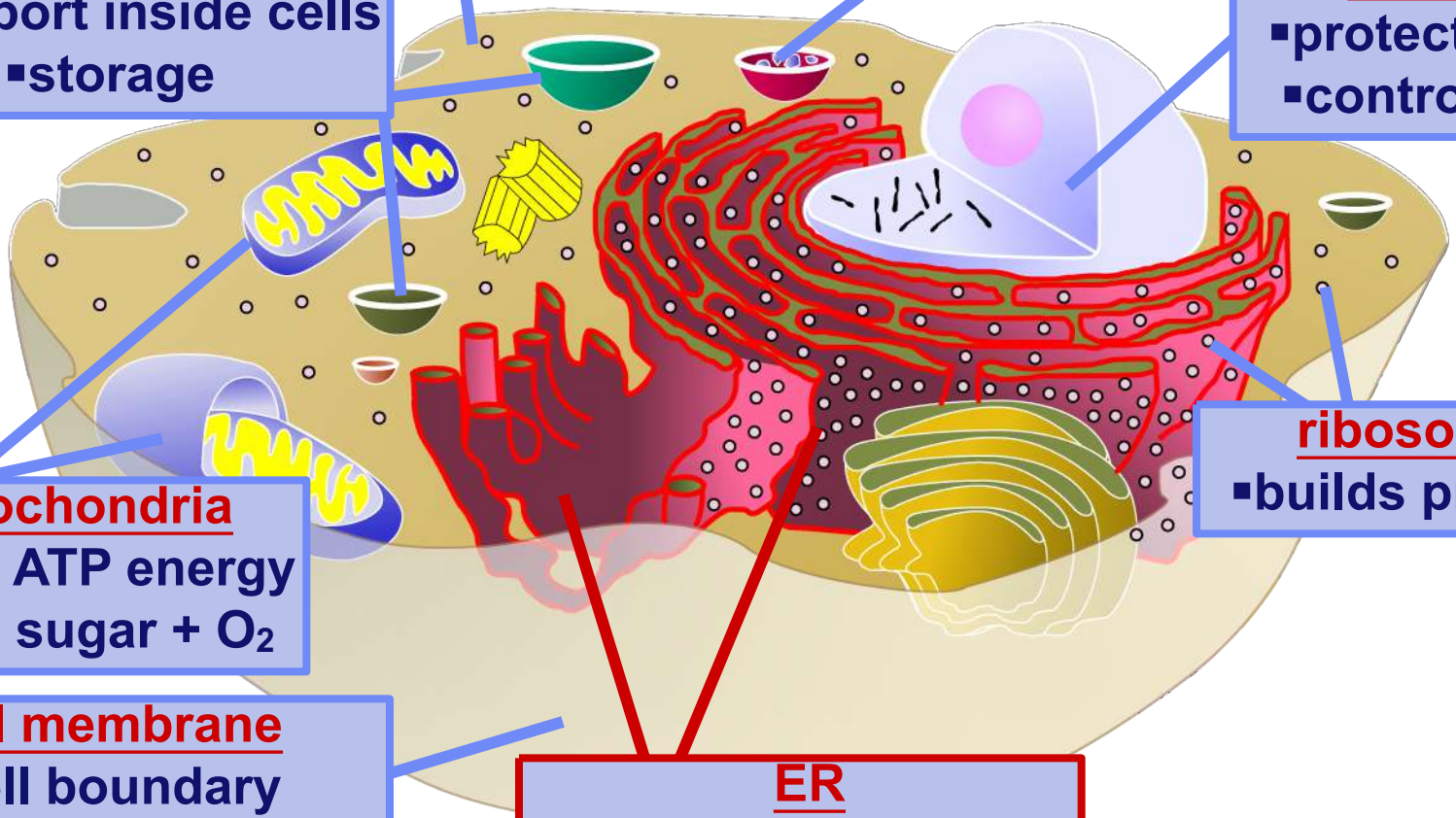
Endoplasmic Reticulum

- Function
  - works on proteins
    - helps complete the proteins after ribosome builds them
    - makes membranes
  - Structure
- rough ER
  - ribosomes attached
    - works on proteins
    - smooth ER
  - makes membranes



