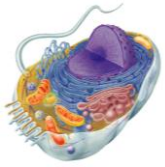
Biology



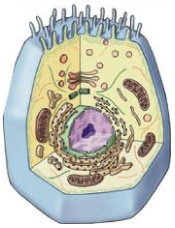
Cells & Cell Organelles

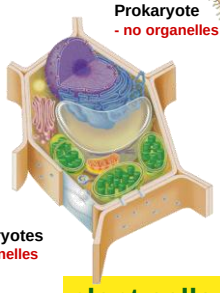
Doing Life's Work

Types of cells

bacteria cells

Prokaryote
- no organelles



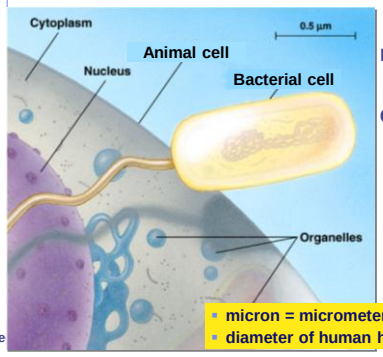


Eukaryotes
- organelles

animal cells **plant cells**

Regents Biology

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

Re

The Cell

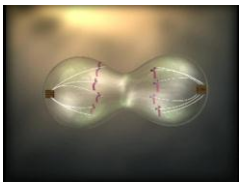
- Hooke first viewed cork – 1600's
  - In 1665, Englishman Robert Hooke used an early compound microscope to look at a cork.
  - Called the empty chambers "cells".

Re

Biology

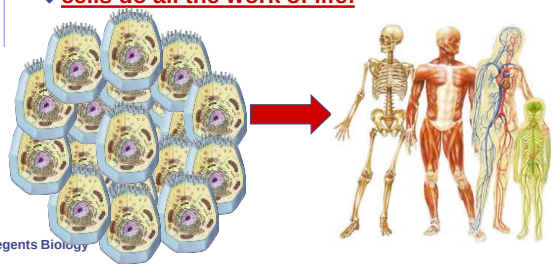
Cell Theory

1. All living things are made up of cells.
2. Cells are the basic units of structure and function in living things.
3. New cells are produced from existing cells.



Why study cells?

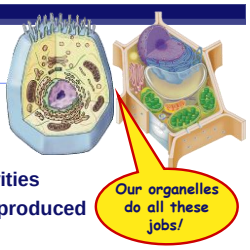
- Cells → Tissues → Organs → Bodies
  - bodies are made up of cells
  - cells do all the work of life!



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

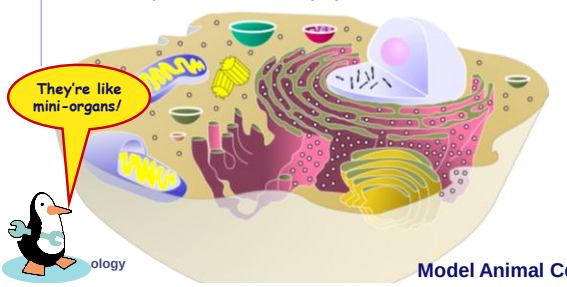


- Cells have 3 main jobs
  - make energy
    - need energy for all activities
    - need to clean up waste produced while making energy
  - make proteins
    - proteins do all the work in a cell, so we need lots of them
  - make more cells
    - for growth
    - to replace damaged or diseased cells

Biology

Organelles

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



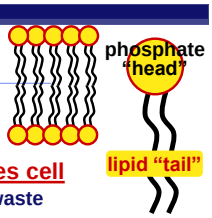
Model Animal Cell

1. Cells need power!

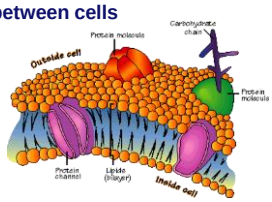
- Making energy
  - to fuel daily life & growth, the cell must…
    - take in food & digest it
    - take in oxygen (O_2)
    - make ATP
    - remove waste
  - organelles that do this work…
    - cell membrane
    - lysosomes
    - vacuoles & vesicles
    - mitochondria

