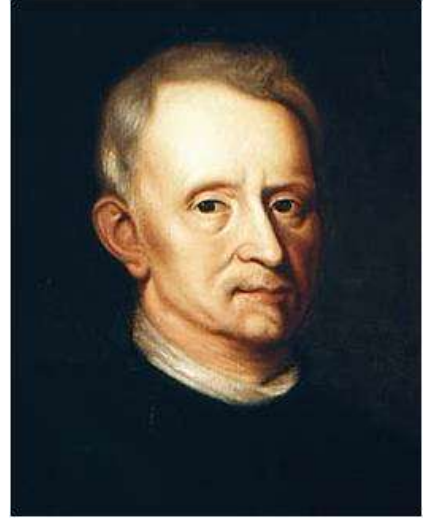


# Lesson

# Photosynthesis

- Chemical reaction
- Factors affecting rate

- Jean Baptista van Helmont (1577-1644) performed one of the classic experiments in plant physiology.
- The prevailing theory at the time was that plants grew by eating soil, and van Helmont devised a clever investigation to test this idea.
- His research was published posthumously in *Ortus Medicinae* (in 1648) and is one of the first examples of the use of the "scientific method."

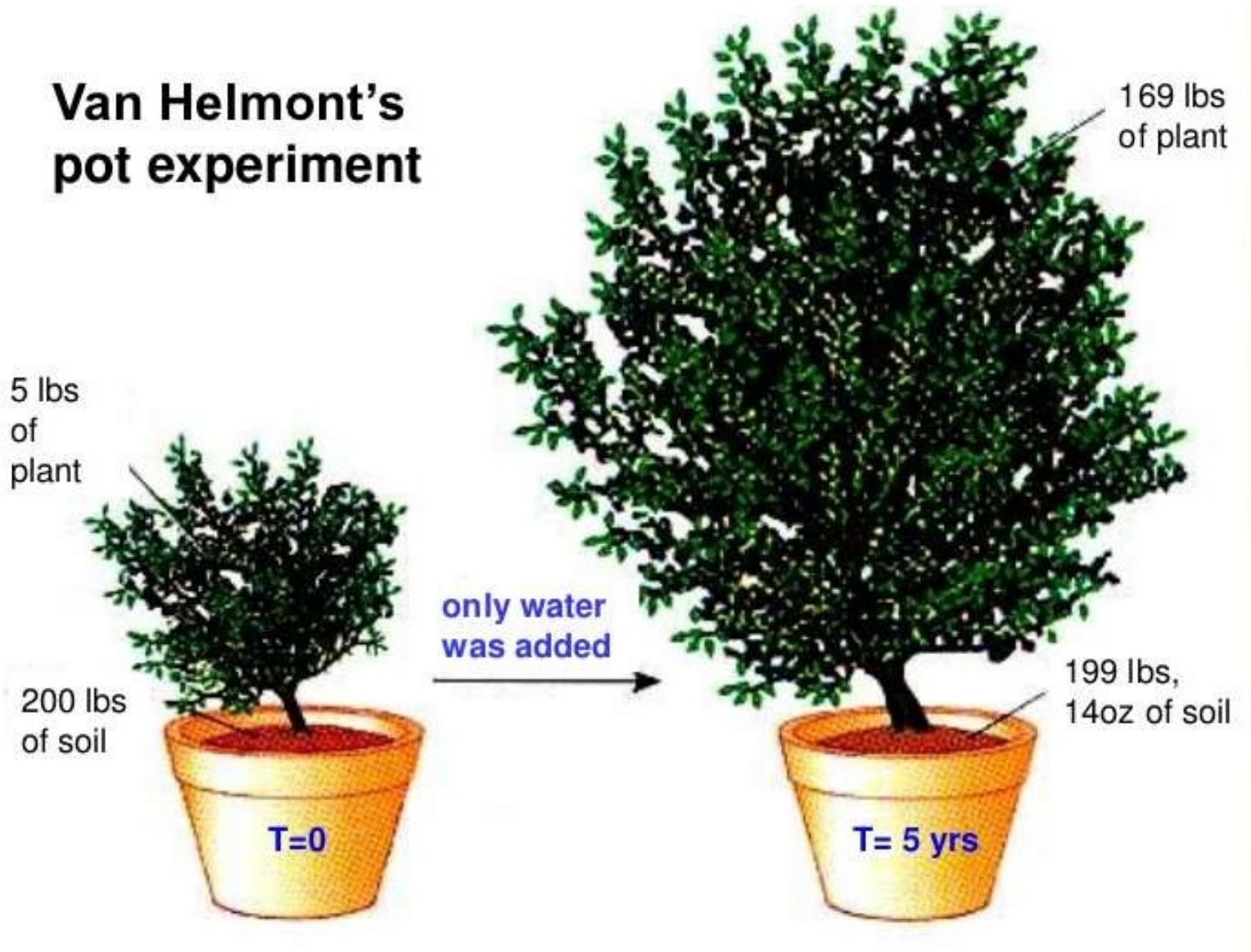


In the following paragraph, van Helmont describes his experiment. Read the paragraph and then analyze the experiment by answering the questions that follow.

"I took an earthen pot and in it placed 200 pounds of earth which had been dried out in an oven. This I moistened with rain water, and in it planted a shoot of willow which weighed five pounds. When five years had passed the tree which grew from it weighed 169 pounds and about three ounces. The earthen pot was wetted whenever it was necessary with rain or distilled water only. It was very large, and was sunk in the ground, and had a tin plated iron lid with many holes punched in it, which covered the edge of the pot to keep air-borne dust from mixing with the earth. I did not keep track of the weight of the leaves which fell in each of the four autumns. Finally, I dried out the earth in the pot once more, and found the same 200 pounds, less about 2 ounces. Thus, 164 pounds of wood, bark, and roots had arisen from water alone."