Reg



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ribosomes
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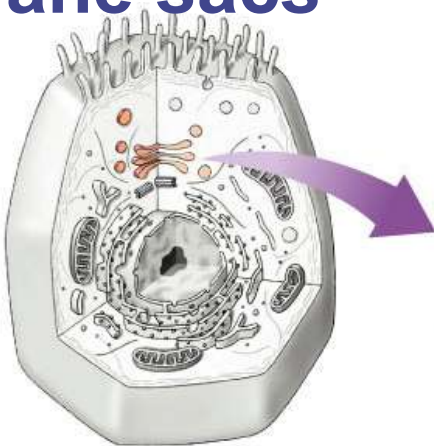
mitochondria
- make ATP energy from sugar + O_2

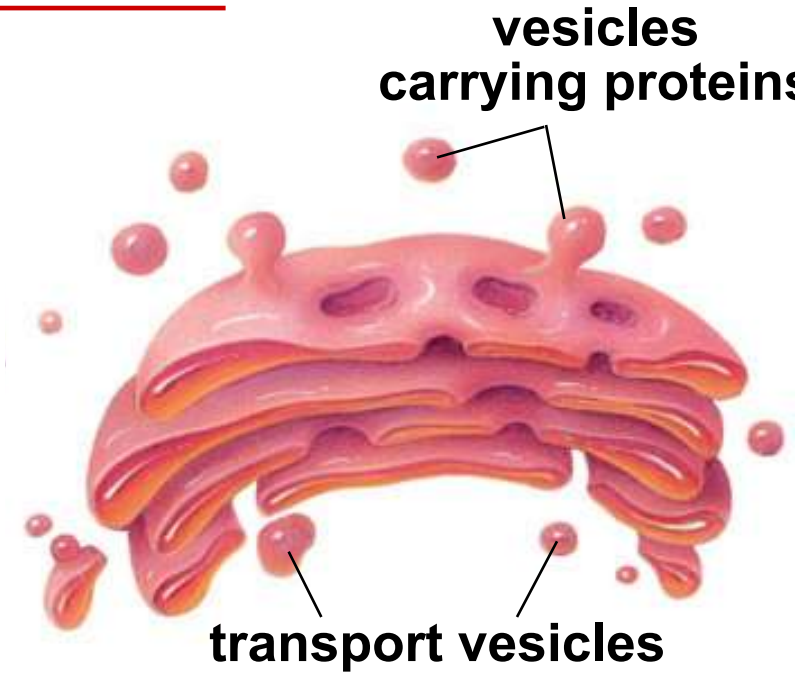
cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