Regents Biology

Cell membrane

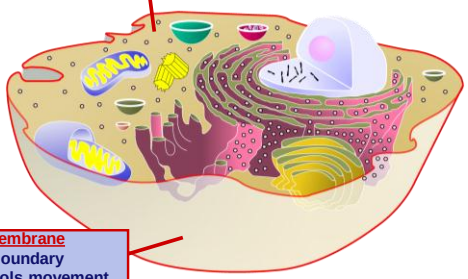


- Function
  - separates cell from outside
  - controls what enters or leaves cell
    - O_2, CO_2, food, H_2O, nutrients, waste
  - recognizes signals from other cells
    - allows communication between cells
- Structure
  - double layer of fat
    - phospholipid bilayer
  - receptor molecules
    -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



Regents Biology

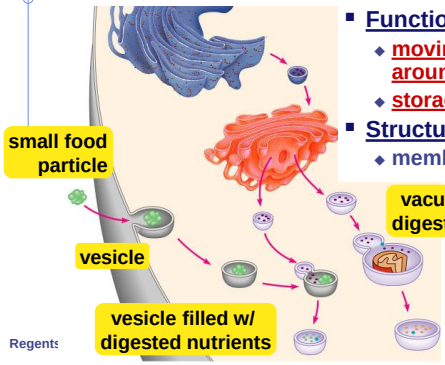
cytoplasm
- jelly-like material holding organelles in place



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

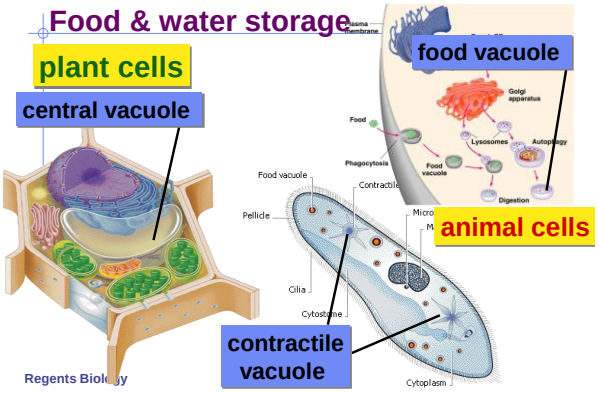
Biology

Vacuoles & vesicles



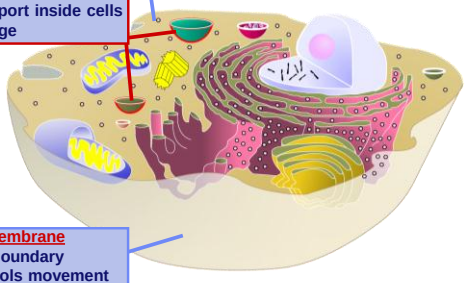
- Function
  - moving material around cell
  - storage
- Structure
  - membrane sac

Food & water storage



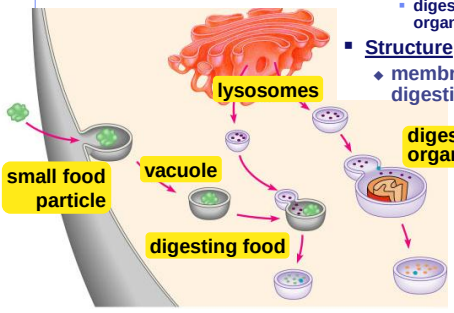
cytoplasm
- jelly-like material holding organelles in place

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

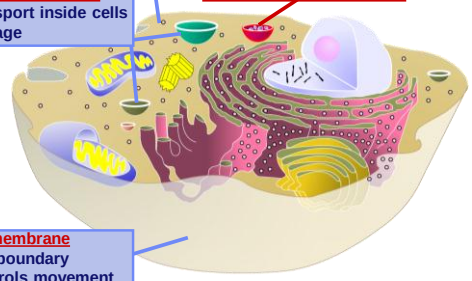
Biology

A Job for Lysosomes

cytoplasm
- jelly-like material holding organelles in place

lysosome
- food digestion
- garbage disposal & recycling

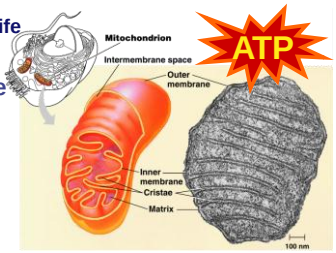
vacuole & vesicles
- transport inside cells
- storage