[Video - Where do trees get their mass?](#)

## Van Helmont's pot experiment



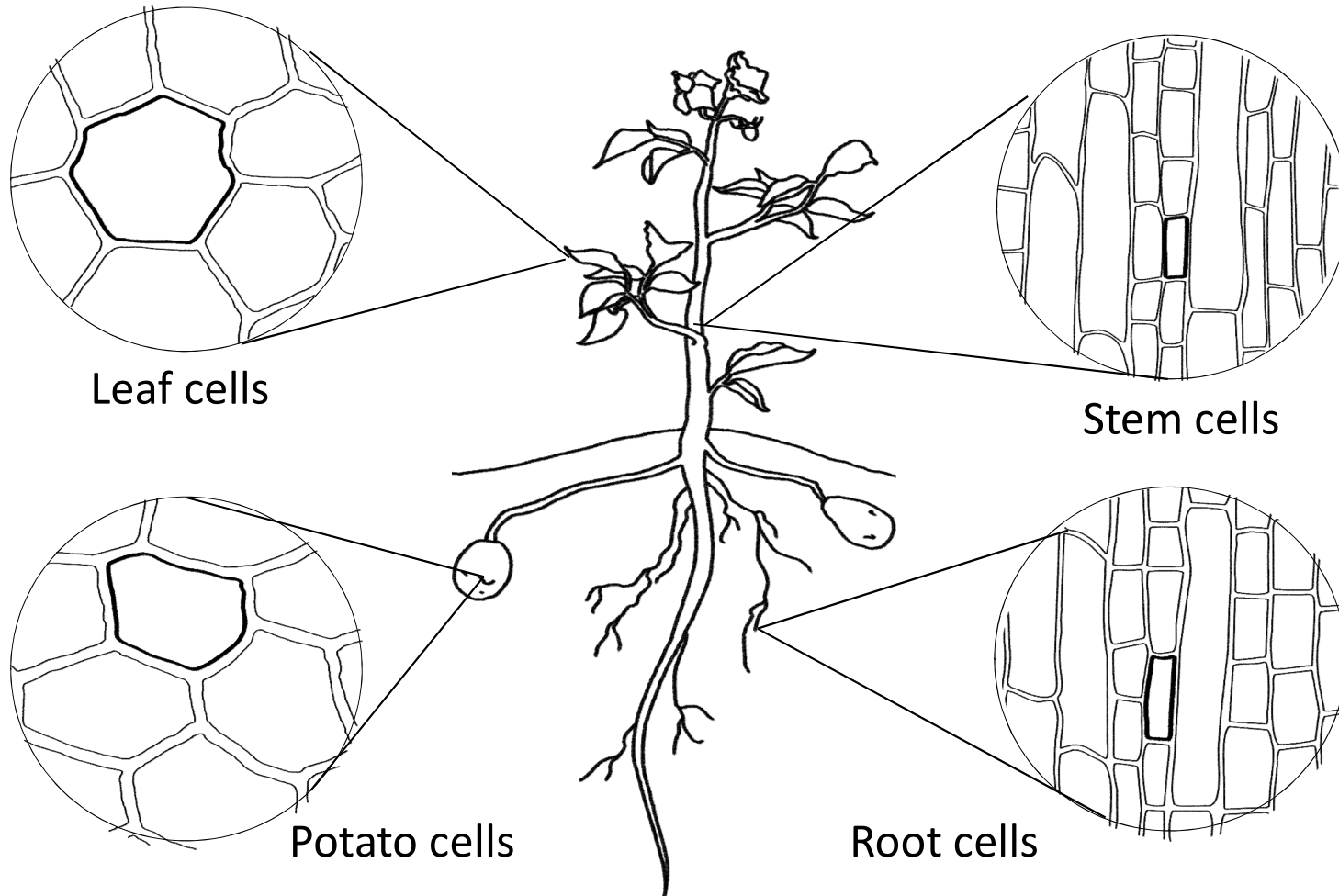
## Questions

1. How would you explain how the tree gained 164 lbs. in mass?
2. What made up that mass?

# Plants come in all shapes and sizes



# All plants have many different kinds of cells



Some ways that all plants are alike...

**Their structures: What they are made of**

- All plants have systems, such as roots, stems, and leaves
- All plants are made of cells
- All cells are made of molecules
- All molecules are made of atoms

