Introductions and connections!

Our green earth

Photosynthesis

Bacteria -- our friends

Decomposition process

Carbon:Nitrogen ratio

Three pile system

Applying what we learned

Uses of compost

Practical questions

Objective of composting:

Harness natural process:
Decomposition

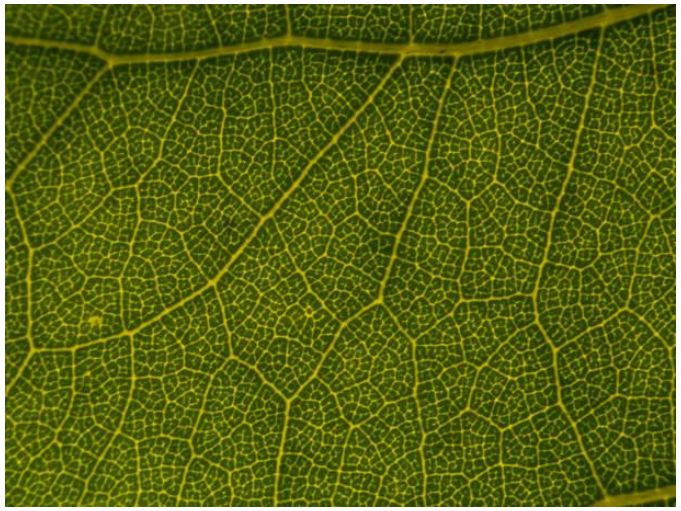
Convert weeds, dead plants, leaves, kitchen scraps, coffee grounds, etc. to …