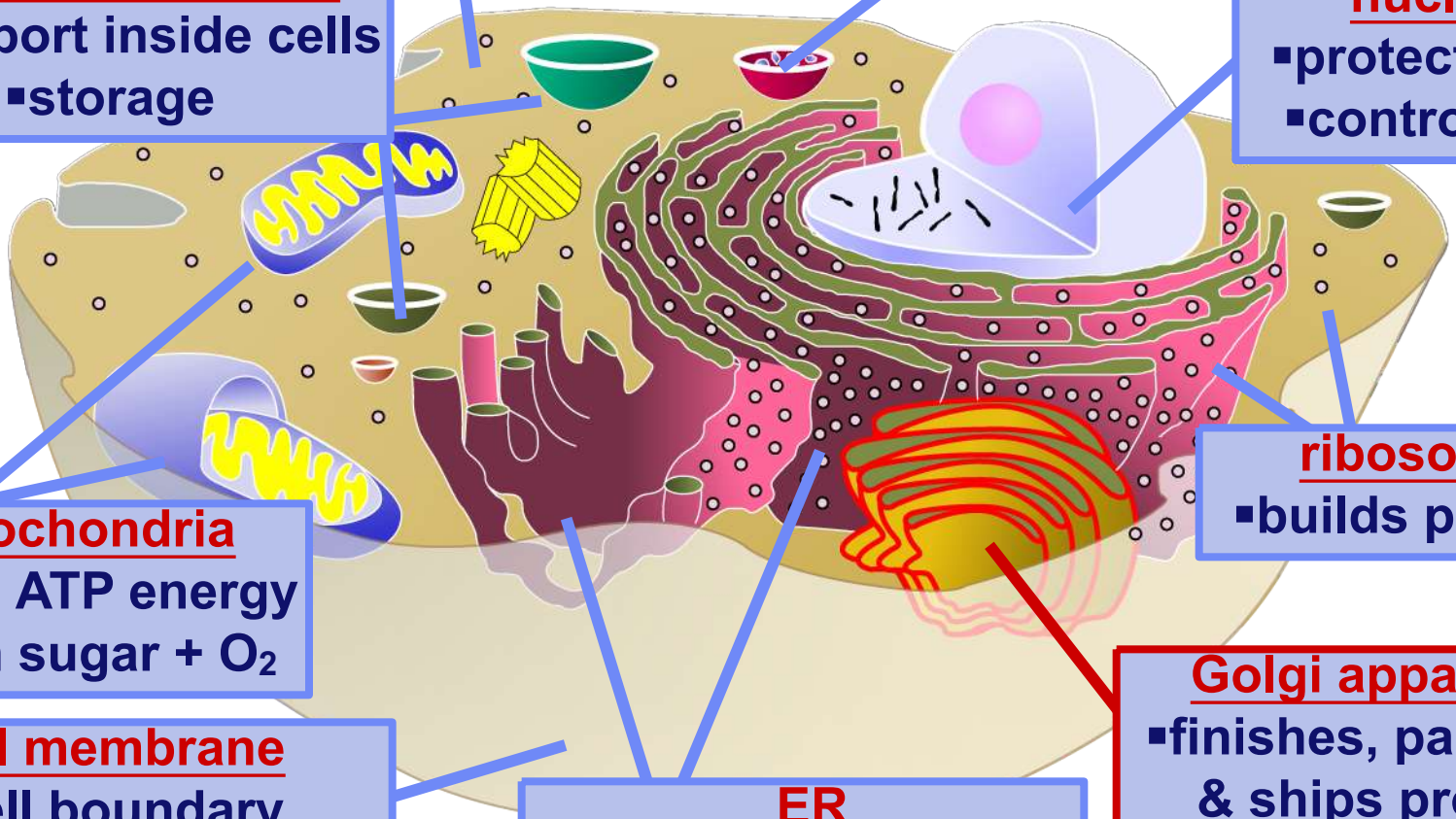
ER
- works on proteins
- makes membranes

Golgi Apparatus

- **Function**
  - **finishes, sorts, labels & ships proteins**
    - like UPS headquarters
      - shipping & receiving department
  - **ships proteins in vesicles**
    - "UPS trucks"
- **Structure**
  - **membrane sacs**