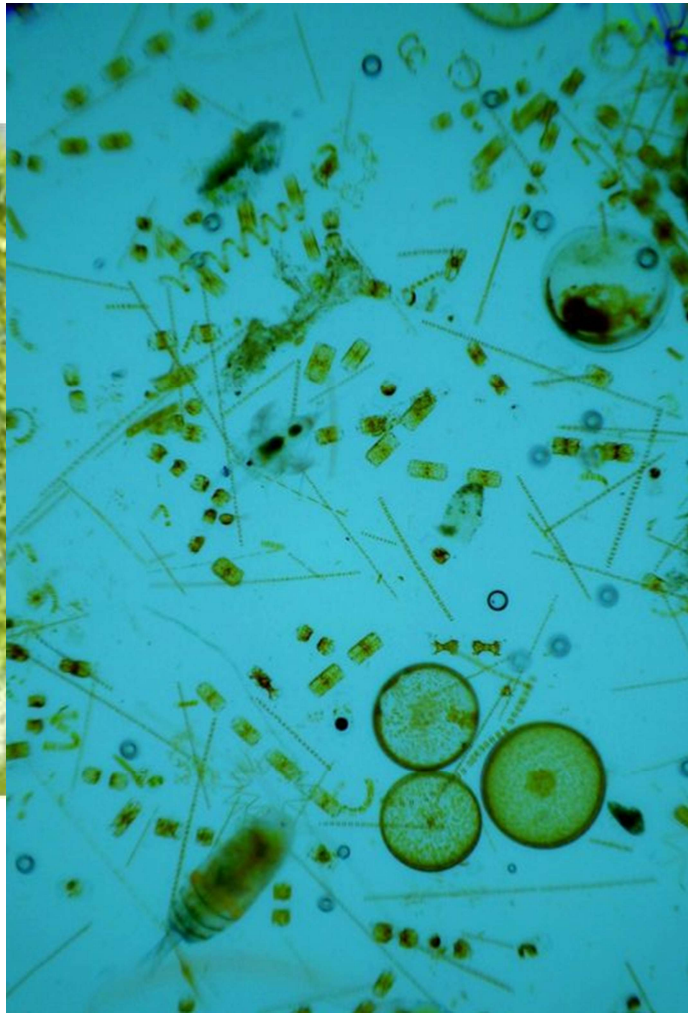
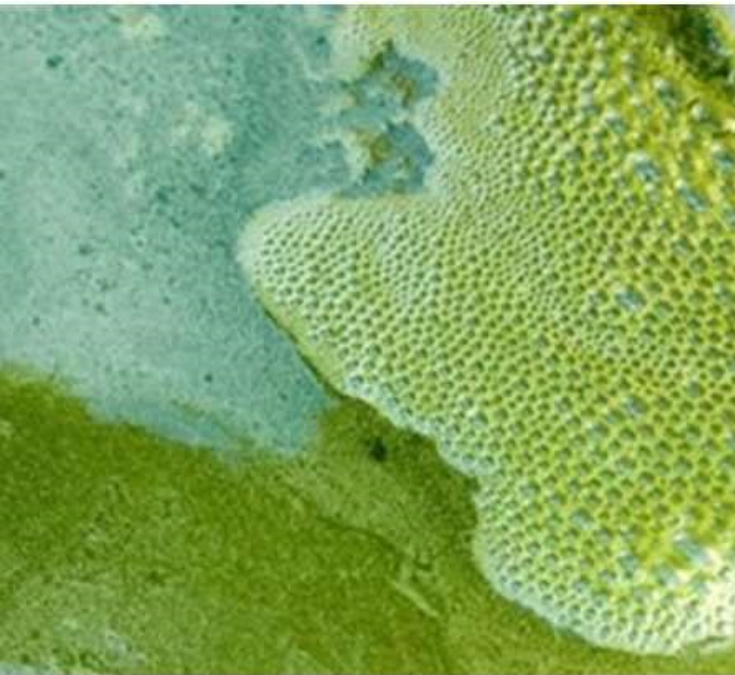
**Their functions: What they do**

- All plants grow.
- All plants use energy to function.

- Plants following light (time lapse)



Photosynthetic organisms include...



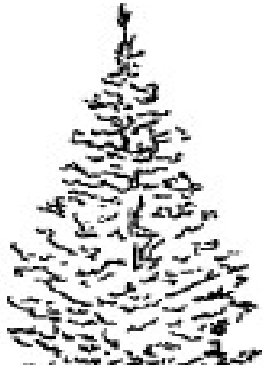
A photosynthetic sea slug (an animal)!

*Elysia chlorotica*

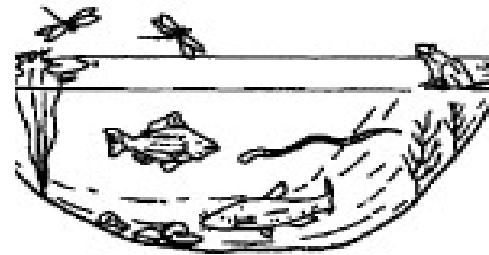


# Photosynthesis

The Sun is the ultimate source of mostly all energy on Earth!



Autotrophs:  
can use light energy from the sun to produce chemical energy (food) in their cells  
Ex. plants & algae

