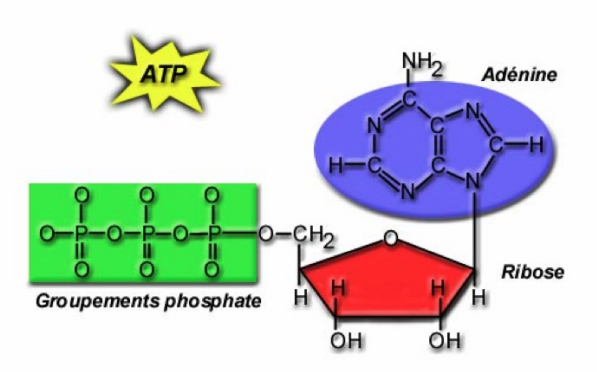
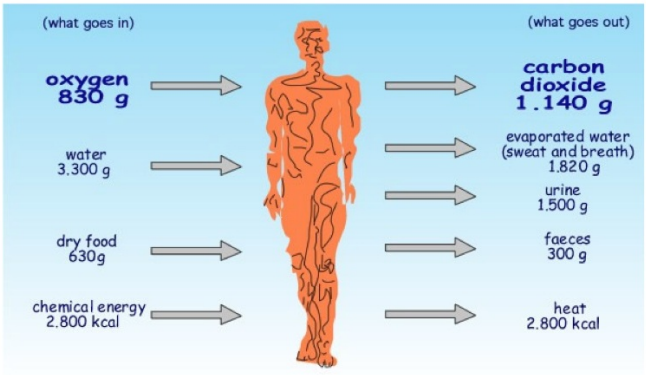
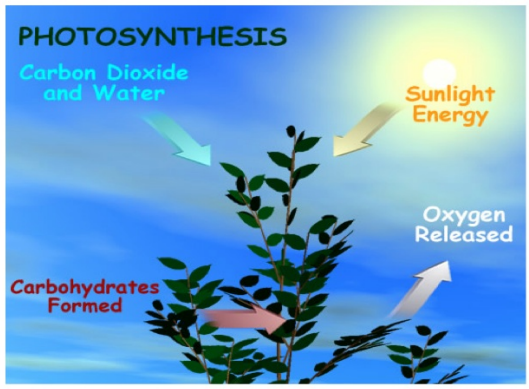
Cells Transform Energy

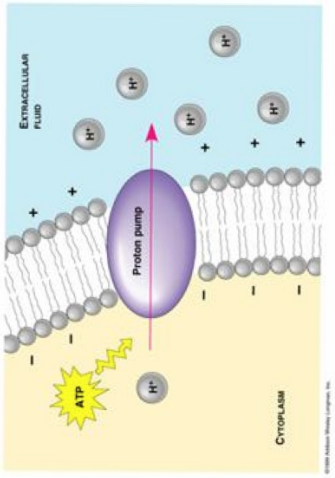


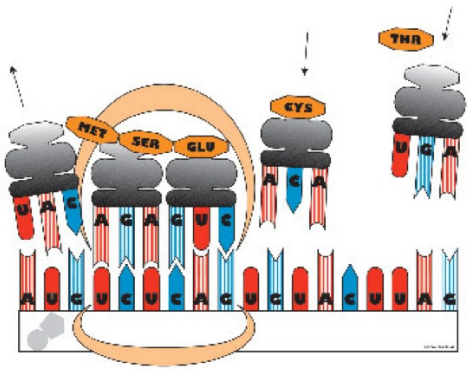




What do cells need energy for?

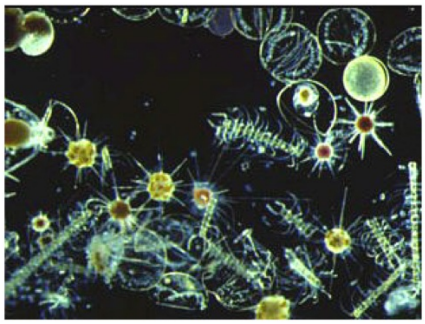
- Active transport.
- Movement.
  - In humans, this means muscles, skeletons, and nerves.
- Building molecules (synthesis).





How do cells get energy?

- Autotrophs
  - Photoautotrophs
  - Chemoautotrophs
- Heterotrophs
  - In humans, this means ingestion and digestion!



