Plants Unit

Week 1 – What are plant cells made from?

Waterford Biology

Plants Unit – W1 Driving Question

- **This week's driving question: How did the General Sherman get so big**?
- What are the cells of plants made from?
- Where does the mass of plant cells come from?
- How are plant cells both similar and different from animal cells?

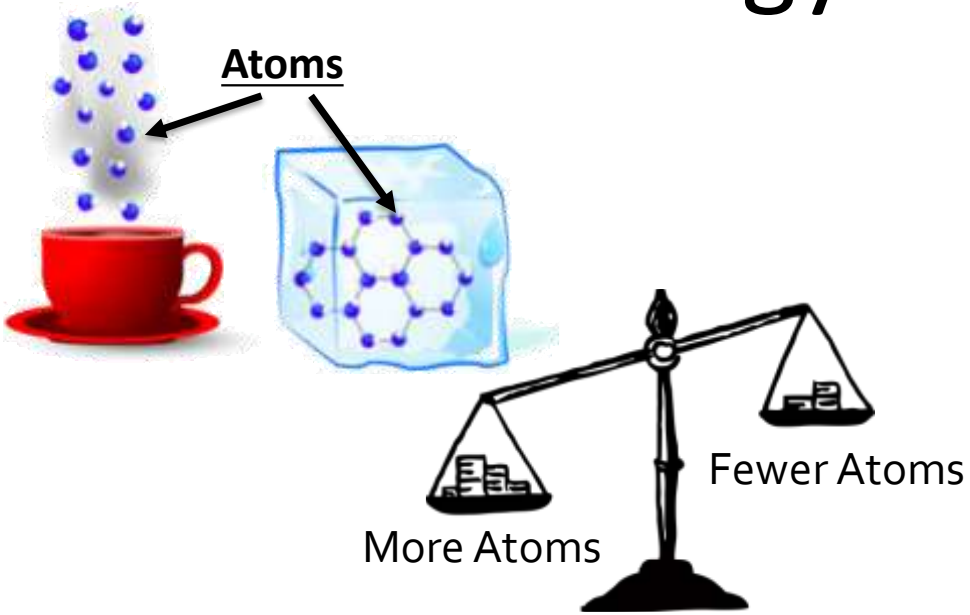
Part 1 Recap

- Earlier we learned that the General Sherman is the largest tree in the world, weighing 5.6 million kg.
- We also learned that sequoia seed only weigh 0.005 g.
- Where did the millions of kilograms of atoms come from?
- What claims can we make based on what we know?

REMINDERS FROM EARLIER WEEKS

Reminders from Matter & Energy

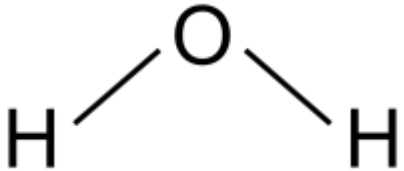
- **All substances are made of <u>atoms</u>.**
  - The greater the <u>mass</u>, the more atoms a substance has.
  - Different kinds of atoms are called <u>elements</u>.
- **Atoms can bond to form <u>molecules</u>.**
  - For example, water is a molecule consisting of three atoms and two elements (O & H).



Source: Tes

Source: Pixabay

If atoms were like students, a class would be like a molecule.



A group of bonded atoms = a molecule.

A group of students = a class.

Source: Pixabay

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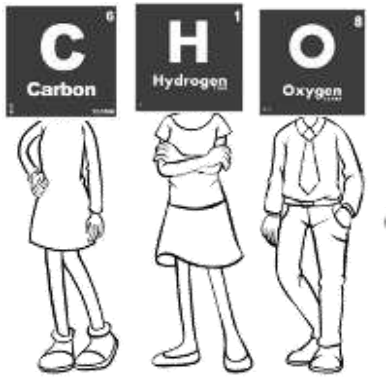
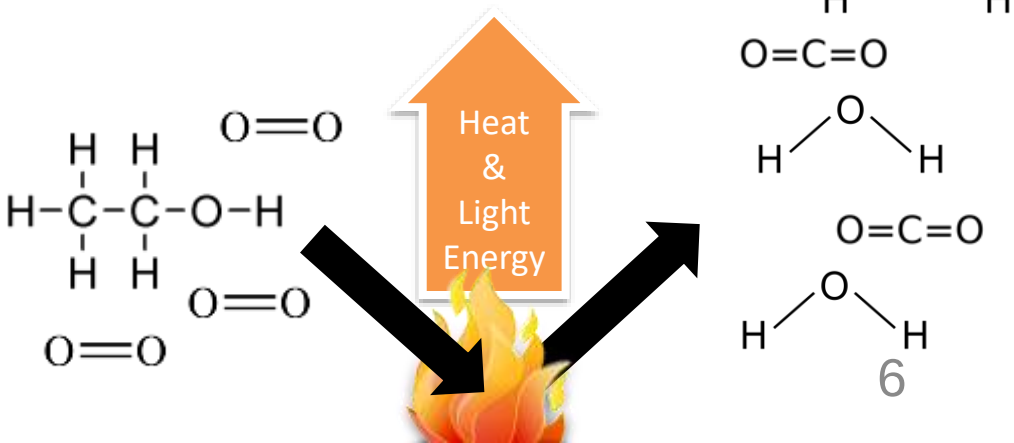
Reminders from Matter & Energy