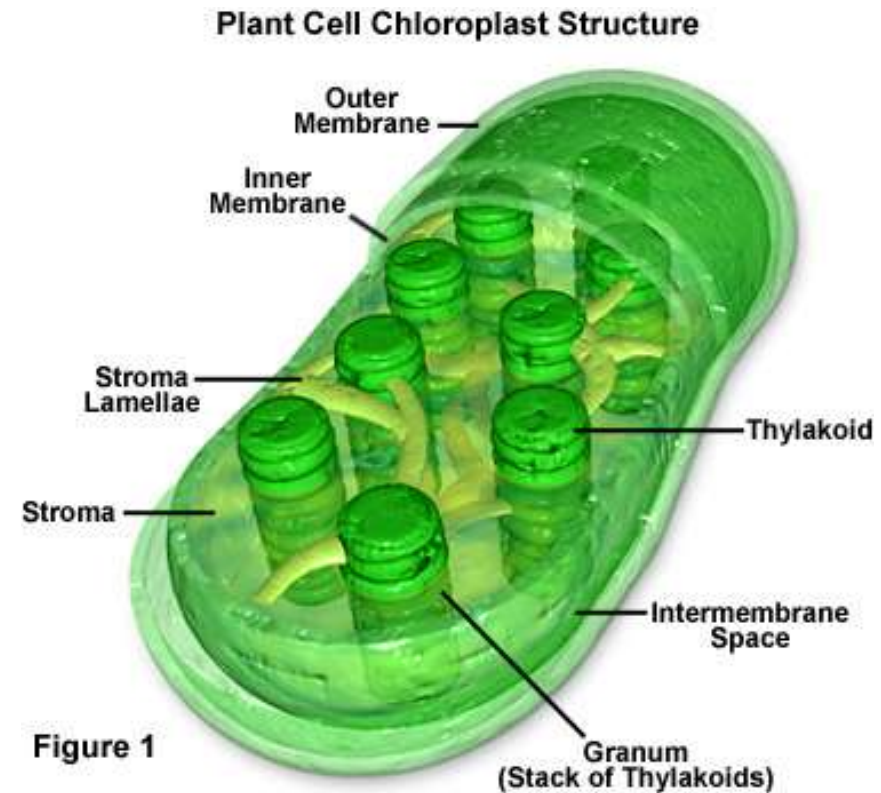


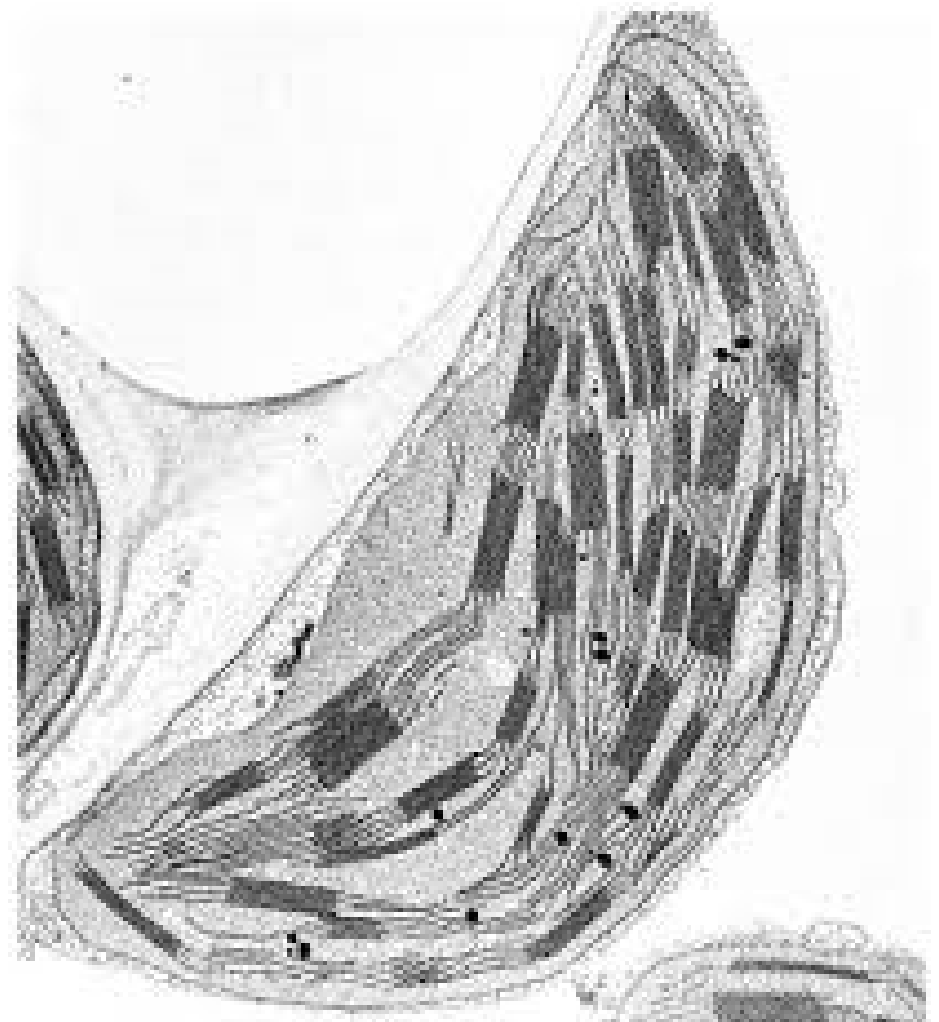
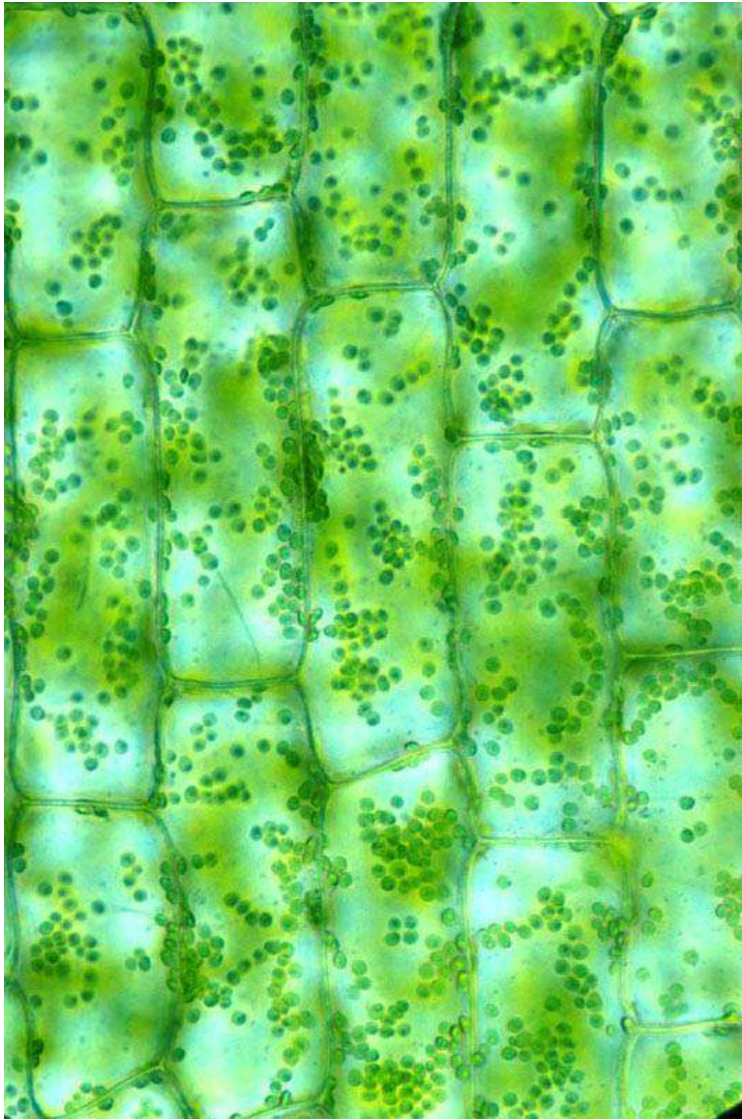
Heterotrophs:  
cannot produce their own food; obtain energy from food consumed  
Ex. animals & fungi