Once cells have energy, they need to convert it to a form that they can store and use...

How do rechargeable batteries work?

Energy cycles

Storing energy

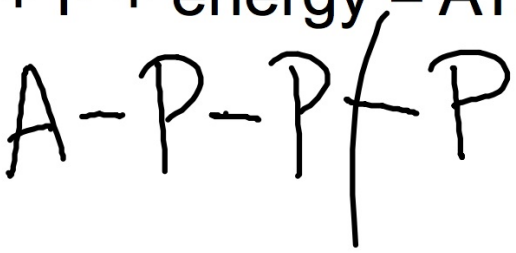
Using energy.

ATP

- ATP = Adenosine Triphosphate.
- Adenine (part of DNA) + Ribose (a sugar) + 3 phosphates.
- Used in cell processes as an energy source.
- Energy stored in the bonds between the phosphates.

ATP - P = ADP + P + energy

ADP + P + energy = ATP



Energy cycles

ADP + P

Storing energy

RESPIRATION!

ATP - P

Using energy.

CELL FUNCTIONS

How do cells do work?

Cells need to get rid of toxins like hydrogen peroxide (H_2O_2) by turning it into water and oxygen.

How would we write that as an equation?
Where are the reactants (what goes in)?
Where are the products (what comes out)?

H2O2 -->

Catalase Demonstration

What was the reactant?
What were the products?
How do we know?

What kind of reaction did we see?
How do we know?

What effect did the apple/liver have on the hydrogen peroxide? Did it speed up or slow down the reaction?

From this, how do we define "catalyst?"

Enzymes are biological catalysts.

- Enzymes are proteins.
- Enzymes speed up chemical reactions in cells.
- Enzymes work on substances called substrates.

  Ex. Catalase works on hydrogen peroxide. Hydrogen peroxide is its substrate.

  Substrates are specific to enzymes like a key is specific to a lock.

- Enzymes have a site that fits the substrate called an active site.

- Enzymes generally end in -ase and may refer to their substrate in their name.

  Ex. Proteinases break down .... PROTEINS

  Ex. Hydratases add ... WATER.

  Ex. Replicases do ... REPLICATION.

CATALASE

Toothpickase!

- What is toothpickase's substrate?

We will be testing the effect of several conditions on toothpickase.

Part 1
We will look at the effect of time on how much product an enzyme can form.

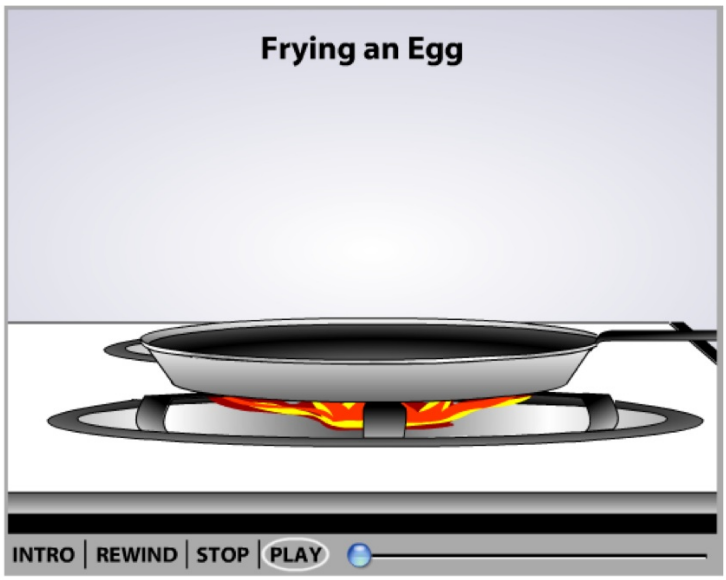
Part 2
We will look at the effect of substrate concentration on how much product an enzyme can form.

Part 3
We will look at the effect of temperature on how fast enzymes work.

Time	Toothpicks broken
Interval 1	Number of toothpicks broken during Interval 1 10
Interval 2	Number of toothpicks broken during Interval 2 + Interval 1 15 10 = 25
Interval 3	Number of toothpicks broken during Interval 3 + Interval 2 + Interval 1 7 + 15 + 10

How temperature affects proteins!

Denaturation!