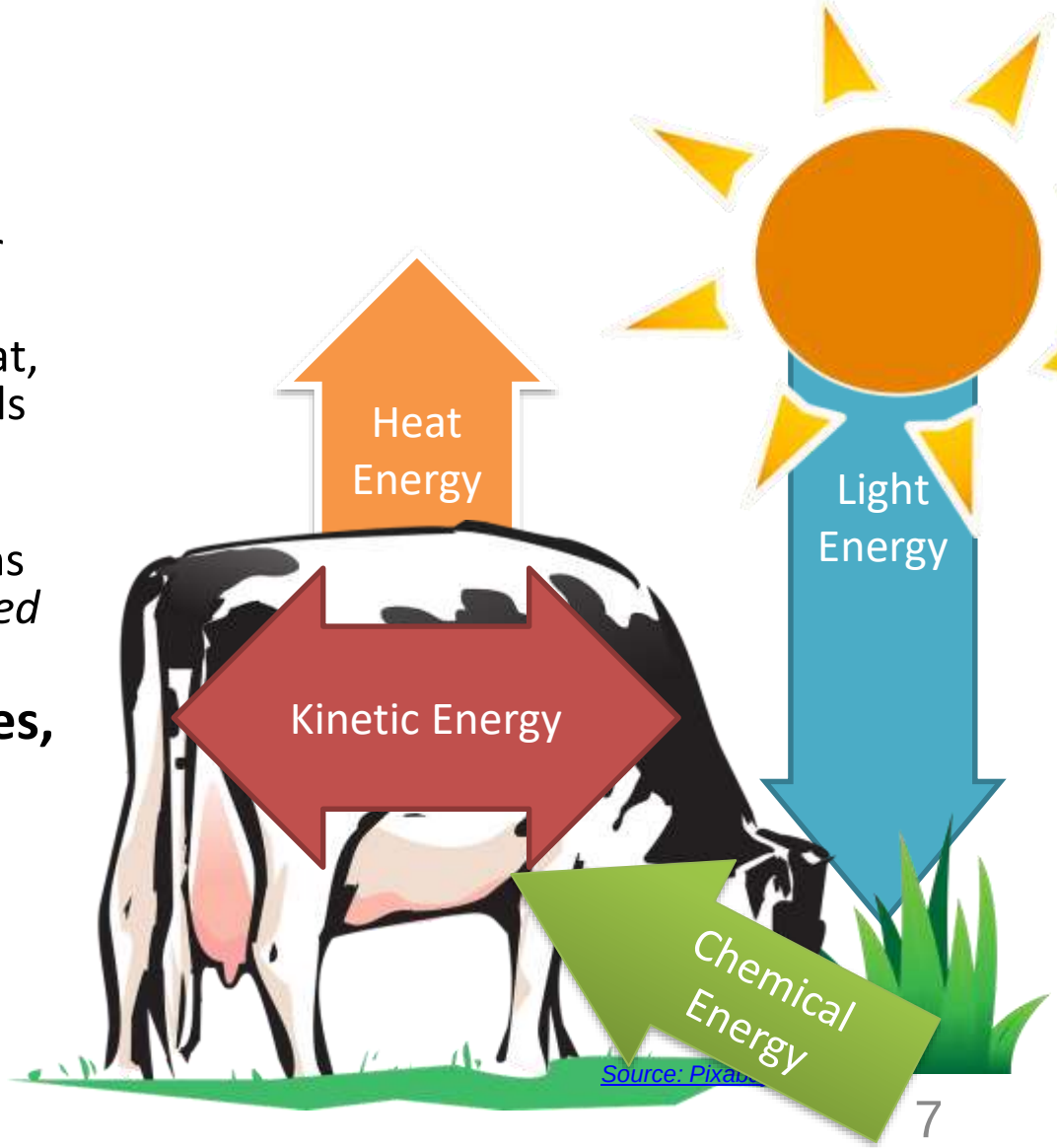
- **In biology, atoms last forever.**
  - Atoms cannot be created or destroyed.
- **Atoms *<u>cannot</u>* be turned into energy or into other elements during a biological reaction.**
  - For example, a carbon atom is always a carbon atom).
  - Atoms can only be rearranged into new molecules.