**Photosynthesis**: process that uses sunlight energy to convert water & carbon dioxide into oxygen & high-energy sugars (form of autotrophic nutrition)

- **Chloroplasts** – site of photosynthesis
- **Chlorophyll** – green pigment in the chloroplast, absorbs light energy





© W. P. Wergin, E. H. Newcomb/Biological Photo Service

# Photosynthesis

## Reactants

Energy Source?

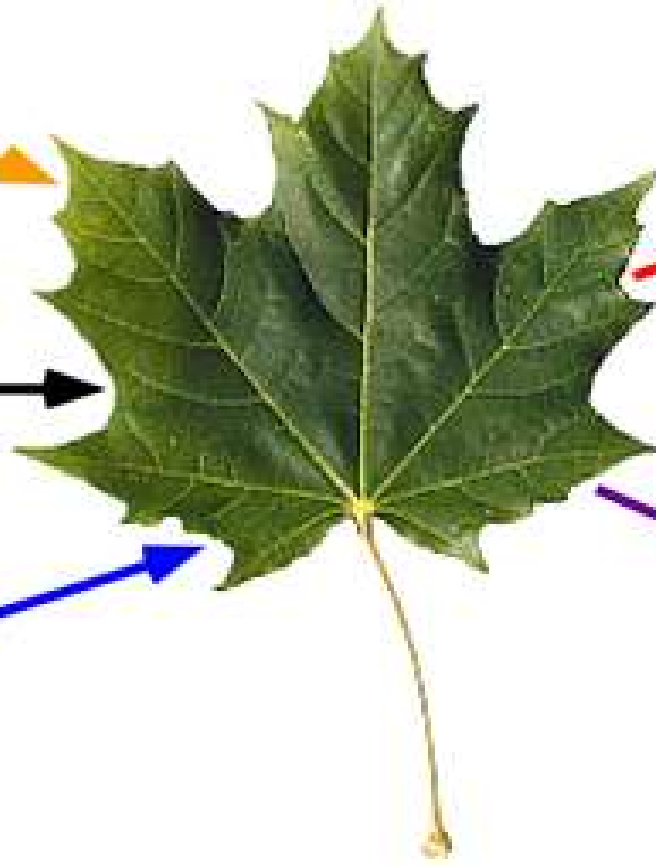
Inorganic  
Compound?

Inorganic  
Compound?

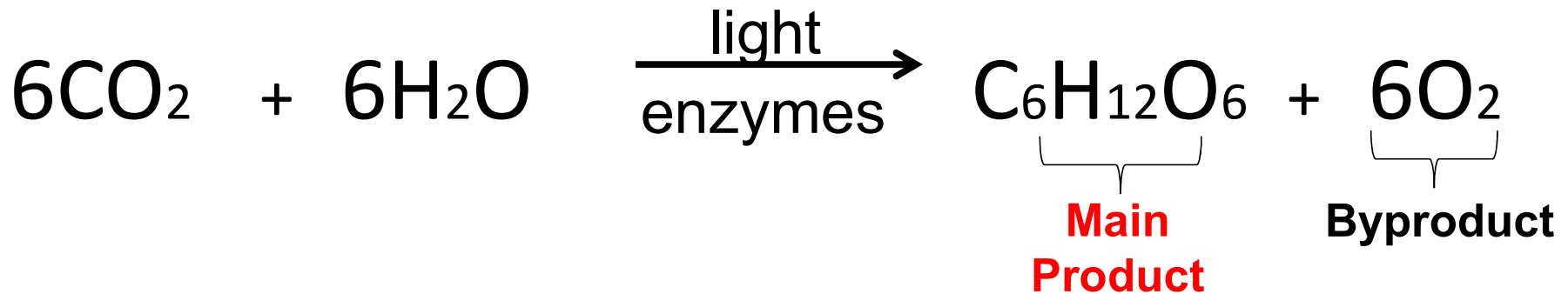
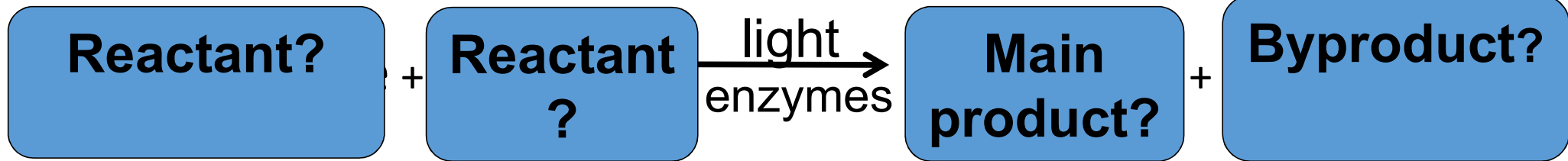
## Products