How pH affects proteins!

Denaturation!

This is a maple seed.

This is a maple tree.

Where does the mass come from?

How could we prove that plants don't eat soil?

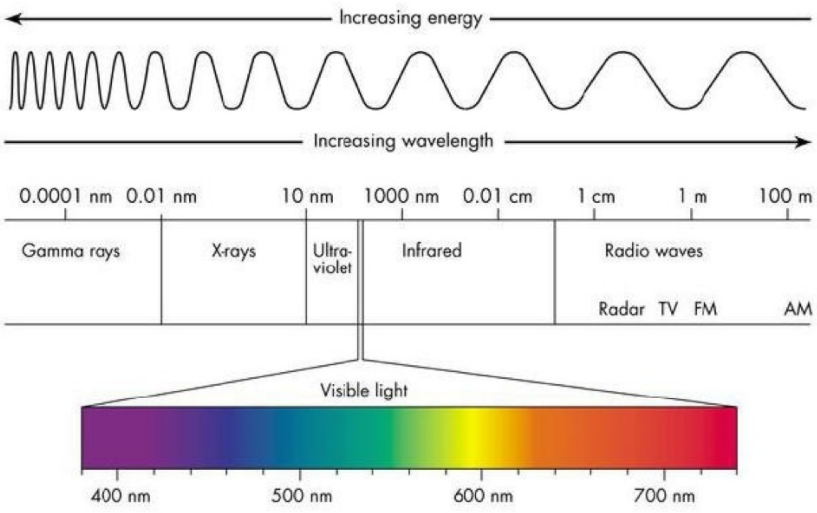
Take a few minutes and think of an experiment that would prove that plants do not eat soil.

Discuss your idea.

Food from light and air

Plants make food from light and air

Visible light contains different wavelengths.
Plants absorb some some of this light and use it to make food. Plants reflect some of this light.

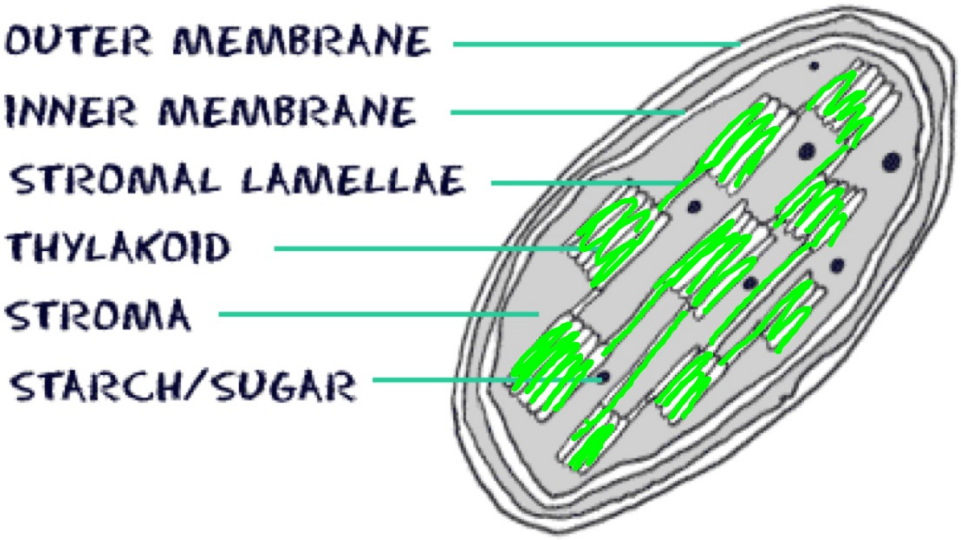


Plants absorb red, blue, purple, etc. light and reflect green light.

What do plants need for photosynthesis?

What do plants produce from photosynthesis?

Chloroplasts



Plants are adapted to perform photosynthesis.

Plants have two basic systems: roots and shoots.