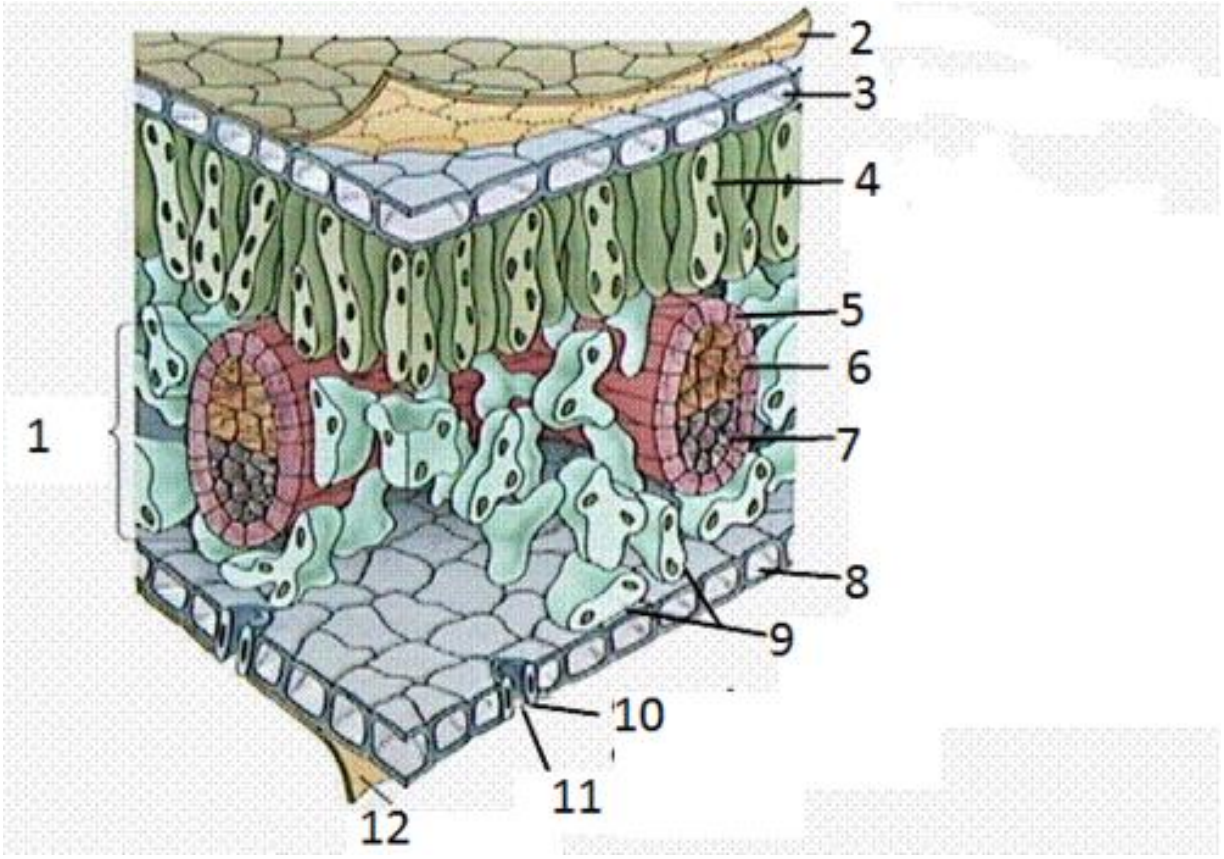
Rich compost!
Nutrients + humus

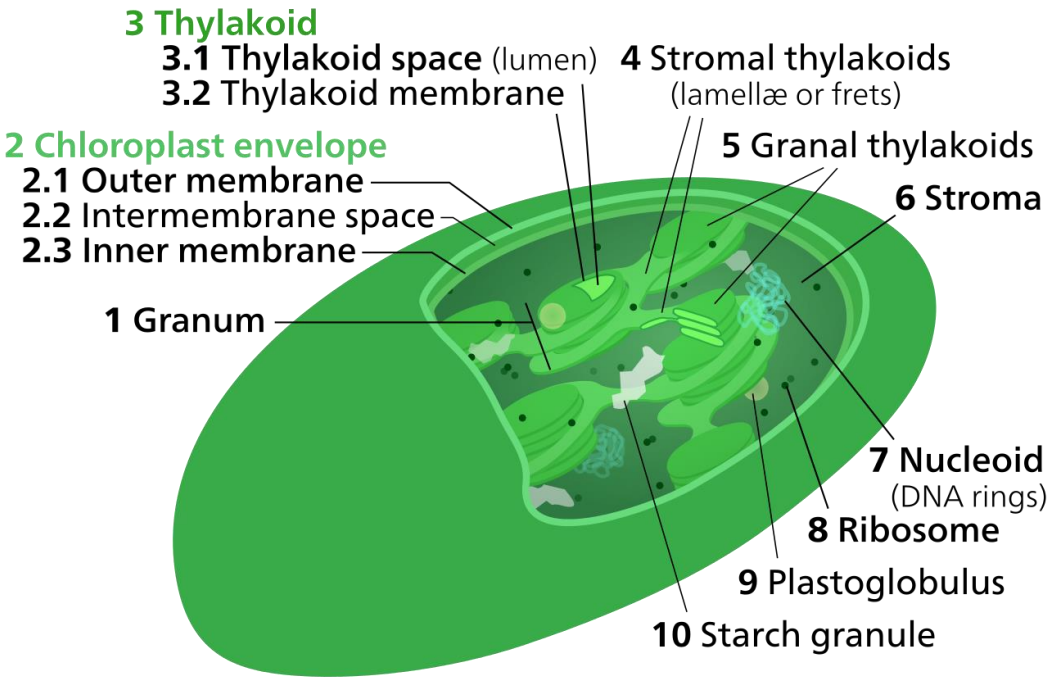
We live on a green planet

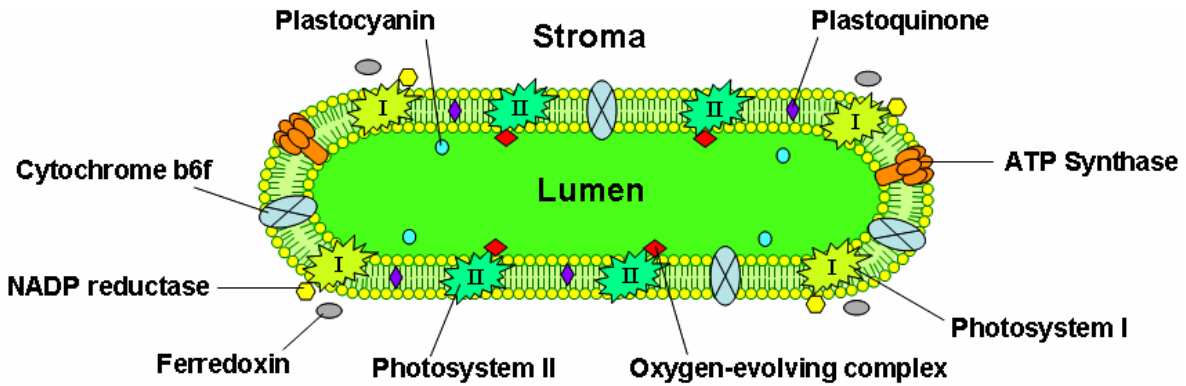

We live on a green planet
because of plants!