cytoplasm
- jelly-like material holding organelles in place

lysosome
- food digestion
- garbage disposal & recycling

vacuole & vesicles
- transport inside cells
- storage

nucleus
- protects DNA
- controls cell

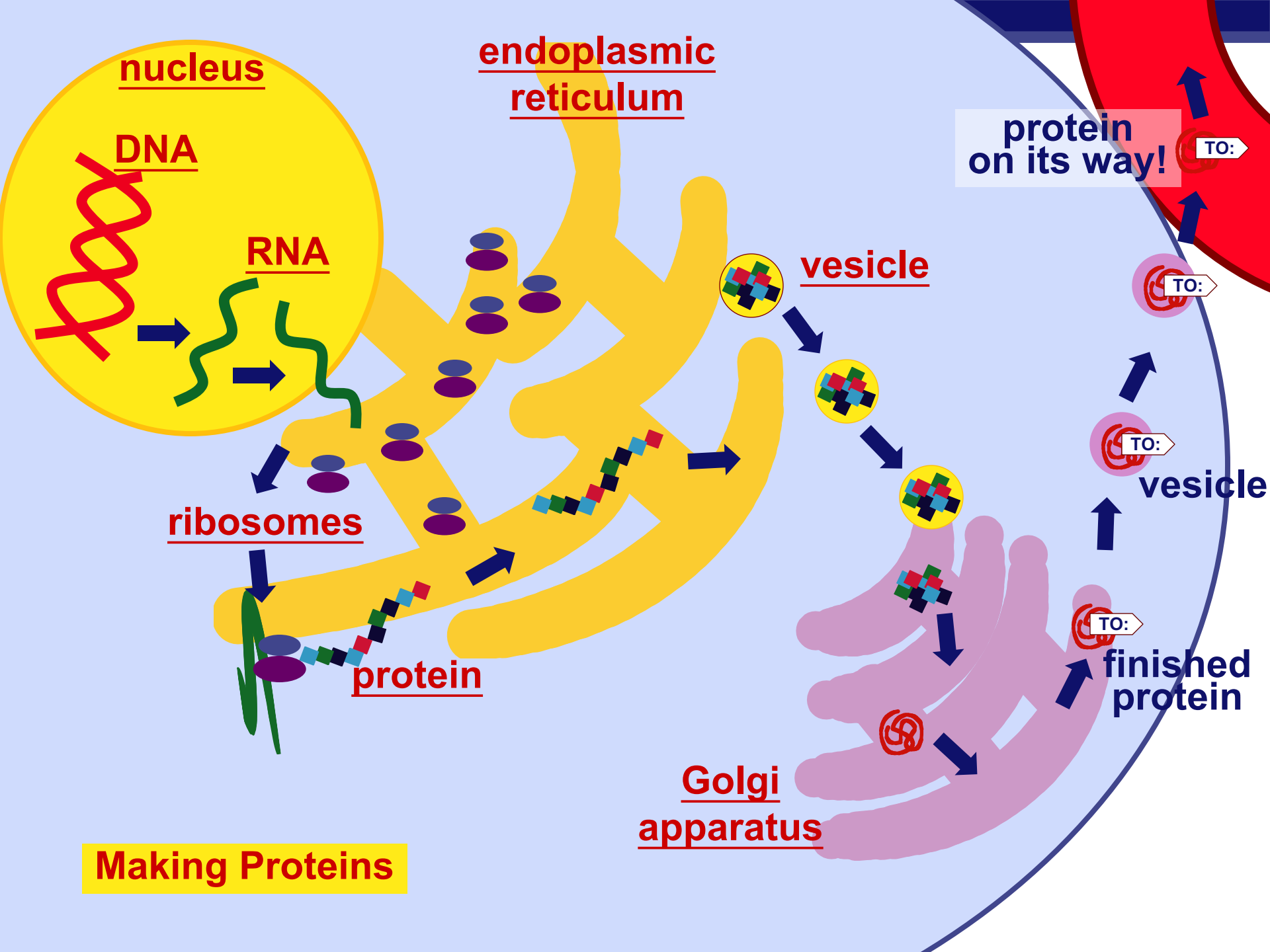
ribosomes
- builds proteins

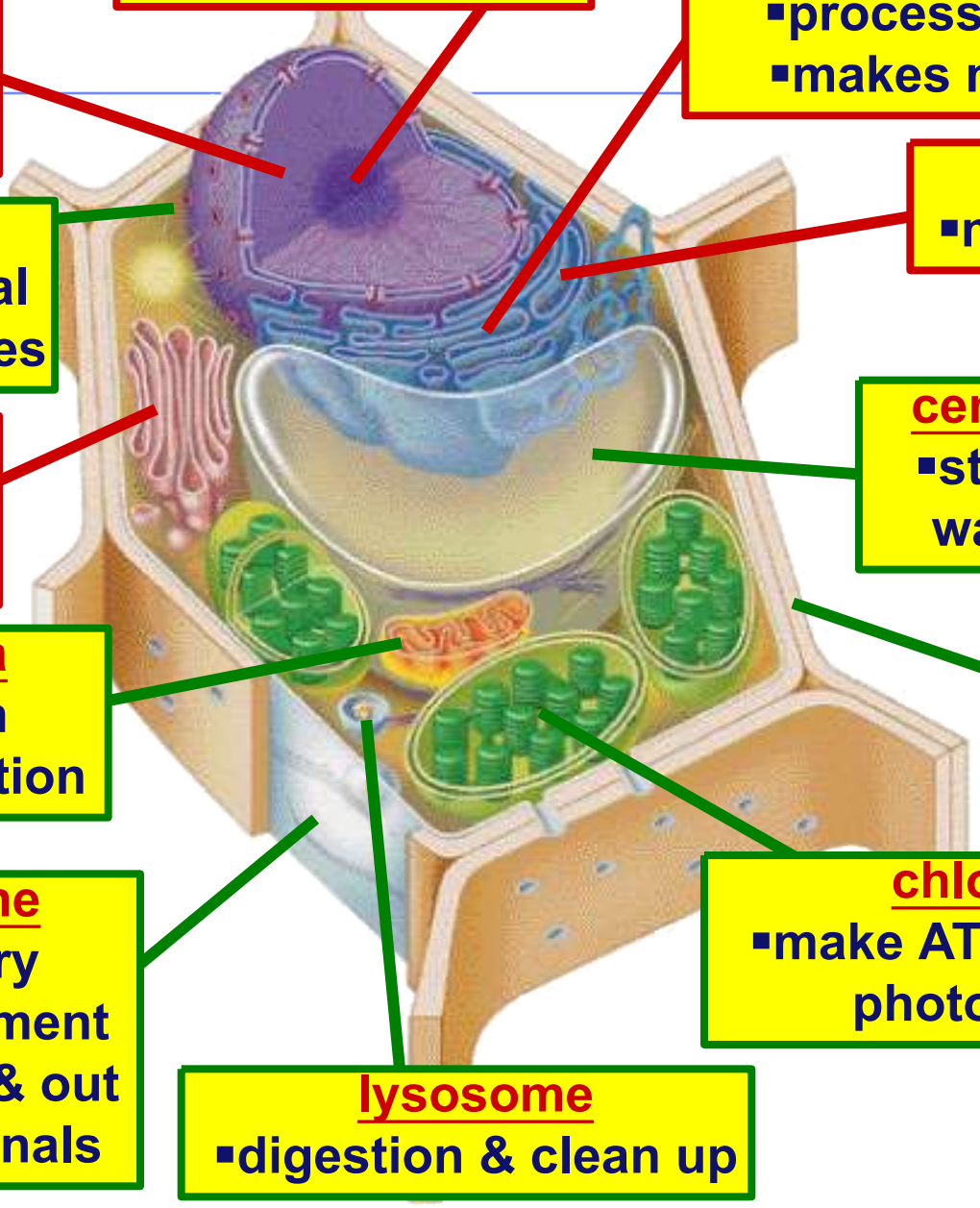
mitochondria
- make ATP energy from sugar + O_2

Golgi apparatus
- finishes, packages & ships proteins

cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

ER
- helps finish proteins
- makes membranes


nucleus
DNA
RNA
endoplasmic reticulum
ribosomes
protein
vesicle
Golgi apparatus
TO:
finished protein
vesicle
protein on its way!
Making Proteins