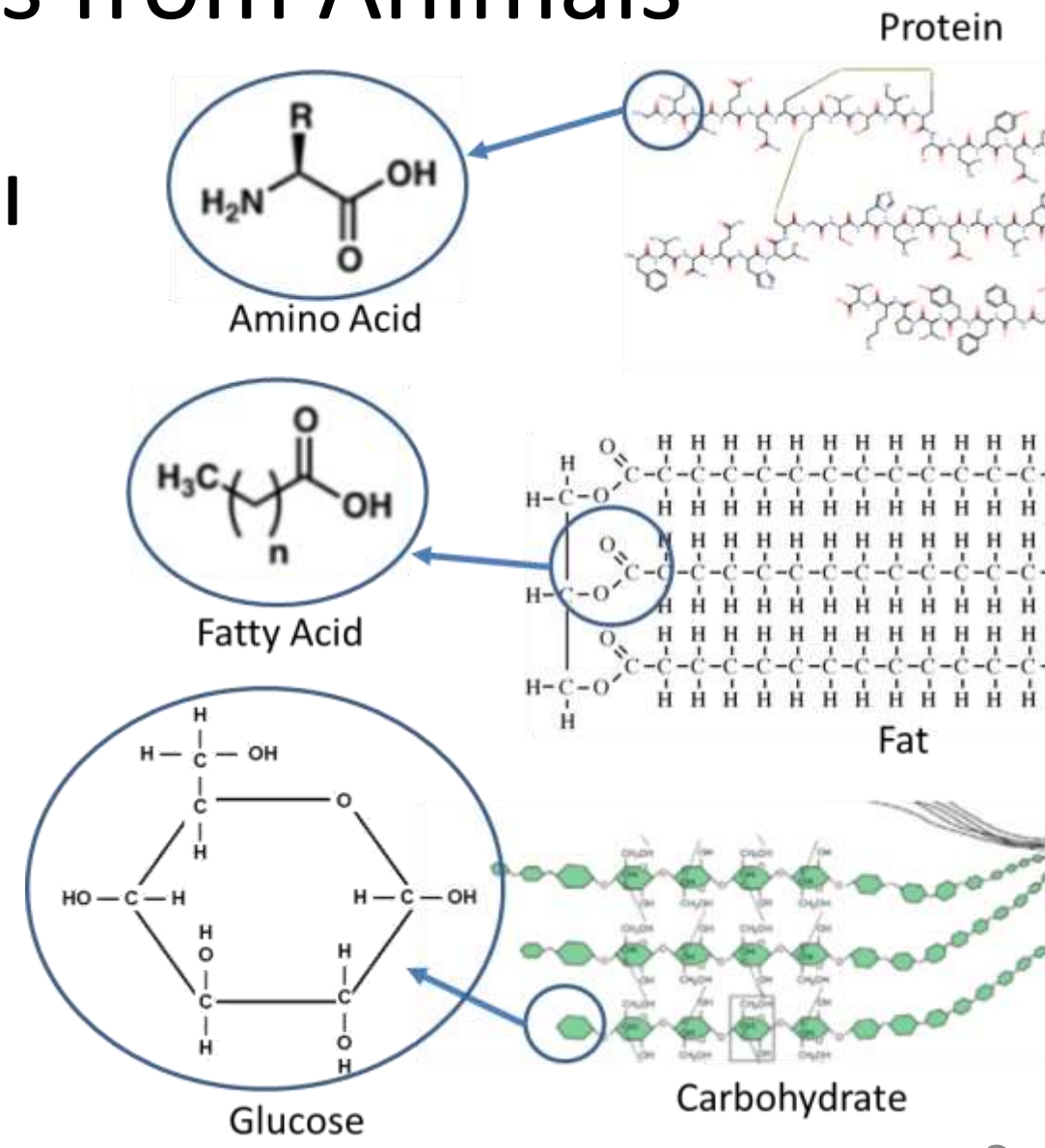
Reminders from Matter & Energy

- Rule #3: In biology, **energy lasts forever**.
  - Energy cannot be created or destroyed.
  - Energy can exist as light, heat, motion, or as chemical bonds in molecules.
  - Energy in one form can be transformed into other forms (*e.g., light can be transformed into heat*).
- **When atoms form molecules, they store energy in their chemical bonds**.
  - Carbon-carbon bonds and carbon-hydrogen bonds are high-energy bonds.



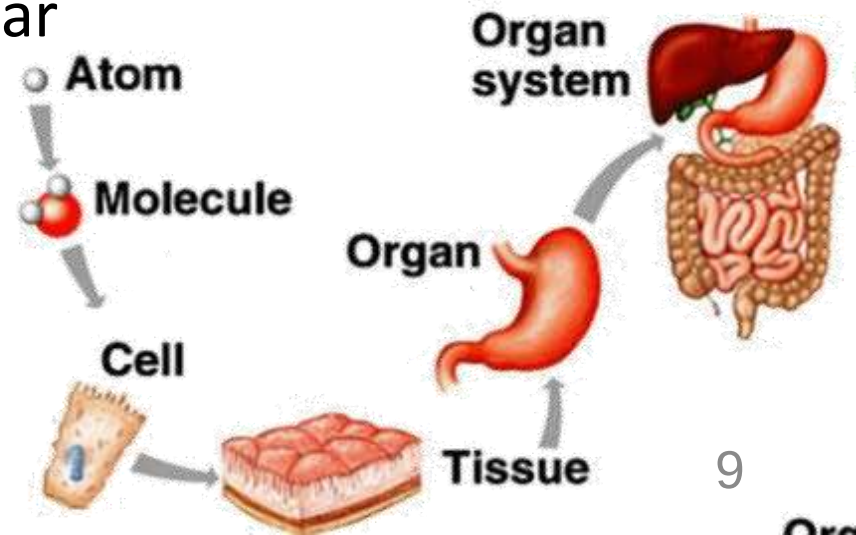
Reminders from Animals

- **A <u>macromolecule</u> is a long chain of individual molecules bonded together.**
  - Macromolecules do all the work of cells.
- **Examples of macromolecules include proteins, fats, & carbohydrates.**
  - These all have high-energy bonds.



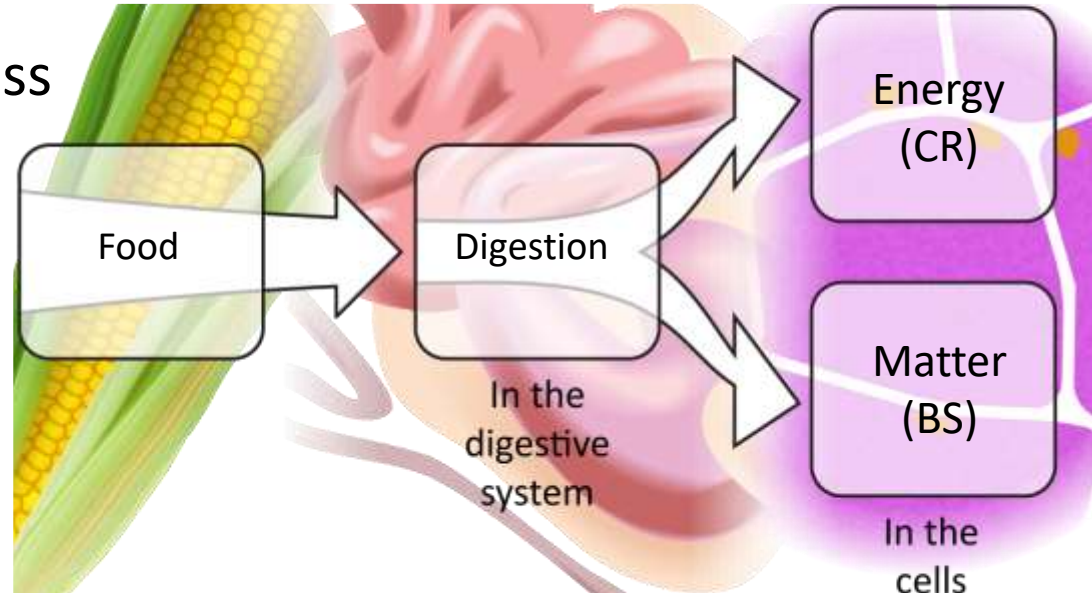
Reminders from Animals

- **Cells are organized at four different levels to create a functioning organism.**
  - Cells & organelles are made from macromolecules.
  - A group of similar cells form tissues.
  - Organs are comprised of different kinds of tissues (muscle, nerves, connective tissue, and lining).
  - Different organs with a similar function form a system.
  - A collection of systems comprises an individual organism.