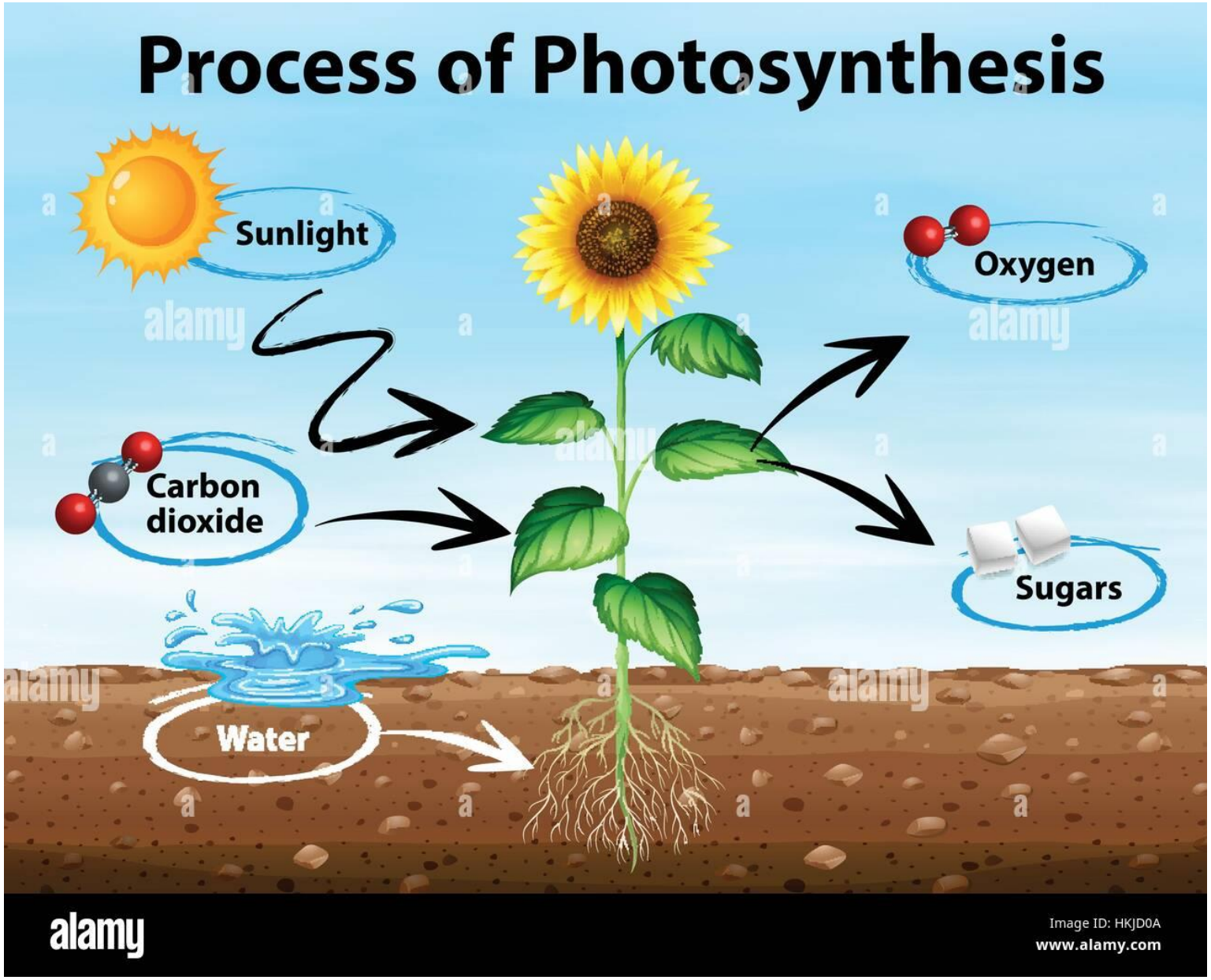
Machinery of photosynthesis – chloroplasts!