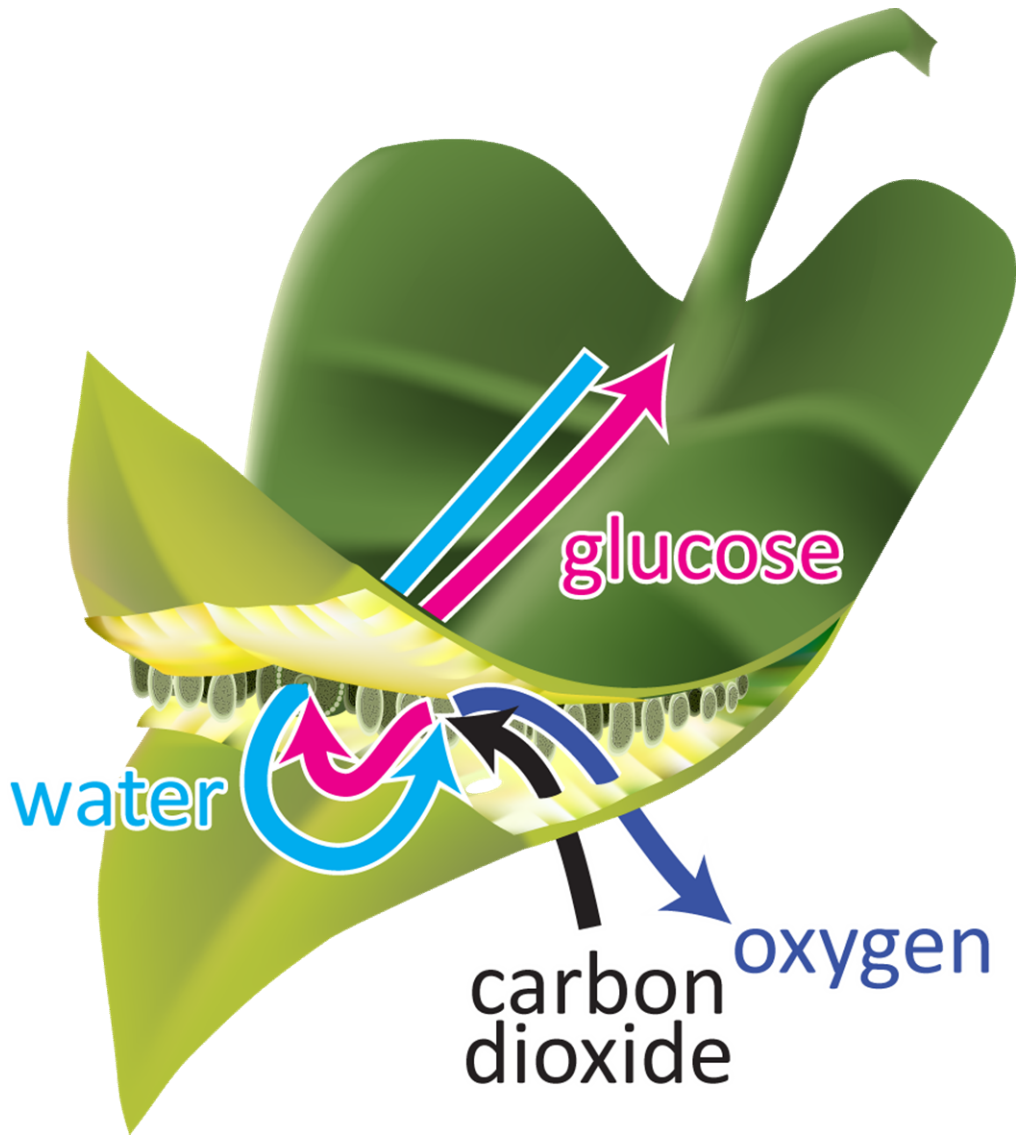
Inorganic  
Byproduct?