nucleolus
- make ribosomes

endoplasmic reticulum
- processes proteins
- makes membranes

nucleus
- control cell
- protects DNA

ribosomes
- make proteins

cytoplasm
- jelly-like material around organelles

central vacuole
- storage: food, water or waste

Golgi apparatus
- finish & ship proteins

cell wall
- support

mitochondria
- make ATP in cellular respiration

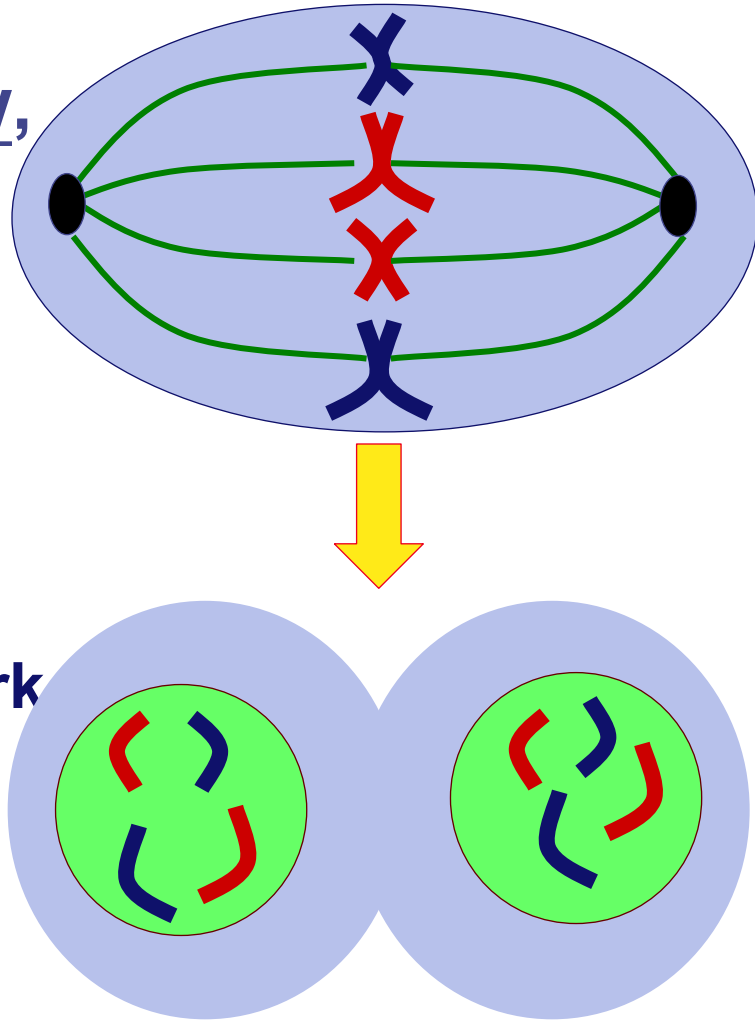
chloroplast
- make ATP & sugars in photosynthesis

cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

lysosome
- digestion & clean up

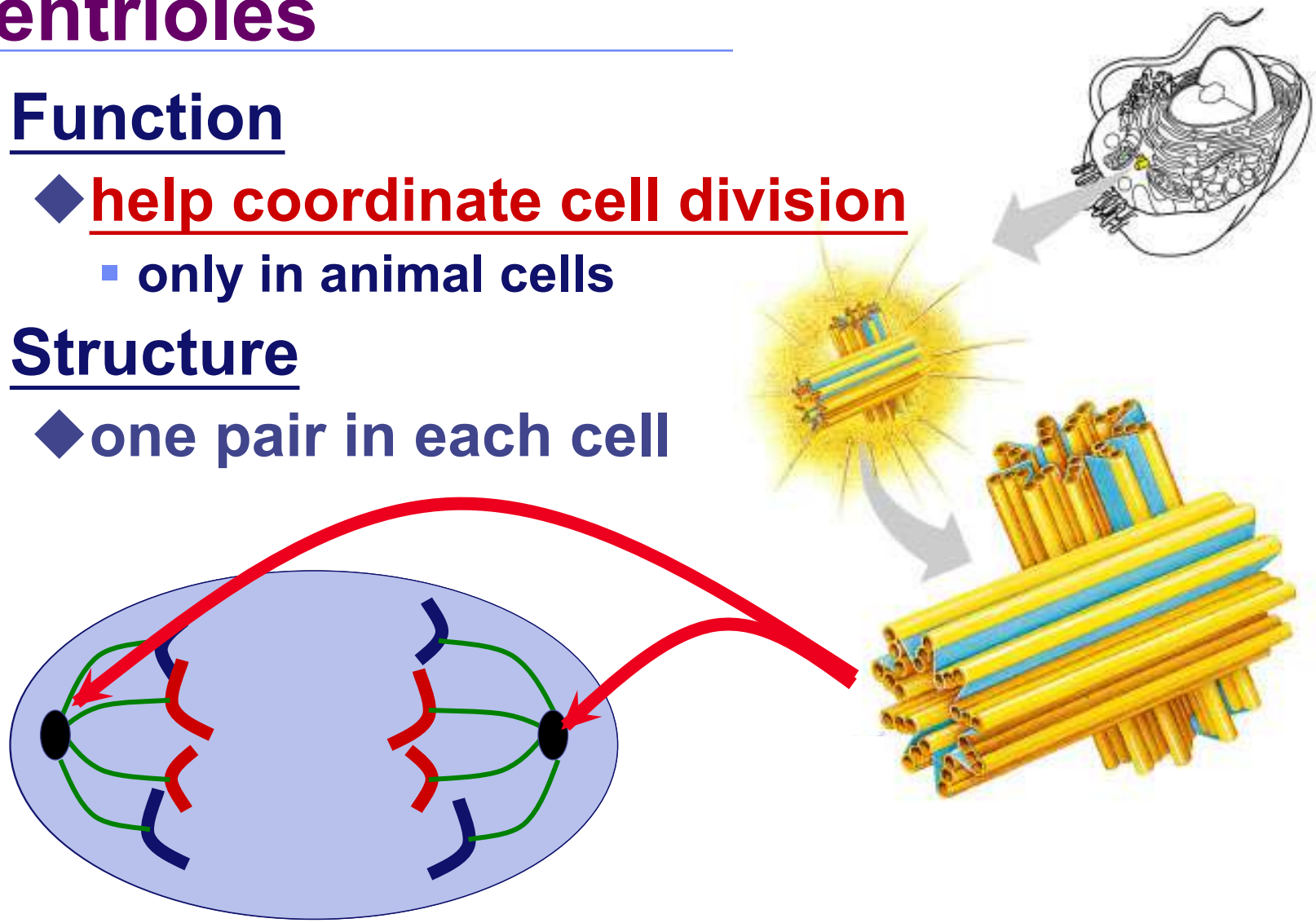
3. Cells need to make more cells!