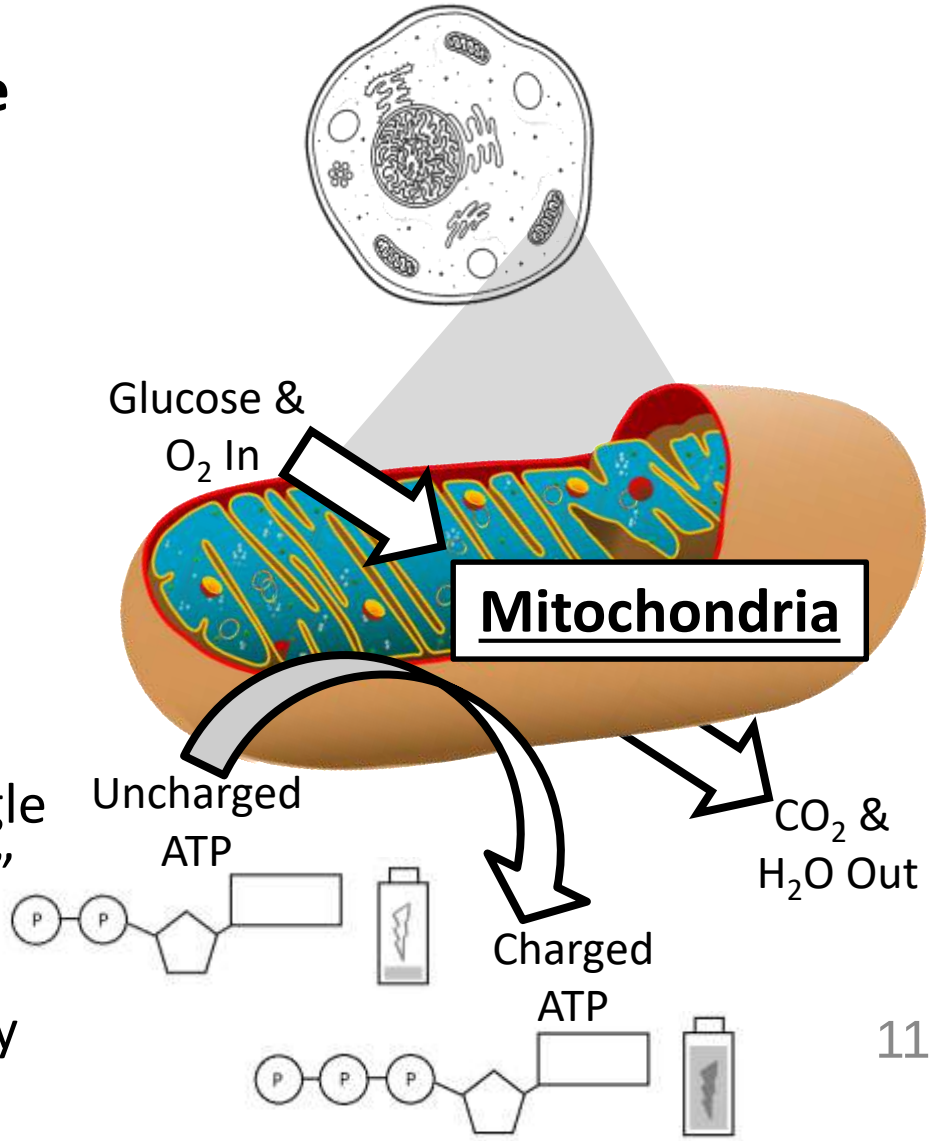
Reminders from Animals

- **The food that animals consume provides either 1) energy or 2) matter.**
  - Cellular respiration is the process in which glucose and oxygen molecules are rearranged into CO_2 and H_2O to acquire chemical energy.
  - Biosynthesis is the process in which organisms use consumed molecules to make macromolecules needed for cell function.



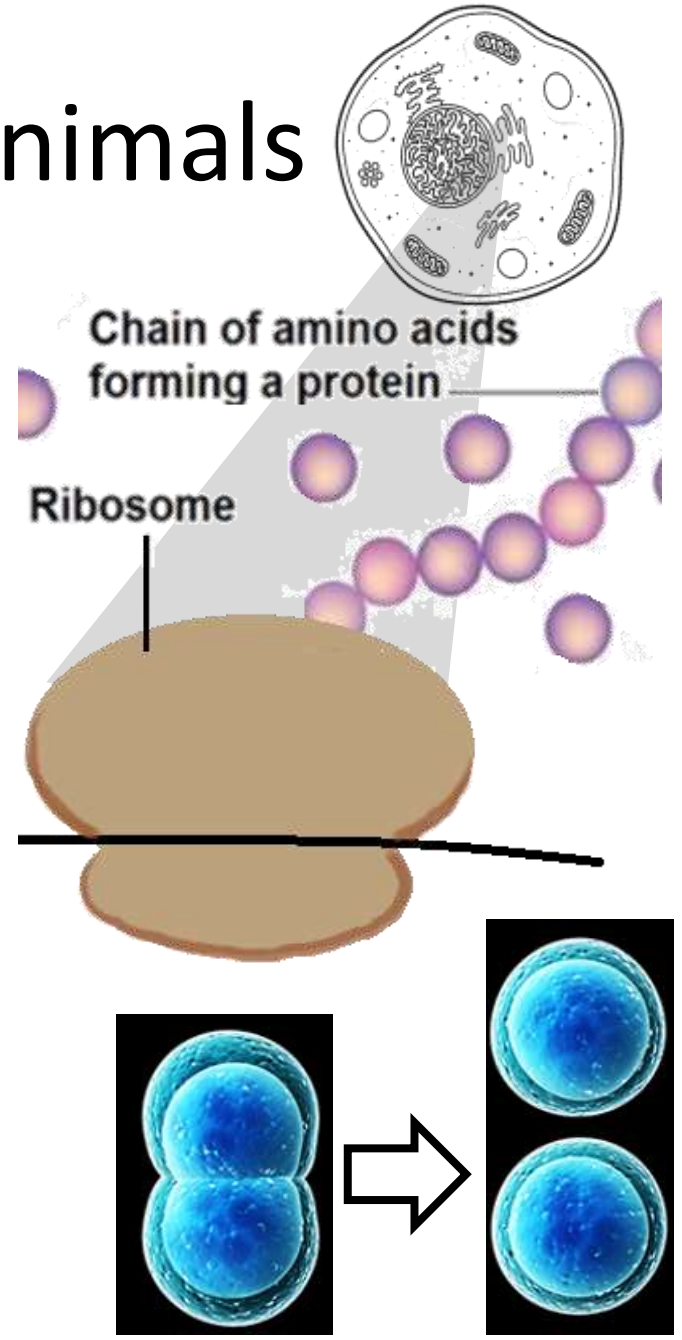
Reminders from Animals

- **Cellular respiration occurs in the mitochondria of cells.**
  - Glucose and oxygen are rearranged into CO_2 and H_2O.
  - The chemical energy in the C-C & C-H bonds of glucose is moved to ATP molecules.
- **ATP is sort of like a molecular rechargeable battery.**
  - The chemical energy from a single glucose molecule can "recharge" dozens of ATP molecules.
  - ATP powers most cellular activity using its high energy bonds.