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

Mitochondria

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



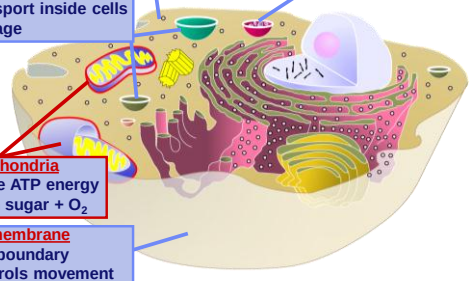
in both animal & plant cells

Regents Biology

cytoplasm
- jelly-like material holding organelles in place

lysosome
- food digestion
- garbage disposal & recycling

vacuole & vesicles
- transport inside cells
- storage



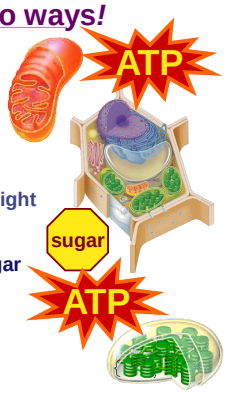
mitochondria
- make ATP energy from sugar + O_2

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

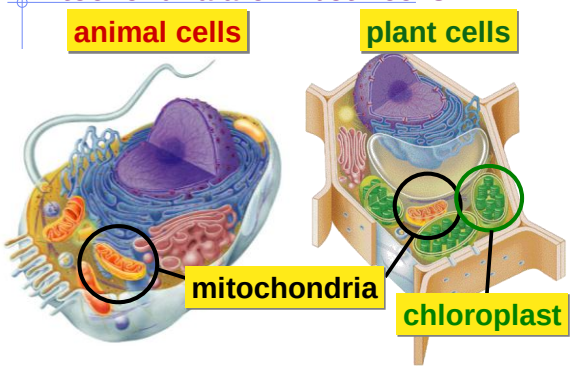
Biology

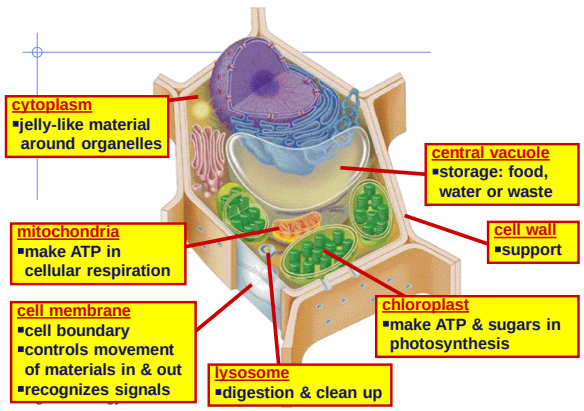
Plants make energy two ways!

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



Mitochondria are in both cells!!





2. Cells need workers = proteins!

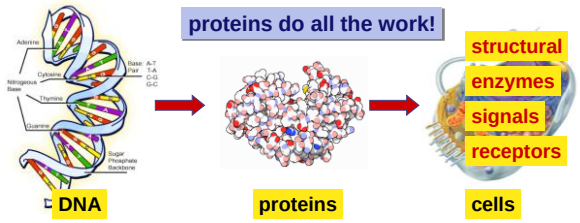
- Making proteins
  - to run daily life & growth, the cell must…
    - read genes (DNA)
    - build proteins
      - structural proteins (muscle fibers, hair, skin, claws)
      - enzymes (speed up chemical reactions)
      - signals (hormones) & receptors
  - organelles that do this work…
    - nucleus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

Regents Biology

Biology

Proteins do all the work!

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



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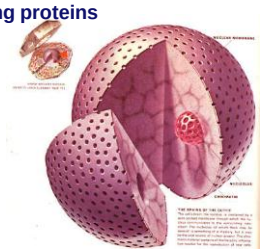
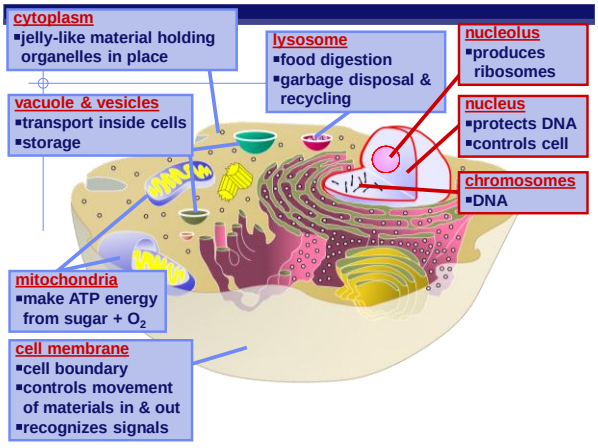
Nucleus