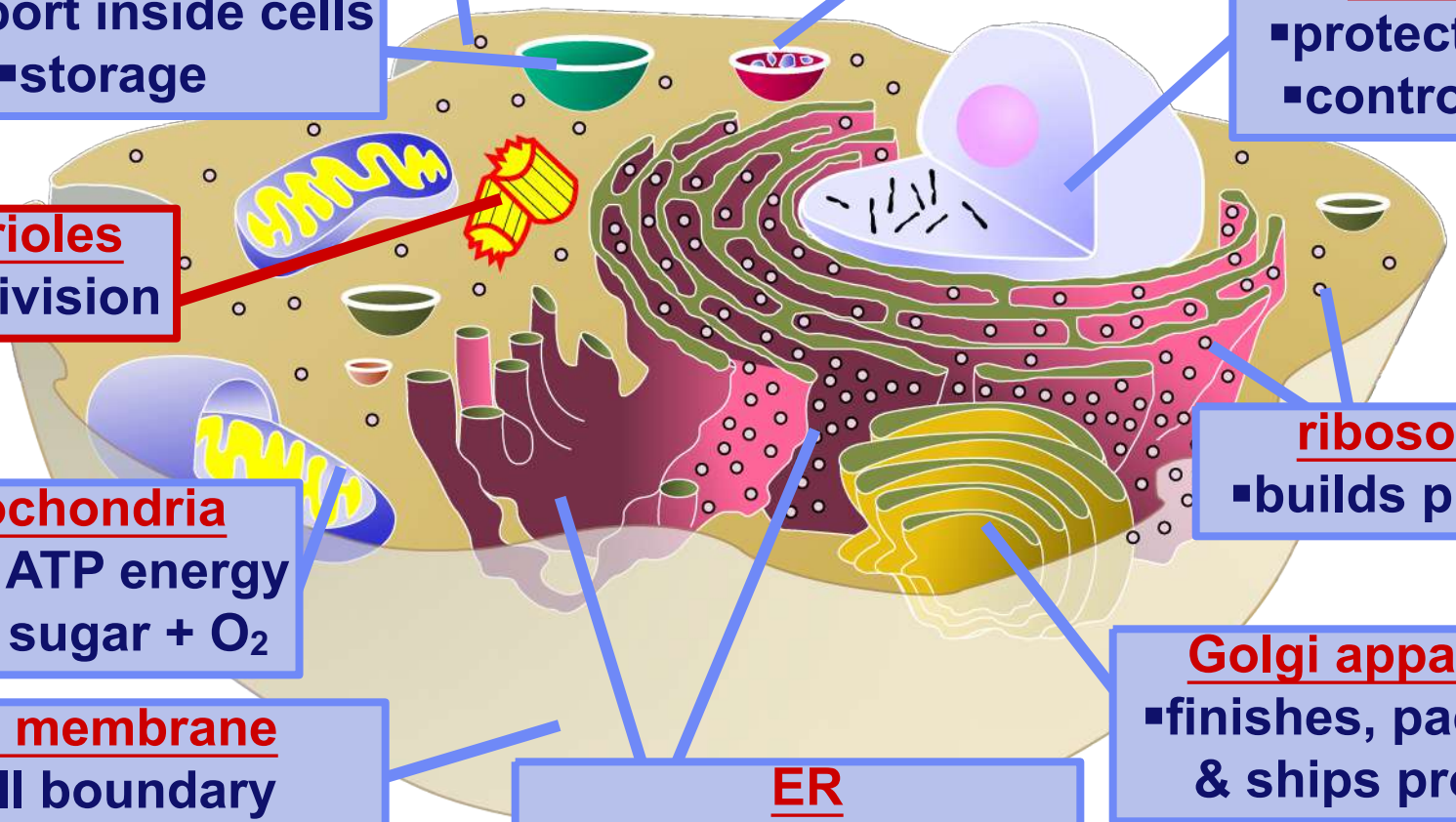
- **Making more cells**
  - to replace, repair & grow, the cell must…
  - copy their DNA
    - make extra organelles
    - divide the new DNA & new organelles between 2 new "daughter" cells
    - organelles that do this work
  - nucleus
    - centrioles