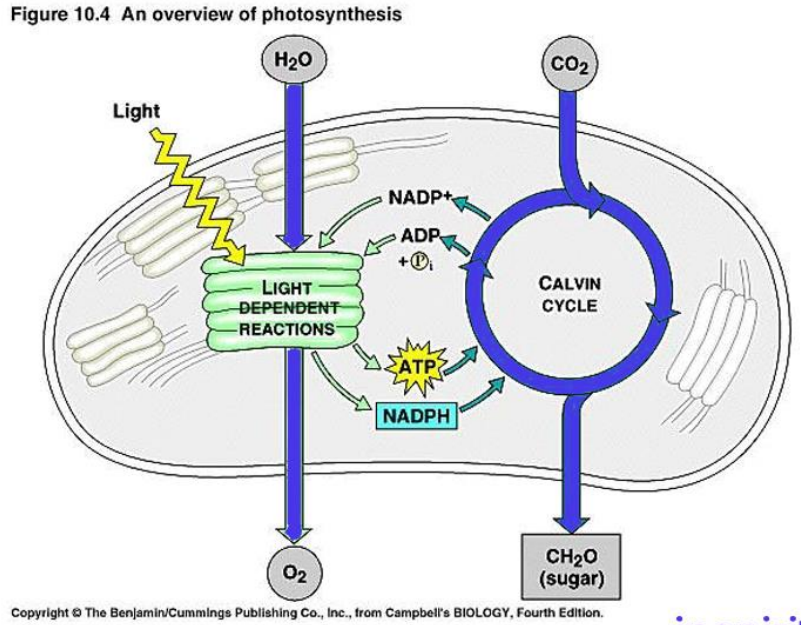






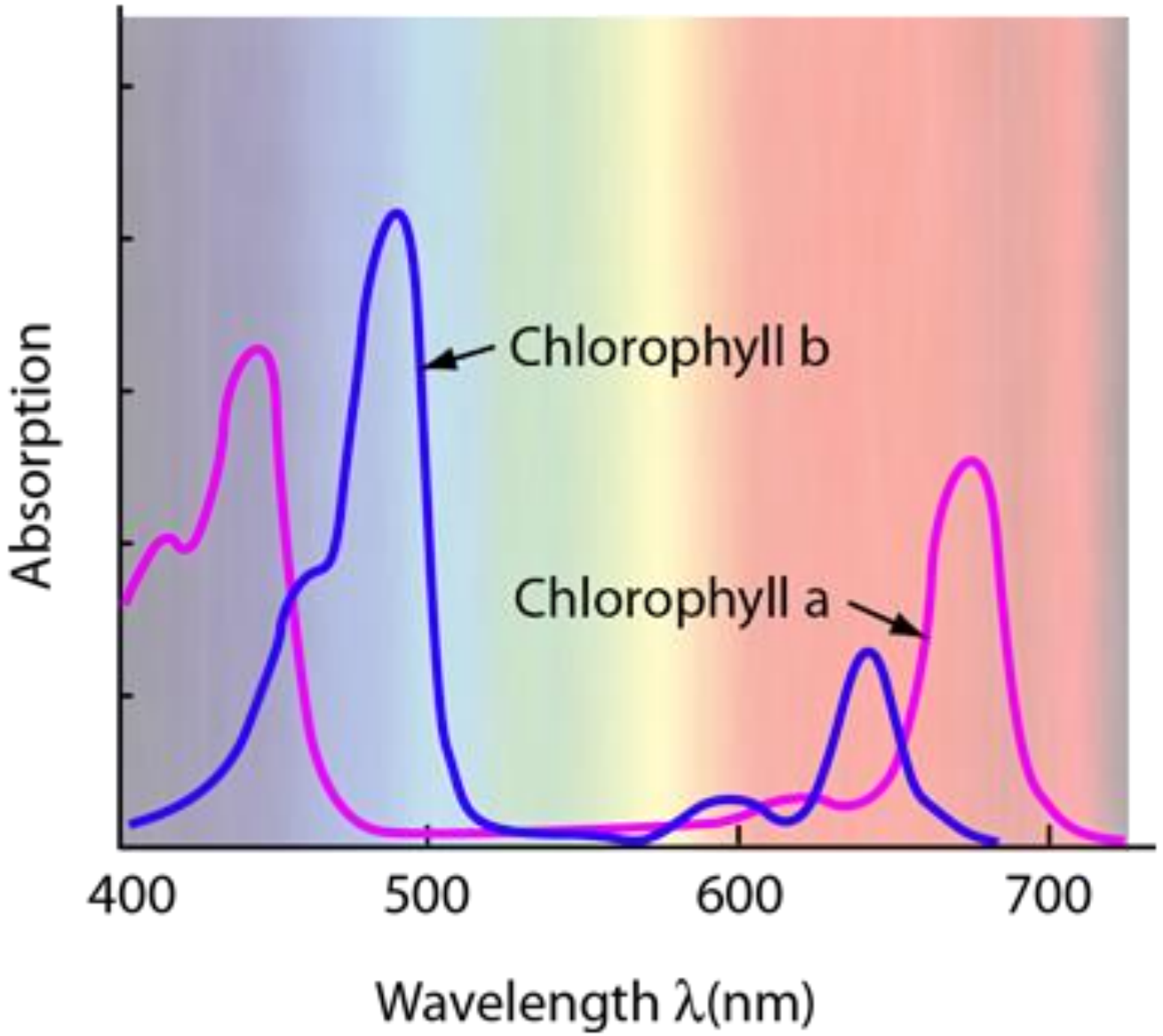


Amazing and complex process!



inspirit

Why is our planet green?



Chlorophyll in the chloroplasts absorb light at different wavelengths but NOT green

Bacteria dominated the planet for a long time!

Earth is about 4.5 billion years old.