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

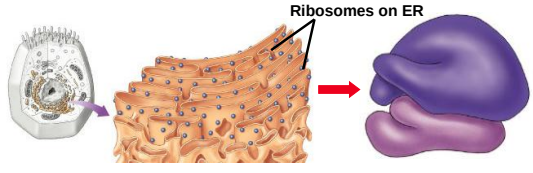


Regents Biology

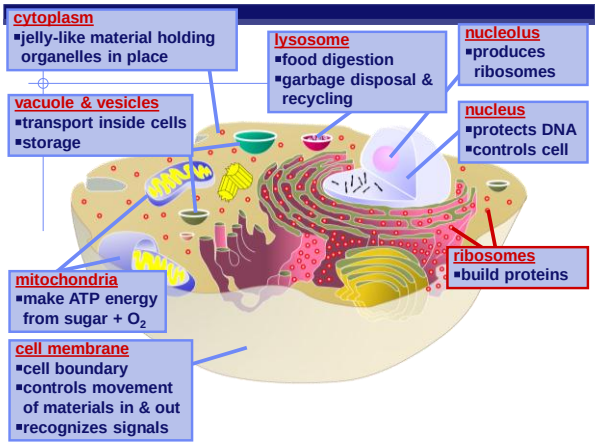


Ribosomes

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

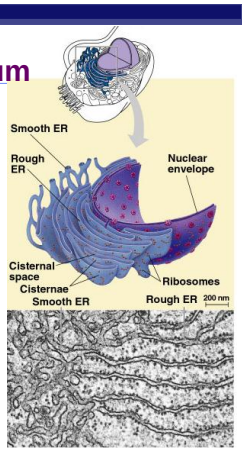


Biology



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



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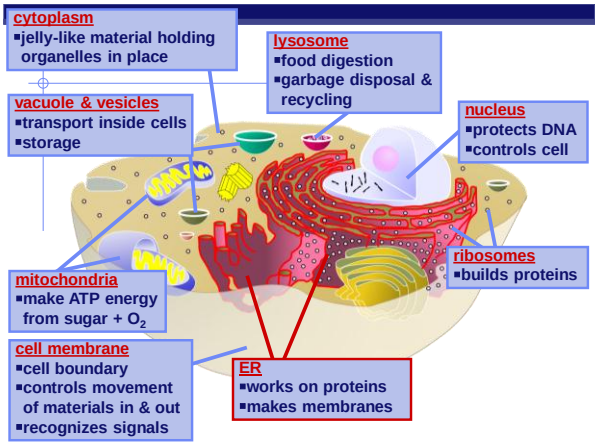
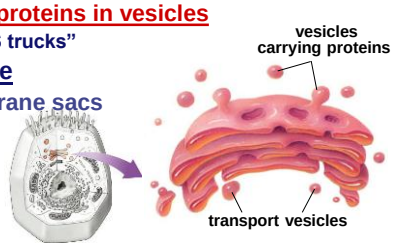