**ORGANIC**  
compound!?!



# Photosynthesis Equation

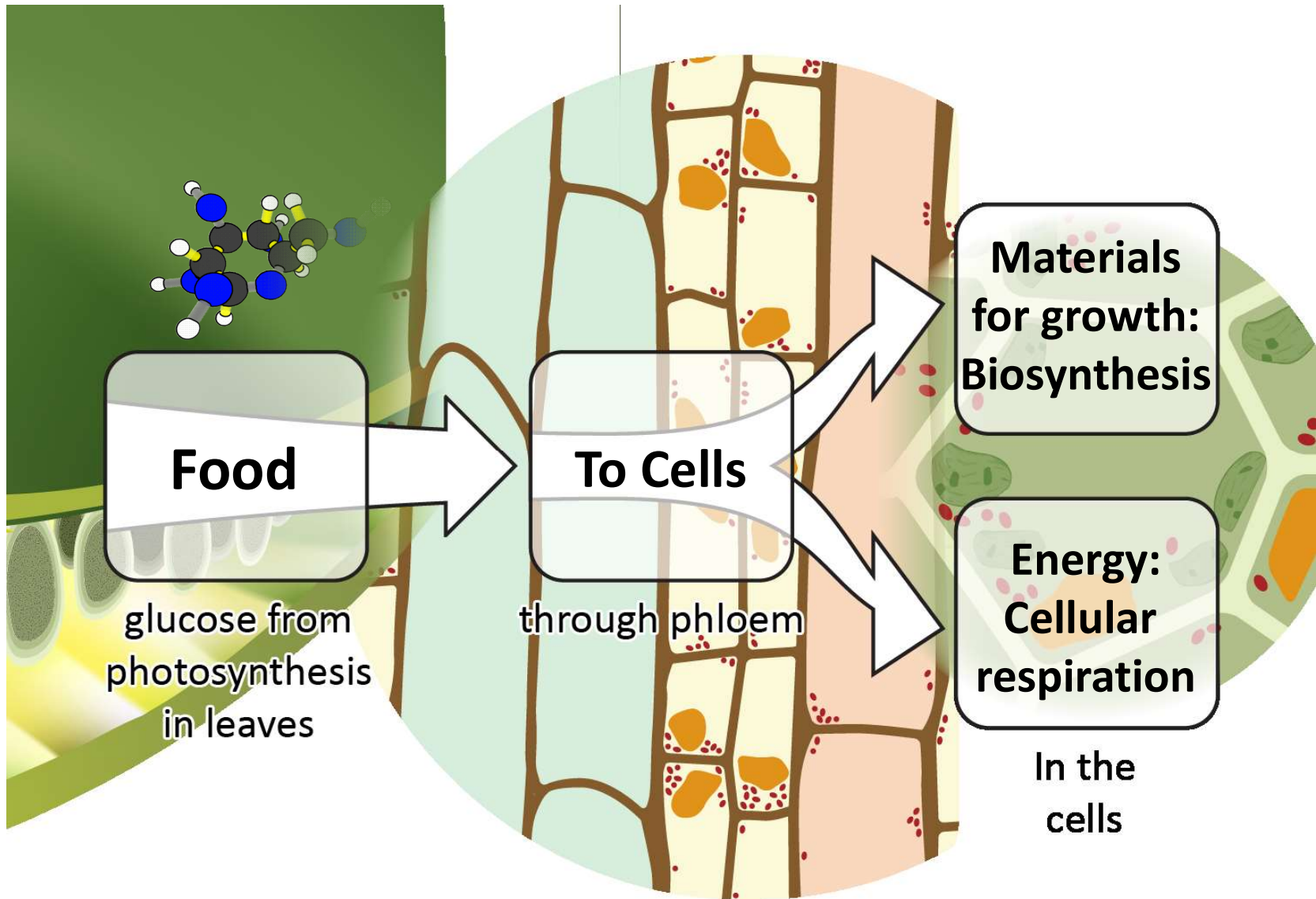


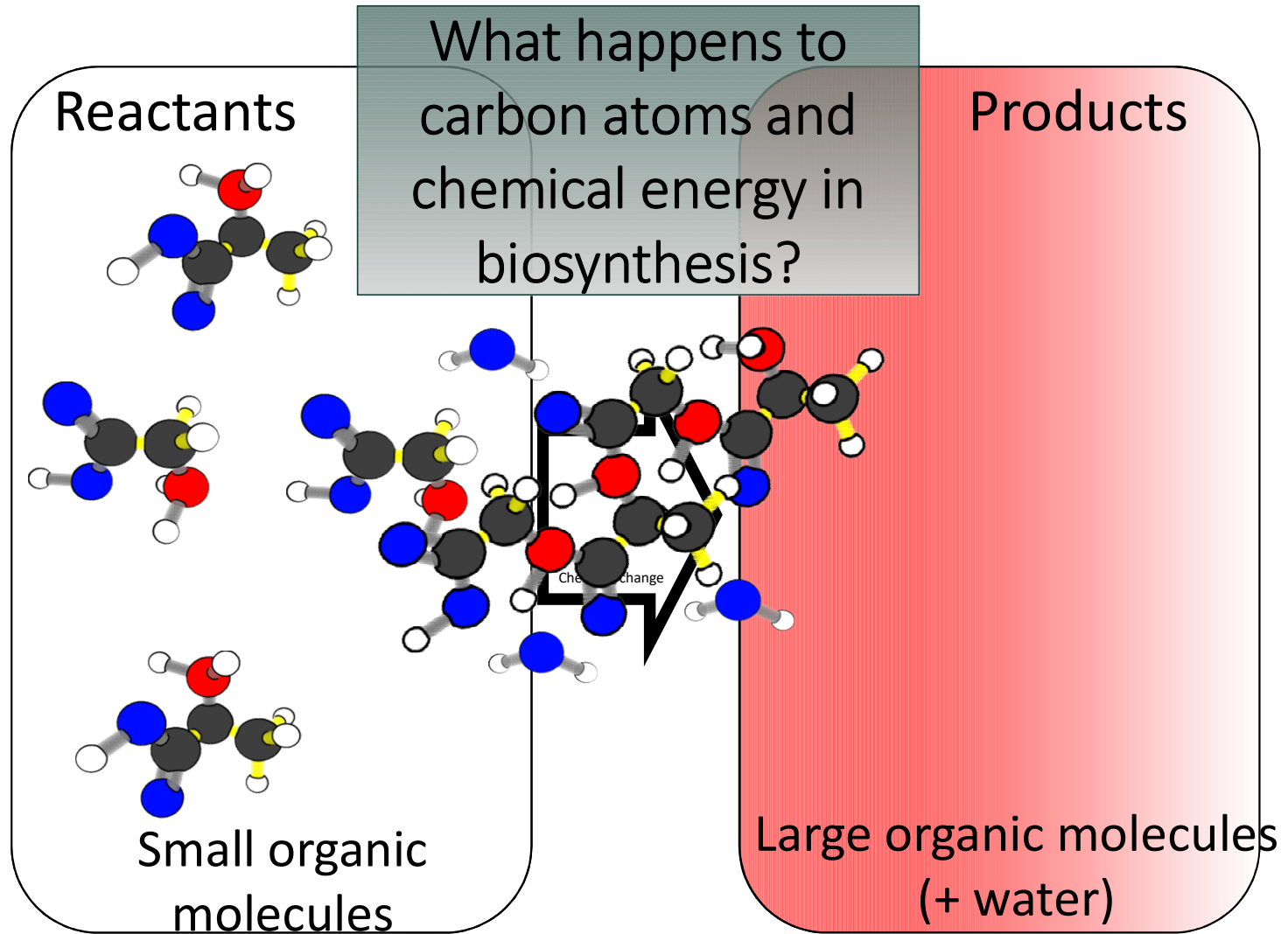


After  $\text{CO}_2$  and  $\text{H}_2\text{O}$  go through photosynthesis to make glucose....