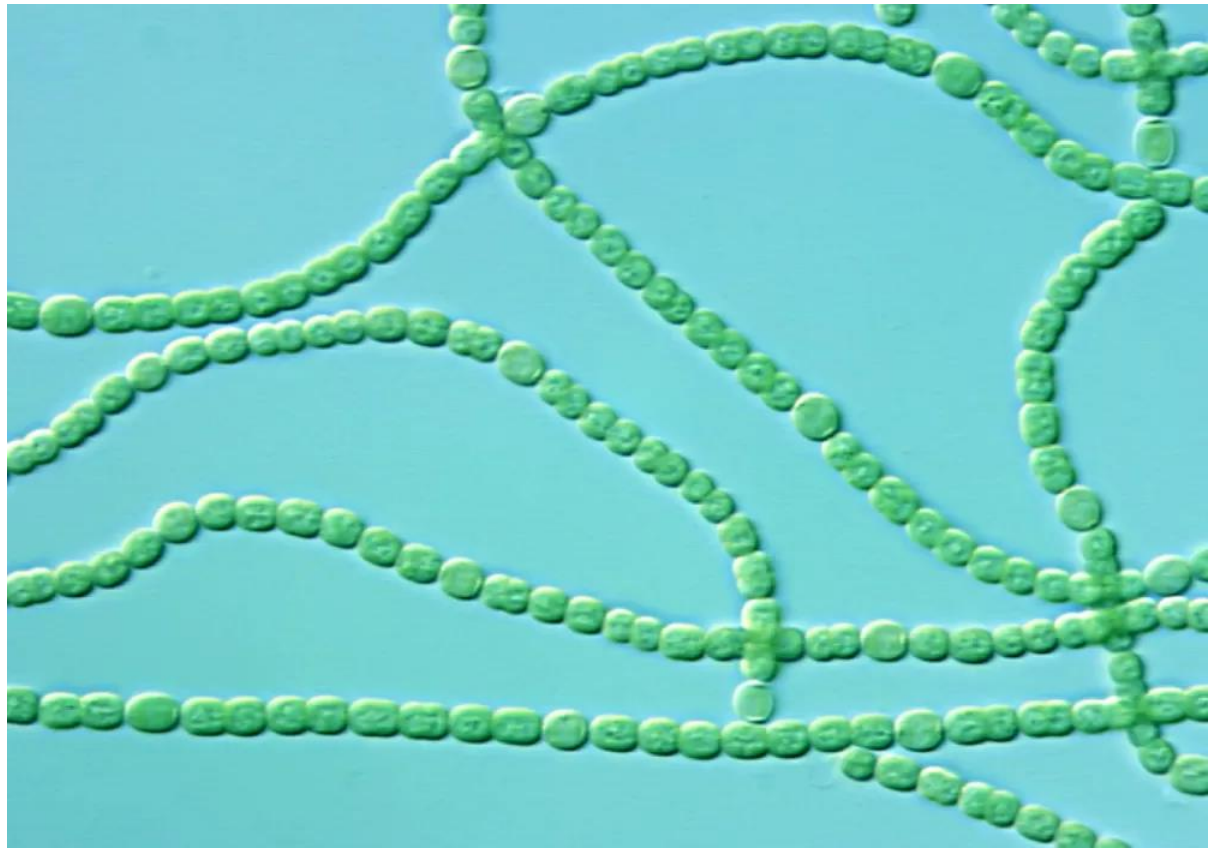
Origin of life – bacteria and friends – 3.5 to 4 billion years ago.

Cyanobacteria and the Oxygen Revolution – 2.4 billion years ago.

Eukaryotes (protists of various forms) –1.6 to 2.1 billion years ago.

Multicellular organisms – 1 billion years ago.

Fungi -- 900 million years ago.



Harness the activity of microbes to make:

Focus on plant decomposition

Animal decomposition is a different process

Disgusting picture of dead animals
No thank you!

Plant Decomposition is photosynthesis going backwards

Plant Material (**Cellulose, Lignin, etc**.) +
Water + **Oxygen** + *Microorganisms* (Bacteria, Fungi) + Enzymes →
Carbon Dioxide + **Water** + Nutrients + Humus

Releases energy as heat!

Rich compost!
Nutrients + humus

1.Hydrolysis: Enzymes secreted by microorganisms break down complex organic molecules. Ex: cellulose broken down into sugars.

2.Glycolysis: Microorganisms further metabolize sugars through glycolysis, releasing energy.

3.Respiration: Microorganisms use **oxygen** for respiration, break down organic molecules further and producing carbon dioxide and water.

4.Lignin Decomposition: Lignin, (complex component of plant cell walls) undergoes decomposition more slowly. Specialized fungi and bacteria involved in breaking down lignin into simpler compounds.

5.Nutrient Release: As organic material breaks down, essential nutrients such as nitrogen, phosphorus, and potassium are released into the soil.

6.Humus Formation: Partially decomposed organic matter, along with microbial biomass, forms a stable, dark-colored substance called humus. Humus contributes to soil structure, water retention, and nutrient availability.

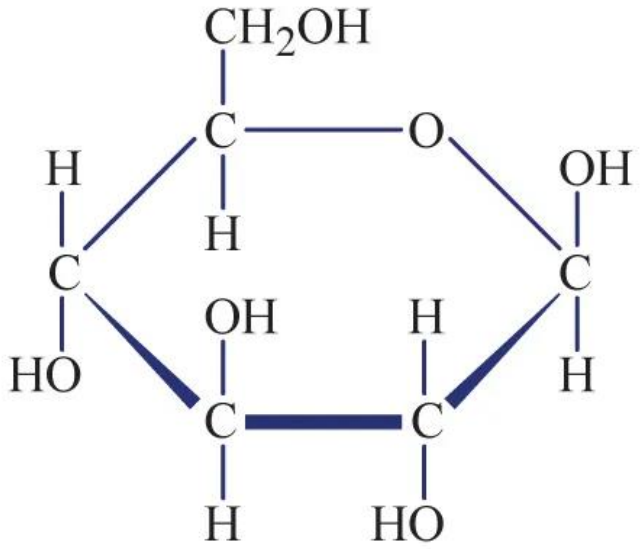
The steps of plant decomposition

Rich compost!