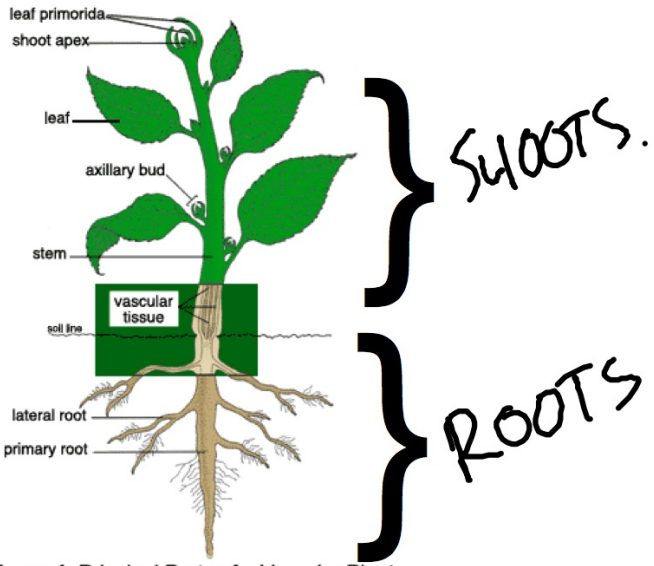


Figure 1. Principal Parts of a Vascular Plant

Plants are adapted to perform photosynthesis.

Roots

- The root system:
  - Anchors the plant.
  - Takes up water and nutrients.
  - Has root hairs for absorbing water. (Lots of surface area equals lots of diffusion.)

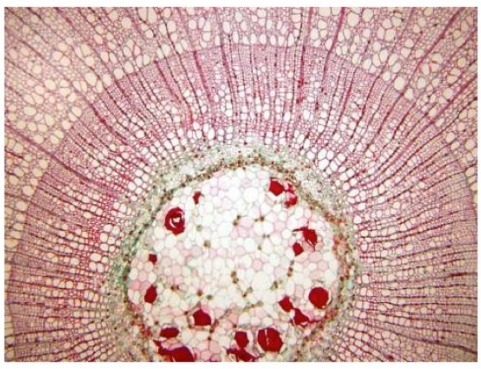
Shoots

- The shoot system:
  - Has leaves that make sugars from light, water and CO_2.
  - Houses the reproductive parts of the plant.

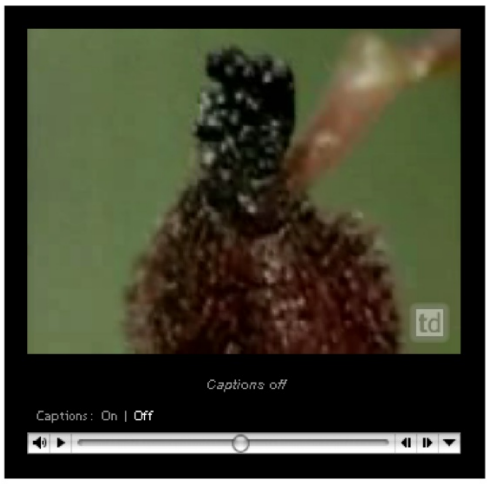
Plants are adapted to perform photosynthesis.

The two systems interact through the vascular system:

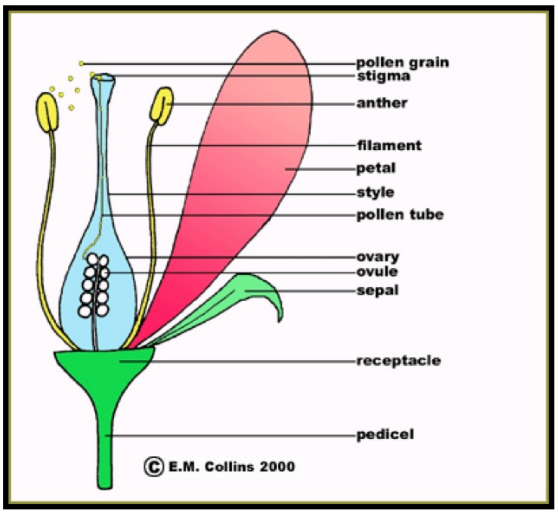
- Xylem: Thin tubes that go from the roots to the shoots; transports water and minerals.
  Water moves by CAPILLARY ACTION.
- Phloem: Thin tubes that go from the leaves to the shoots, buds, flowers, roots, etc. that carry sugars from leaves to whereever needs energy.



Plants Reproduce



Flowers are reproductive organs.



Respiration

Think about a candle burning. Where does the energy to produce light and heat come from?

What physical changes are occuring in the candle? Chemical changes?