Reminders from Animals

- **Biosynthesis is the process in which organisms use consumed molecules to make the macromolecules needed for its cells.**
  - Cells first absorb individual molecules from the blood.
  - Structures inside the cell then assemble individual molecules into macromolecules like proteins.
- **As a cell assembles macromolecules, the cell grows bigger.**
  - The process of dividing one large cell into two smaller cells is called <u>mitosis</u>.

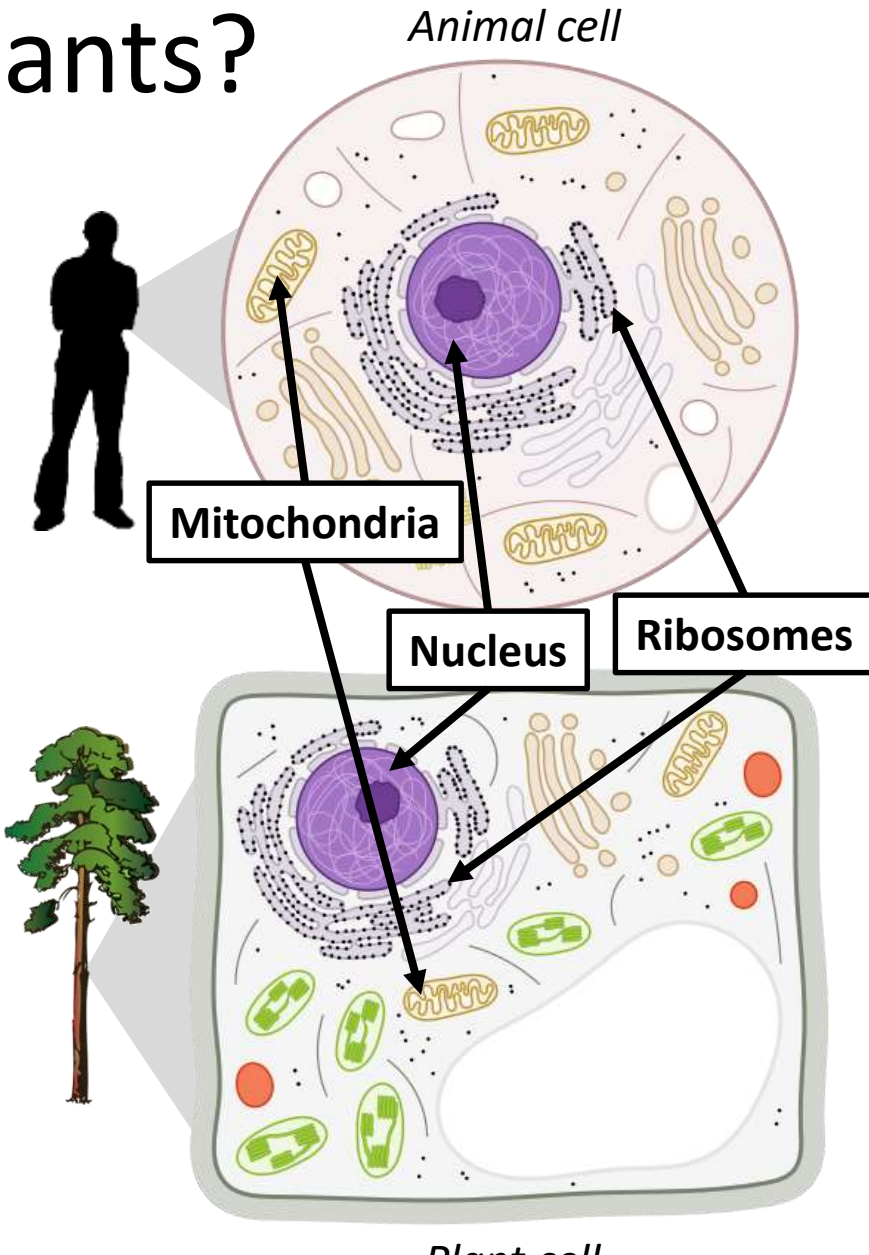


INTRODUCING: PLANTS!

What are Plants?