Nutrients + humus

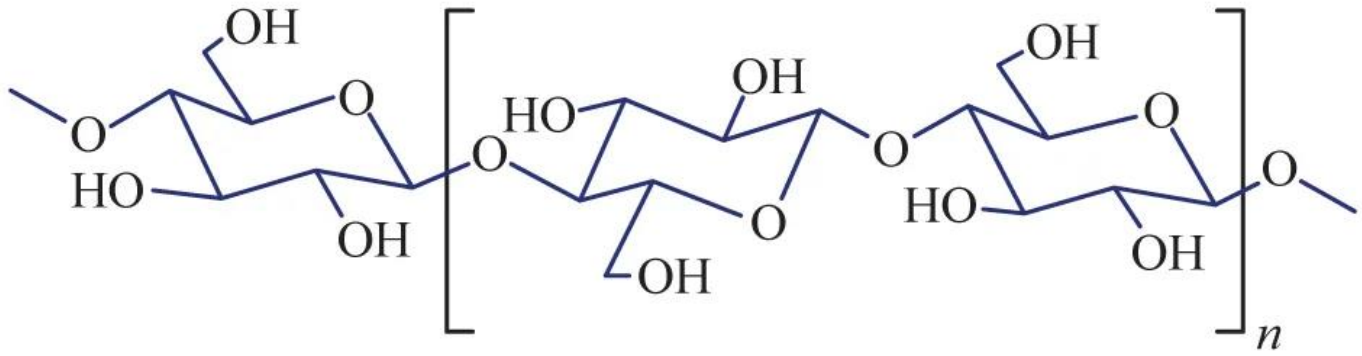
Carbon is the source of ***energy*** for decomposition