**Where does the glucose go?**

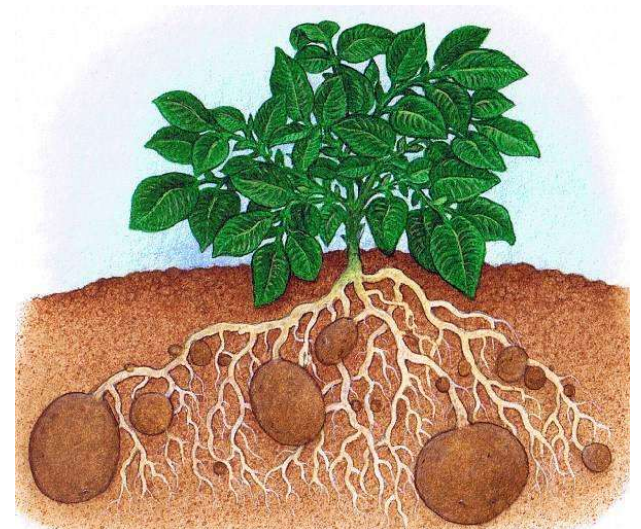






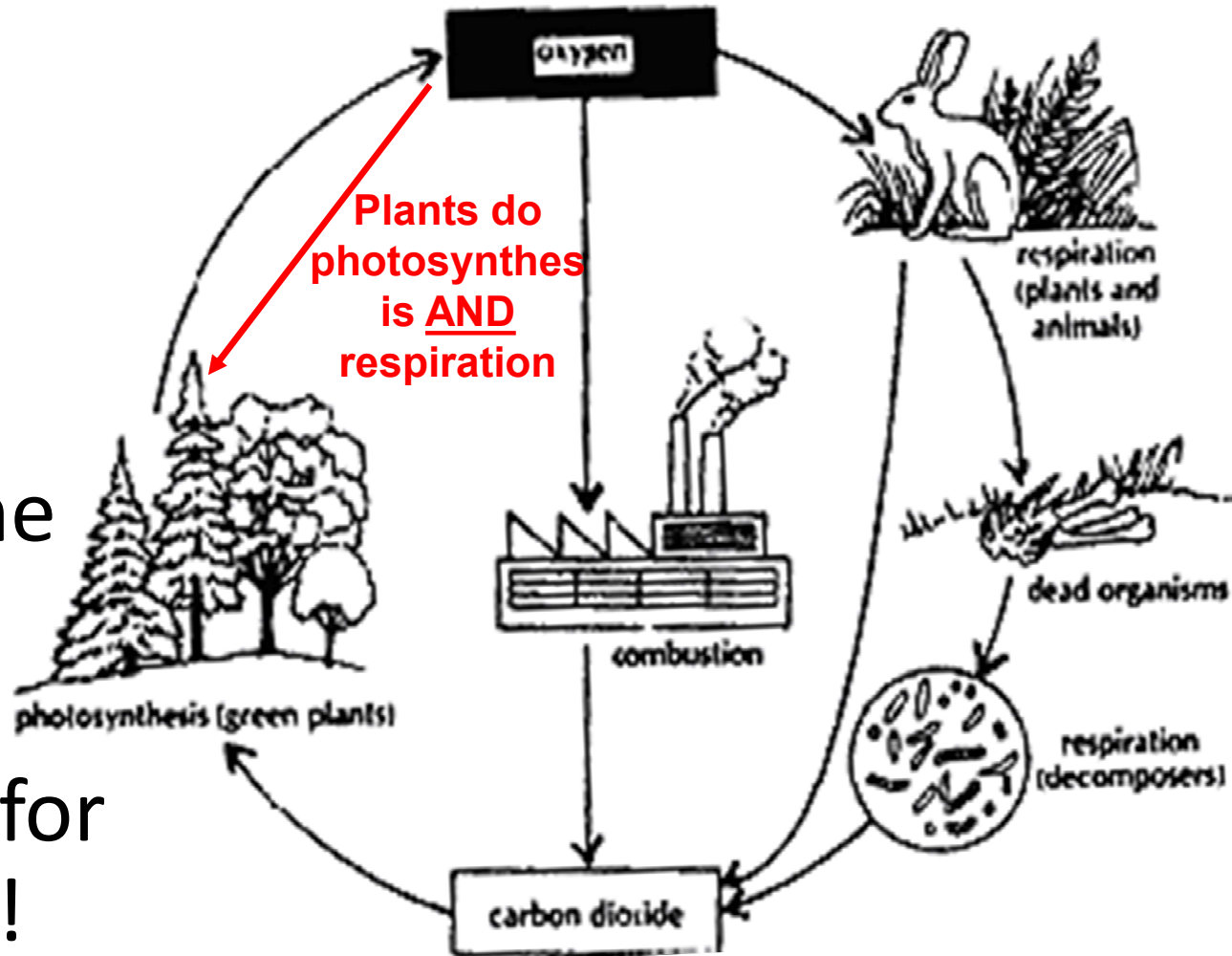
## Uses for Glucose Produced

- Energy source for plant to perform cellular respiration
- Growth of the plant
- Converted into complex starches during biosynthesis & stored by plants



## Uses for Oxygen being Produced

- Released into atmosphere to be used in aerobic cellular respiration
- Plants transfer some of the oxygen produced to their own mitochondria for aerobic respiration!



# What factors can affect the Rate of Photosynthesis?

- Light (intensity, duration, color/wavelength)
- Availability of water
- Temperature & pH (affect enzymes)



[Cell Energy Online Simulation \(photosynthesis & respiration\)](#)

[Bozeman - Floating Spinach Leaf Disks Lab set up](#)