

Photosynthesis

1. What is Photosynthesis?

ENGAGE

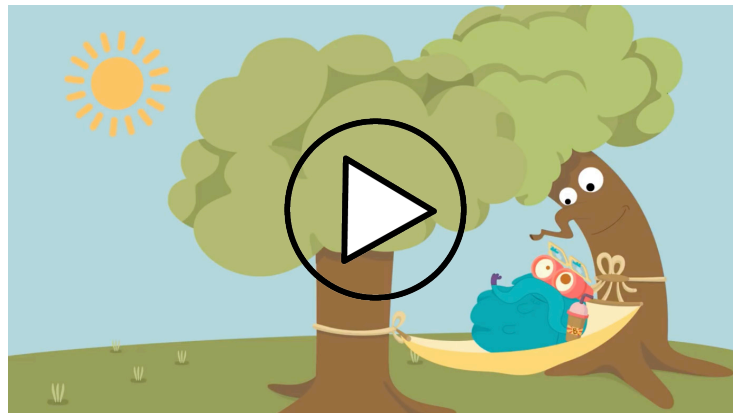
Photo . synthesis

is the Greek word for light

to put something together

So photosynthesis is a chemical process that plants use where they use the energy from sunlight to *put together* their food.

Take a few minutes to watch this short video about photosynthesis.



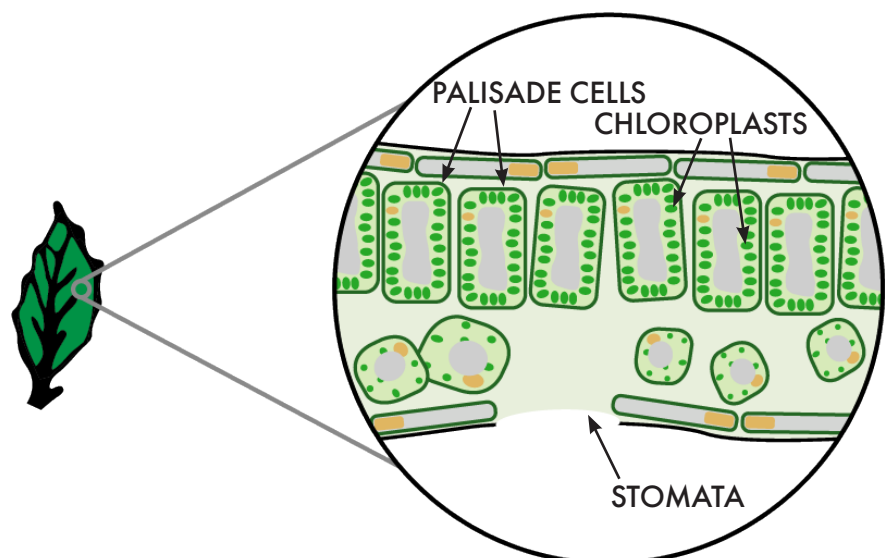
<https://www.youtube.com/watch?v=D1Ymc311XS8>

Photosynthesis is the process that plants use to make food. Photosynthesis occurs in special cells in the green parts of a plant.

These special cells are called **palisade cells** and they contain a whole bunch of organs called **chloroplasts**. The green comes from a pigment called **chlorophyll**.

Chlorophyll gives the leaves their green color and is responsible for carrying out photosynthesis.

Cross Section of a Leaf



Plants gather the three ingredients for photosynthesis from the world around them. They take in carbon dioxide from the air through their **stomata** which are tiny holes on the bottom of a leaf. Flip back to the close-up diagram of a leaf on the last page and find the stomata. They use energy from the sunlight which is absorbed by the green chlorophyll pigment in their cells. And they gather water mostly through their root system. The plants then use these ingredients, or **reactants**, to make sugar and oxygen, the **products** of photosynthesis.

Plants use the sugar they make, in the form of **glucose**, for food and nourishment to help them grow and produce seeds. The glucose, or sugar, that a plant makes is not like the sugar you use in the kitchen but like the sugar that is in an apple.

The oxygen is a waste product of photosynthesis. The plant has no use for it, so it releases it again through the stomata on the bottom of the leaves. This is the plant equivalent of breathing out.