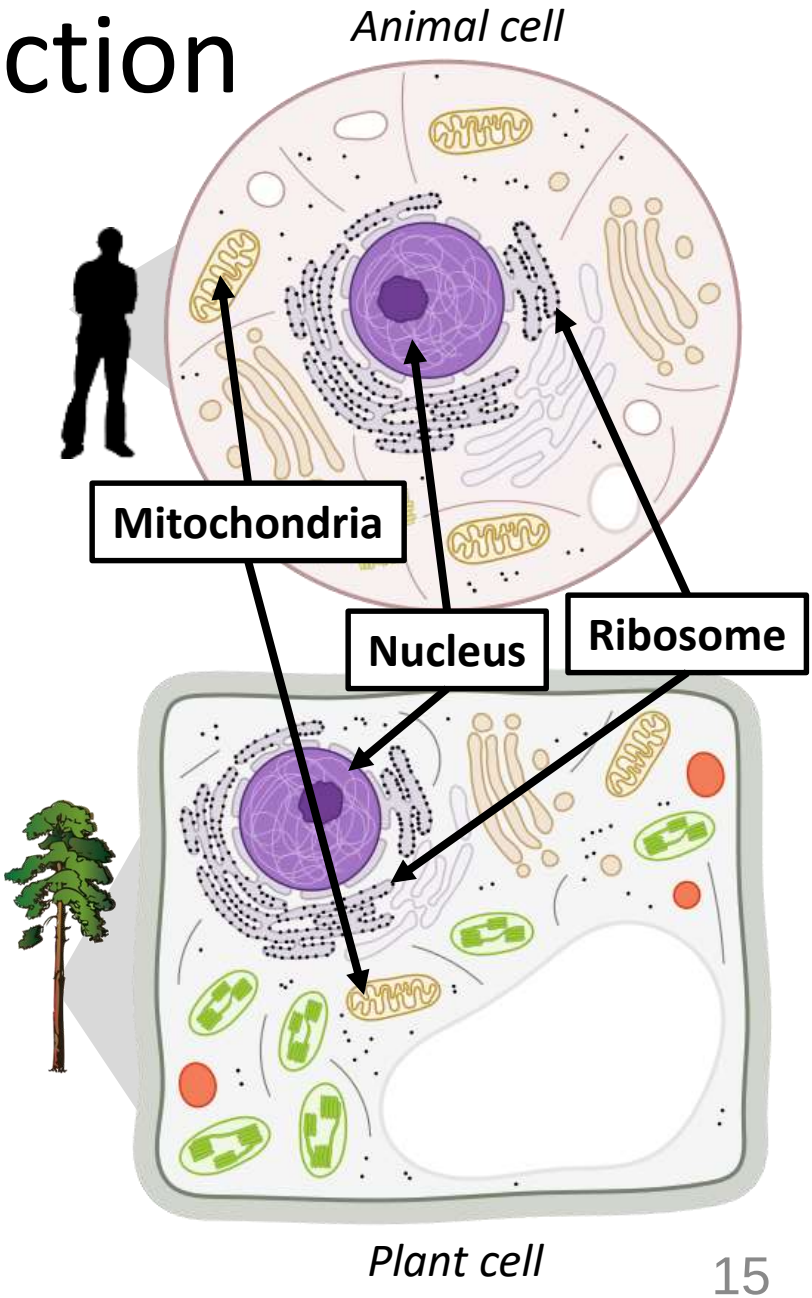
- **Like animals, plants are living organisms with complex cells.**
  - Plants and animals are both eukaryotic (their cells contain organelles).
  - Simple prokaryotic organisms like bacteria lack organelles in their cells.

– **Most of the organelles found in animal cells are also found in plant cells.**
  - Plant cells also have a nucleus, mitochondria, and ribosomes, among other organelles.



Plant Cell Function

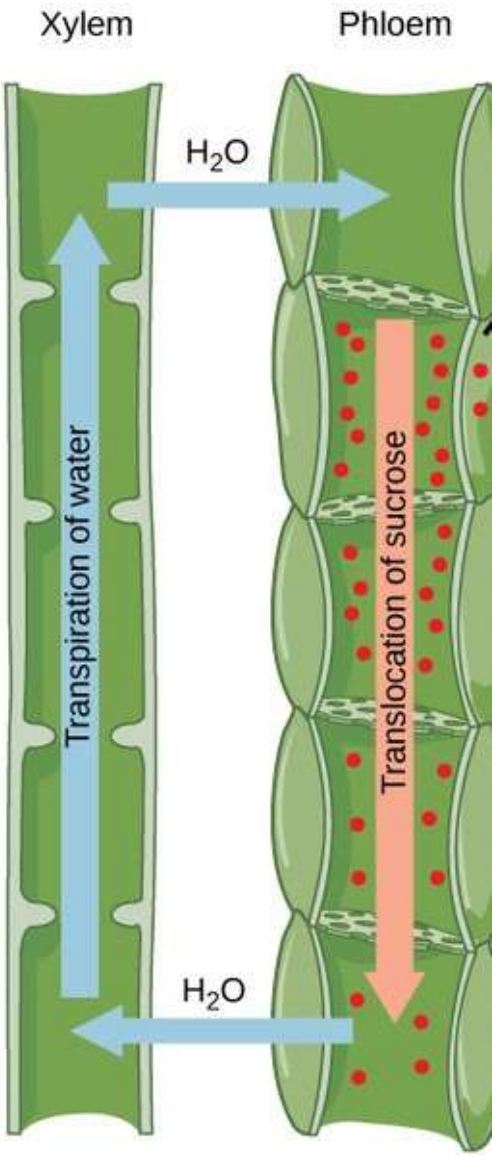
- **Plant cells have most of the same organelles as animal cells and perform similar cellular functions.**
  - Both plant & animal cells have *DNA.*
    - DNA provides 'instructions' to assemble *proteins* from *amino acids* via <u>biosynthesis</u> in the *ribosomes*.
  - Plant cells also divide via <u>mitosis</u>.
  - Plant cells also have *mitochondria.*
    - This is where glucose and O_2 are rearranged to form CO_2 and H_2O during <u>cellular respiration</u>.