Centrioles

- **Function**
  - **help coordinate cell division**
    - only in animal cells
- **Structure**
  - one pair in each cell





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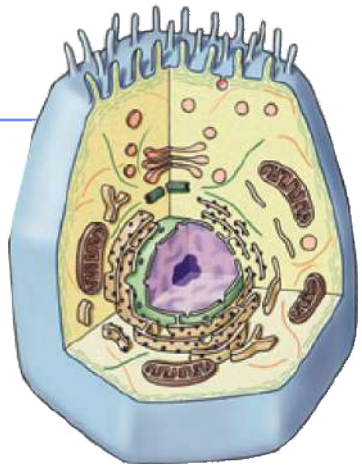
- make ATP energy from sugar + O_2

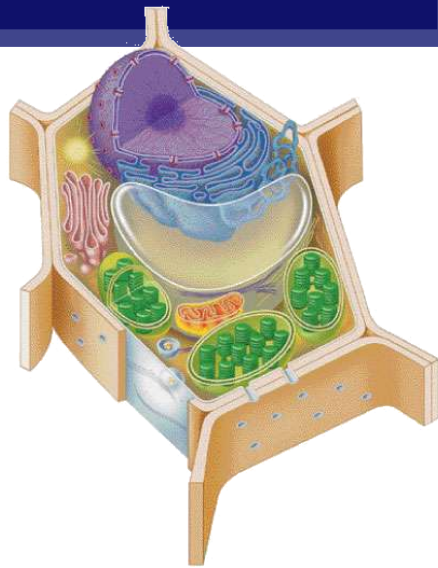
Golgi apparatus
- finishes, packages & ships proteins

cell membrane
- cell boundary
- controls movement of materials in & out
- recognizes signals

ER
- helps finish proteins
- makes membranes

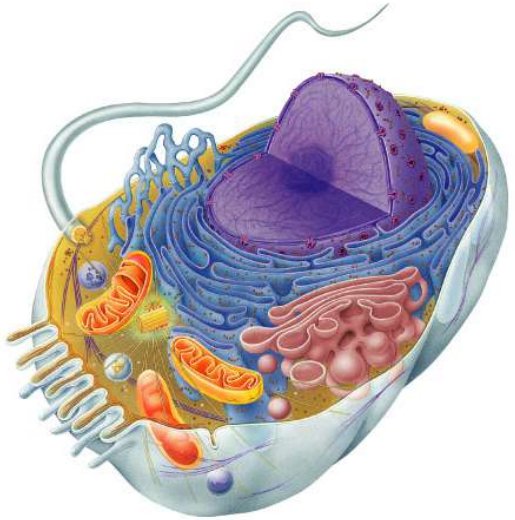
Cell Summary





- Cells have 3 main jobs
  - make energy
    - need food + O_2
    - cellular respiration & photosynthesis
    - need to remove wastes
  - make proteins
    - need instructions from DNA
    - need to chain together amino acids & "finish" & "ship" the protein
    - make more cells
  - need to copy DNA & divide it up to daughter cells

Our organelles do all those jobs!



That's my cellular story…

Any Questions?