6 carbons



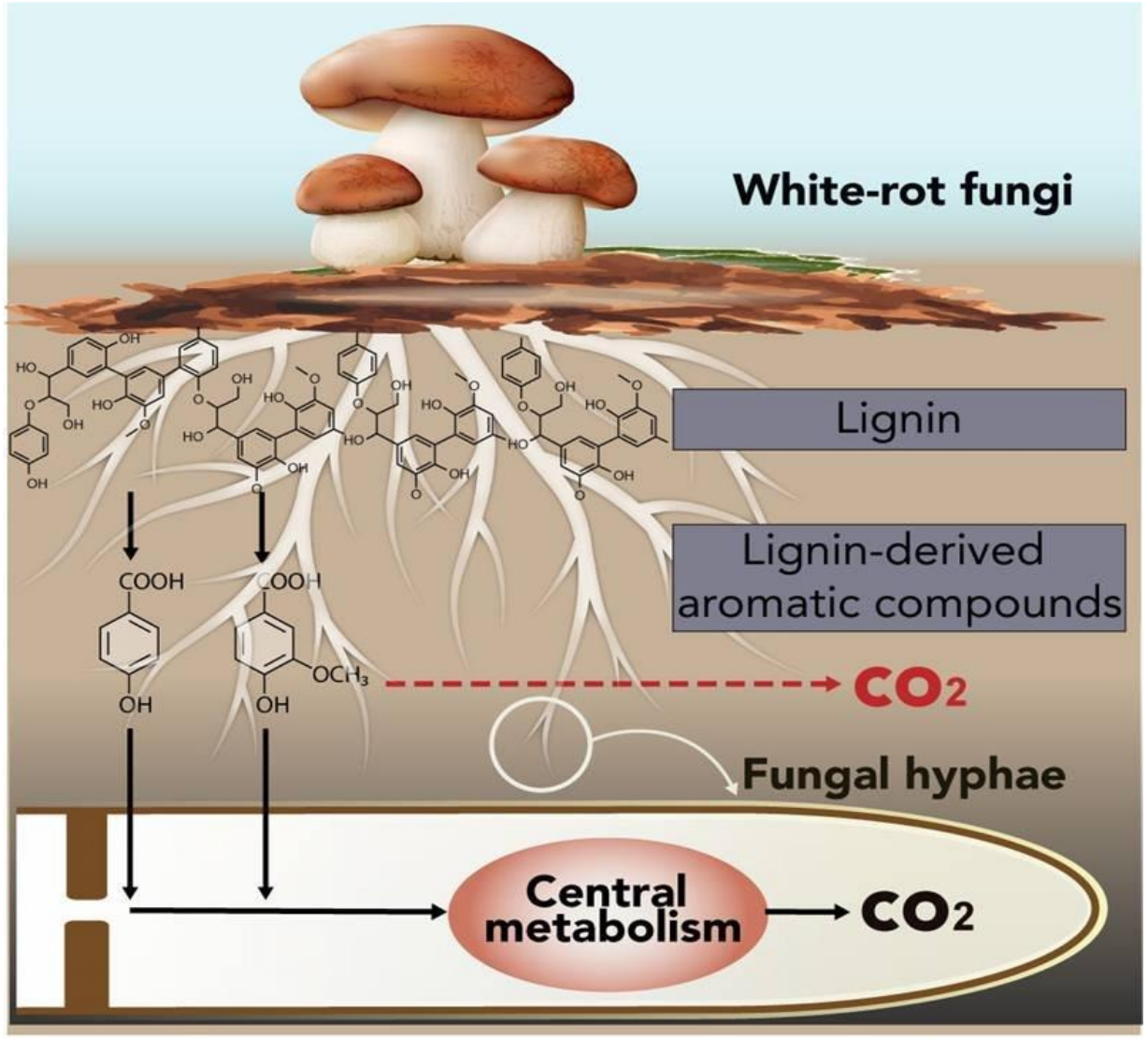
glucose

12 carbons



cellulose

Lignin is a very complex carbon compound



High lignin

Woody materials

Straw

Corn stalks

Seed husks

Medium lignin

Leaves

Grass clippings

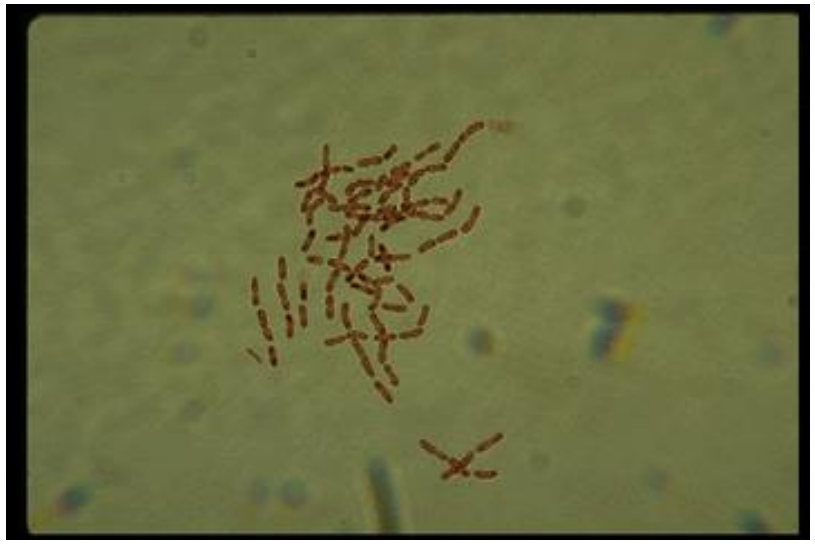
Low lignin

Fruit and vegetable scraps

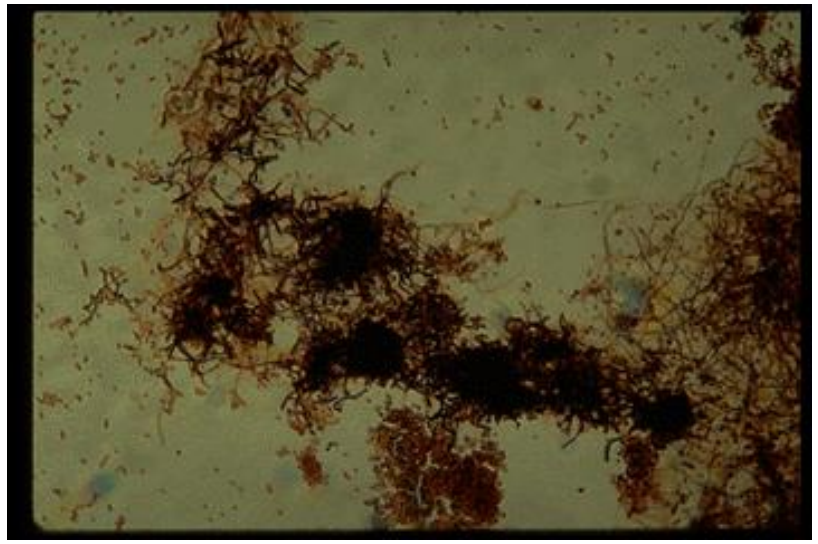
Flowers and soft stems

Nitrogen important for growth and reproduction of microorganisms involved in decomposition and enzymes for various reactions

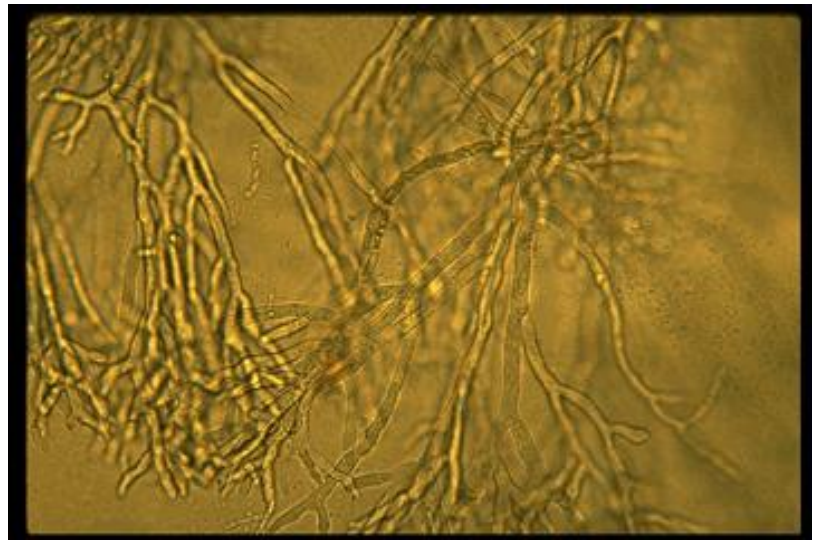
Bacteria



Actinomycetes



Fungi



Carbon to nitrogen ratio
is a crucial concept in composting

Carbon is the source of energy for the microorganisms

Nitrogen important for growth and reproduction of microorganisms involved in decomposition and enzymes for various reactions

We need both,
but at the correct balance

Craft beer

We make Craft Compost!