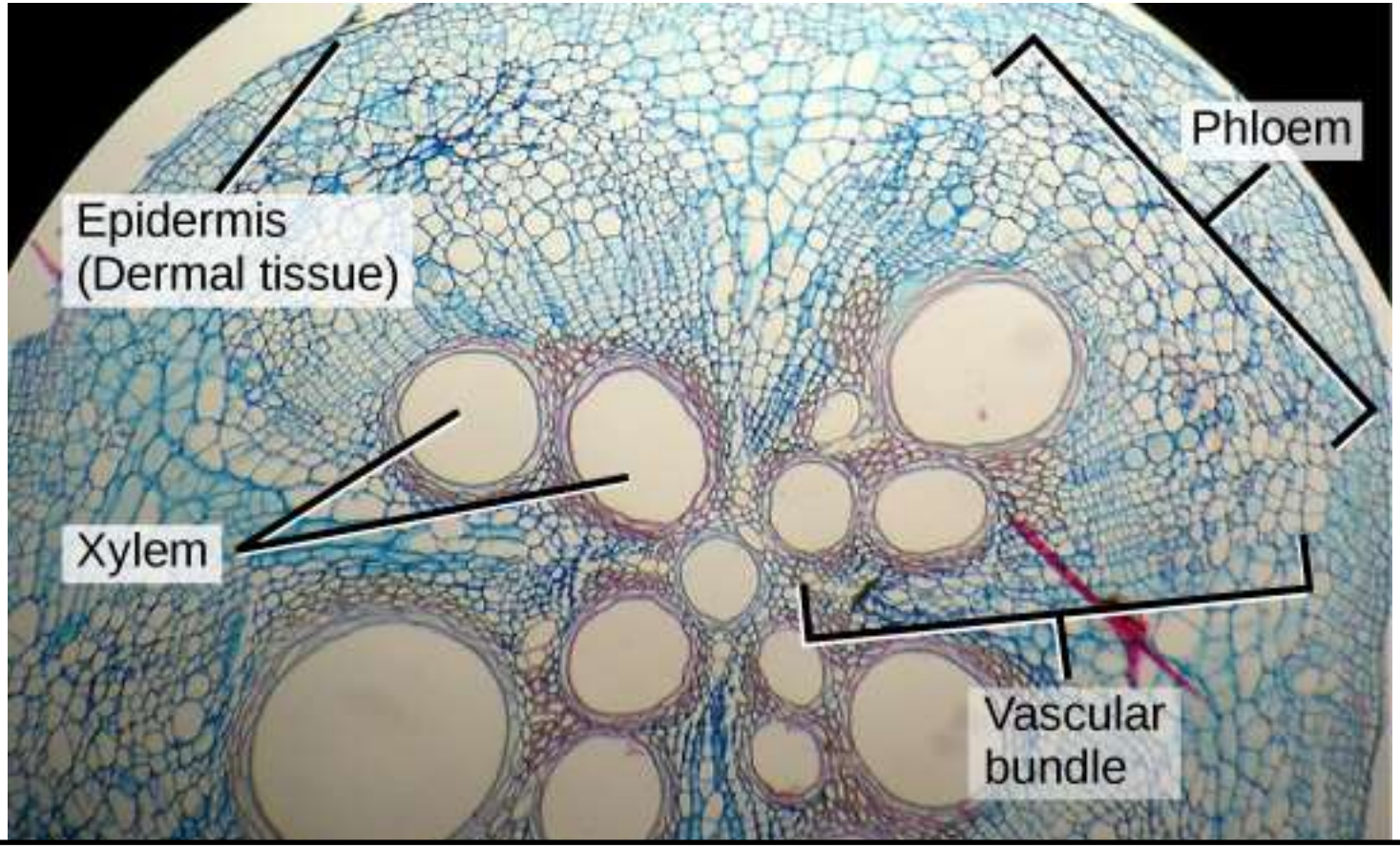
Plant Tissues & Systems

- **Plant cells are organized like animal cells.**
  - A group of plant cells form tissues.
  - Plant tissues form organs (roots, stems, leaves).
  - Plant organs form systems.

– **Plant tissues include xylem & phloem.**
  - Xylem are hollow tubes through which water and minerals move *up* through the plant as water is evaporated from pores in the leaves.
  - Phloem are tubes through which sugars move *down* throughout the plant via gravity.
  - Xylem & phloem in roots, stems, and leaves form a vasculature system (like the *circulatory system* in animals).