Golgi Apparatus

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



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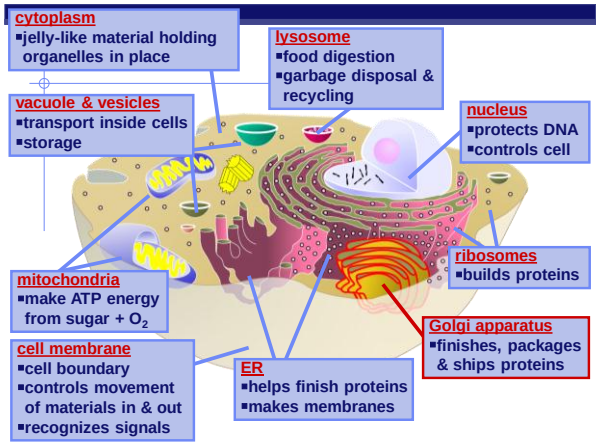
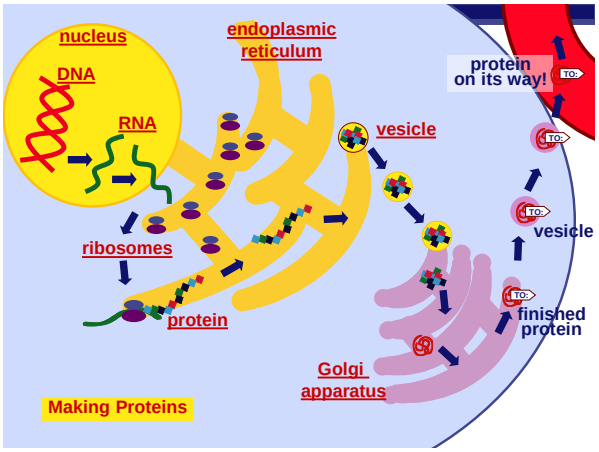
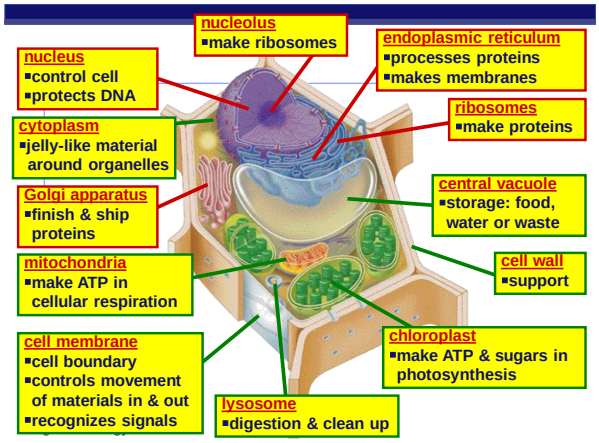
Biology

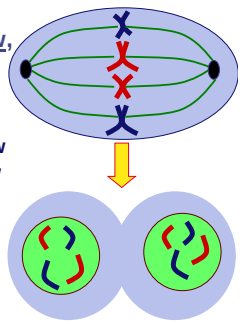






3. Cells need to make more cells!

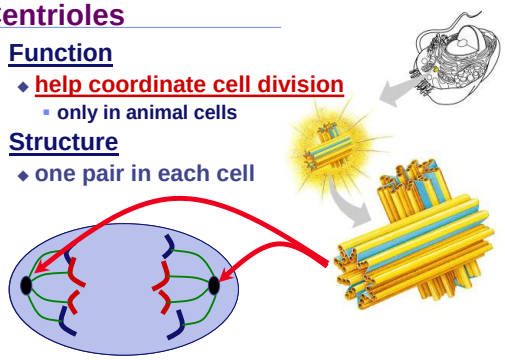
- Making more cells
  - to replace, repair & grow, the cell must…
    - copy their DNA
    - make extra organelles
    - divide the new DNA & new organelles between 2 new "daughter" cells
  - organelles that do this work…
    - nucleus
    - centrioles



Biology

Centrioles

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



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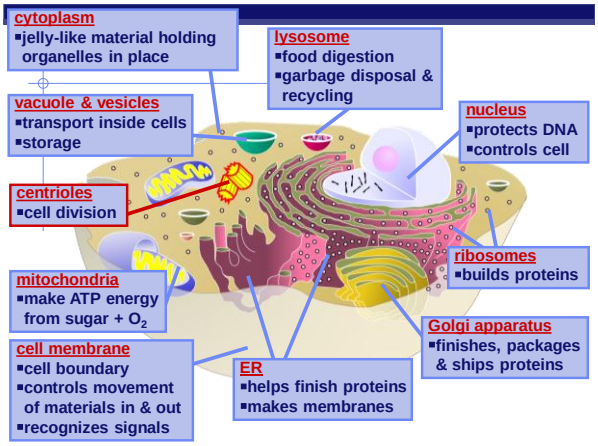
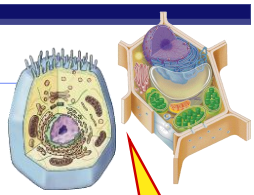


Cell Summary

- 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!

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