Carbon to nitrogen ratio is a crucial concept in composting

C:N favorable for microbial activity

Carbon rich and nitrogen rich materials
in appropriate proportions

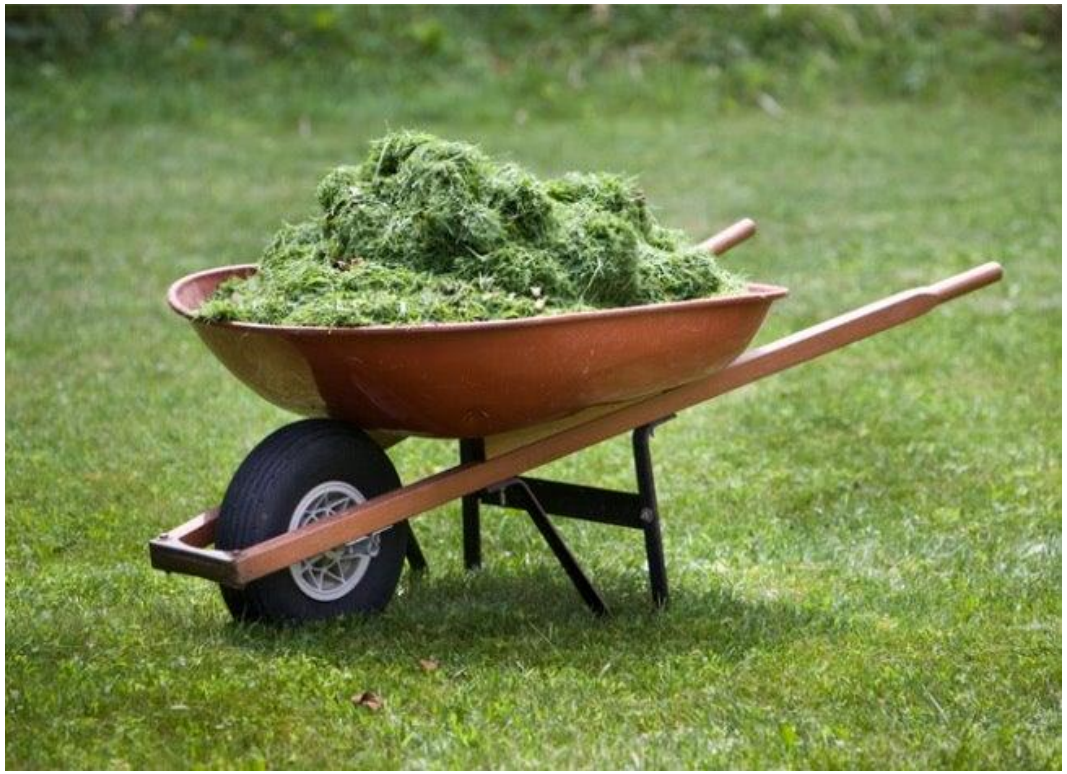
C:N ratio: **20:1 – 40:1**

Browns (carbon rich)
Wood chips: 100-500:1
Paper and cardboard: 150-200:1
Straw: 40-100:1
Dry leaves: 20-80:1

Greens (nitrogen rich)
Fruit peels: 25-35:1
Grass clippings: 12-25:1
Vegetable scraps: 12-25:1
Coffee grounds: 20:1

Too much carbon:
Slows the decomposition process

Too much nitrogen:
Odors, slows decomposition, leaching of nutrients



Carbon to nitrogen ratio is a crucial concept in composting

What proportions of A (x) and B (y) do we need to make C?

Browns (carbon rich)

A. Tomato vines: 150:1

Greens (nitrogen rich)

B. Coffee grounds: 20:1

Compost (good balance)

B. Our goal: 30:1

For the C:N ratio:

$$\frac{150x+20y}{x+y} = 30$$

For proportion of mixture:

$$x + y = C$$

Or

$$y = C - x$$

$$\frac{1}{13}\,A + \frac{12}{13}\,B = C$$

Carbon to nitrogen ratio is a crucial concept in composting

$$\frac{1}{13} A + \frac{12}{13} B = C$$

For every pound of tomato vines

We need 12 pounds of coffee grounds

To have a good balanced mixture for making compost

Browns (carbon rich)

A. Tomato vines: 150:1

Greens (nitrogen rich)

B. Coffee grounds: 20:1

Compost (good balance)

B. Our goal: 30:1

Rich compost!

Nutrients + humus