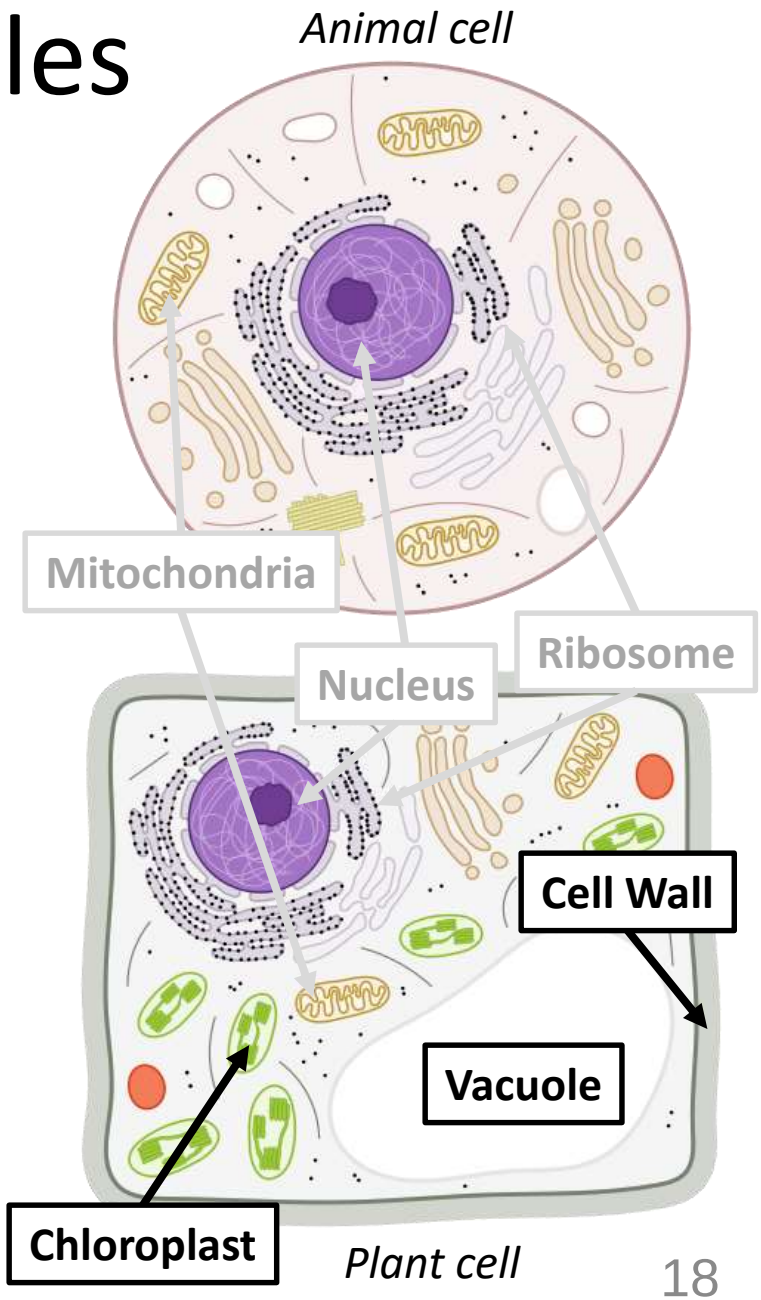
Xylem & Phloem



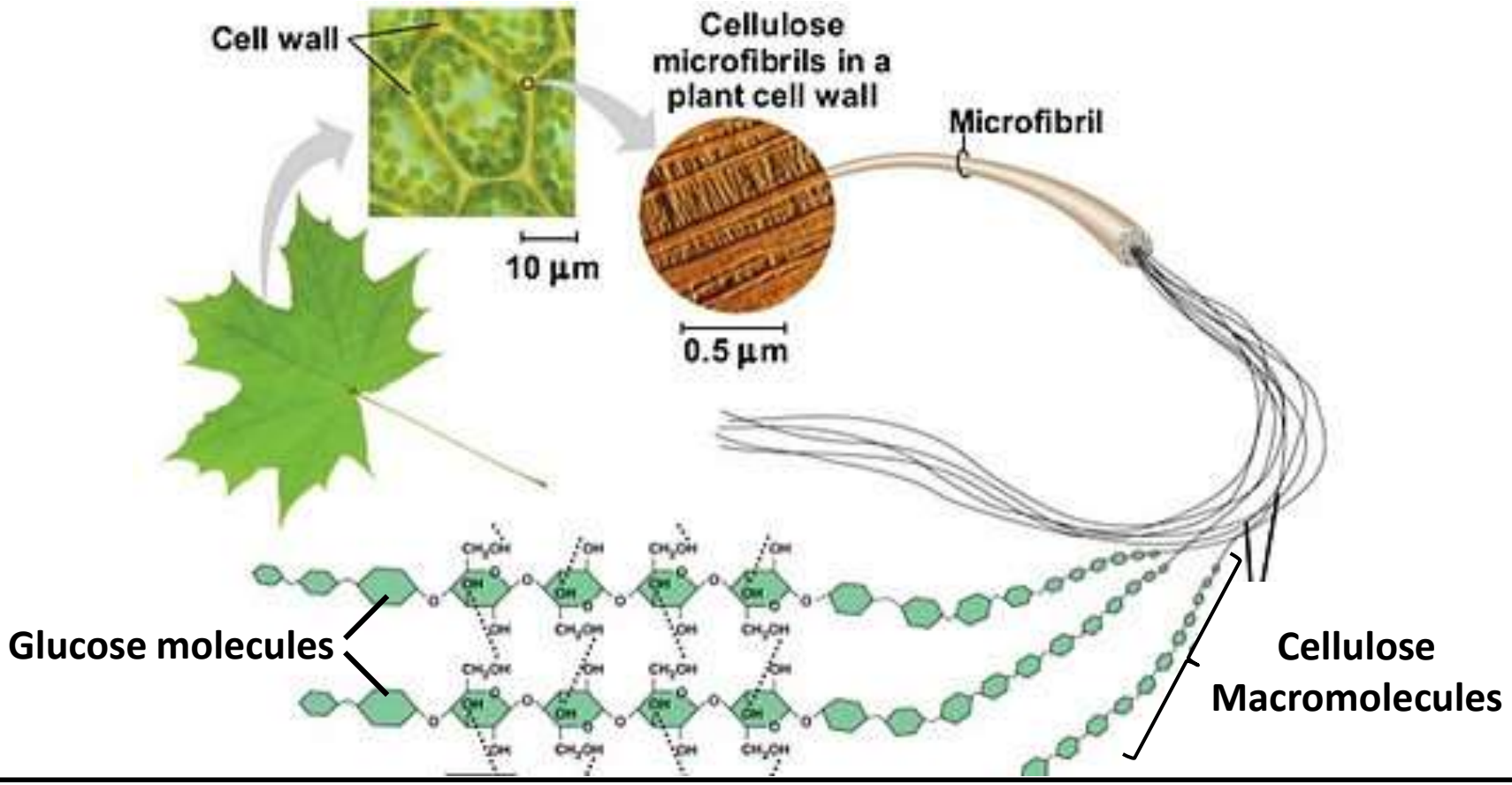
- **Shown above is a cross section of a plant stem.**
  - Water moves up the center of the stem in the xylem tubes.
  - Sugars & nutrients move down in the outer phloem.

Plant Organelles

- **Plant cells have three organelles that animal cells do not:**
  - **<u>Chloroplasts</u>:** organelles that can transform light energy into chemical energy (high-energy bonds of glucose).
    - This process is called <u>photosynthesis</u>.
  - **<u>Cell Wall</u>**: a rigid shell made from cellulose surrounding the membrane that provides rigidity (like a skeleton).
    - <u>Cellulose</u>: a type of carbohydrate made from long chains of glucose.
  - **<u>Vacuole</u>**: a storage organelle for waste products and other molecules.



Cellulose



- **In the image above, you can see the long chains of individual glucose molecules in the cellulose macromolecules.**
  - Cellulose provides plants with structure & rigidity.
  - Cellulose is the most abundant organic molecule on earth.

Image Source: https://ecoworldonline.com/viscose-fabric-the-textile-made-from-cellulose/

Revising Our Claims

- Re-visit your ideas about the General Sherman.
  - **How did the General Sherman get so big**?
  - What are the cells of plants made from?
  - Where does the mass of plant cells come from?
  - **Hint**: *Are there similarities between plant cells and animal cells that can help explain how the General Sherman grows and functions?*
- Revise your explanation using the following terms: *cell respiration; mitochondria; biosynthesis; cell walls, cellulose.*
- What do you still need to know to answer this question? What is still uncertain or unknown?

Looking Ahead: Part 3 Investigation

- In Part 3, you will be conducting two investigations.
  - In 3A, you will determine the difference in mass between seeds and seedlings.
  - In 3B, you will investigate plant cells with a microscope.