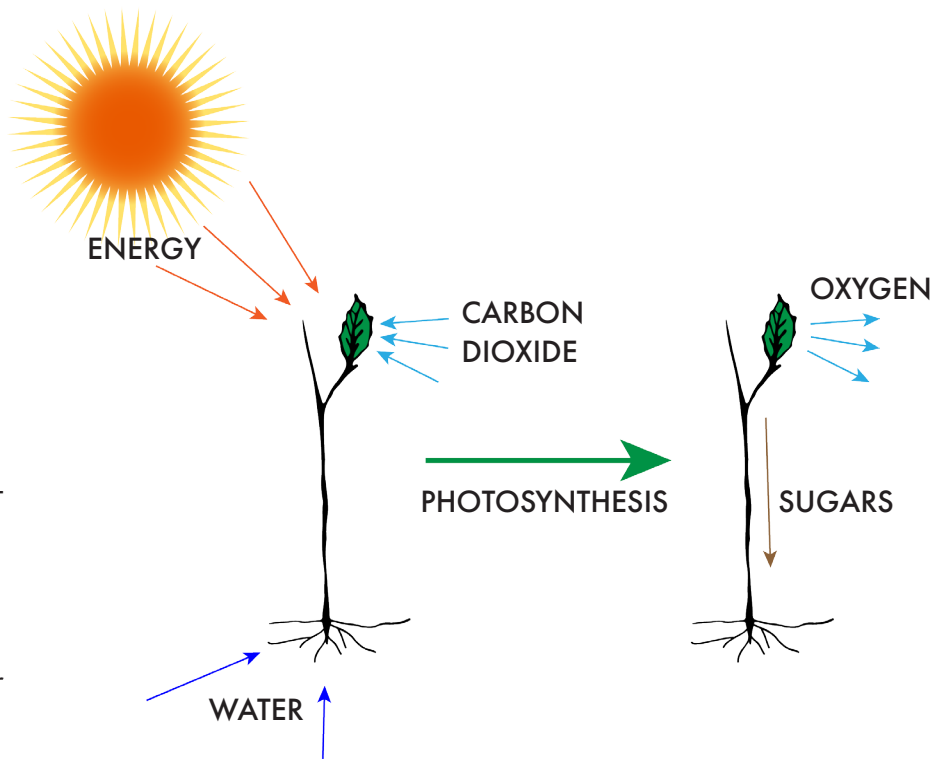
This is a microscope image of a real stomata in the bottom of a leaf. The stomata can open to let air in or out of the leaf.

Phew! That was a lot of information! Let's see if you can answer a few questions about photosynthesis now:

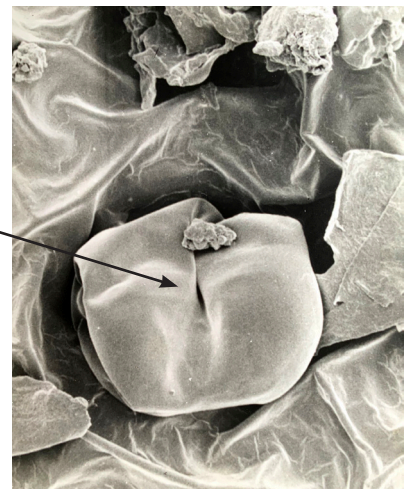
1. What three things does a plant need to conduct photosynthesis?

2 What type of sugar do plants produce through photosynthesis?

3. What do we call the pigment that makes leaves look green?



STOMATA

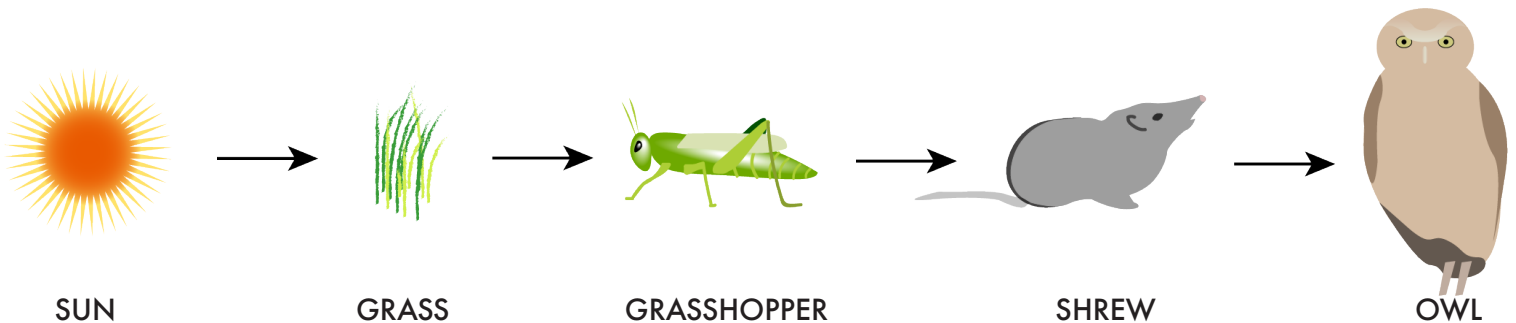


In ecosystems some organisms are producers and others are consumers. Producers are able to make their own food. Consumers get energy by eating something else.

Are plants producers or consumers?

Now that we have learned how photosynthesis works and how plants use sunlight to make food and grow, let's talk about the role photosynthesis plays in a food chain. A **food chain** shows us how energy is transferred within an ecosystem. Food gives us energy, so when a creature eats something the food's energy is transferred to the eater.

Here's an example of a simple food chain:



Notice how the sun and the producers, the plants, are at the beginning of the food chain.

2. Watch it Happen

EXPLORE

Before going outside and investigating some plants, let's make some predictions first.

Where will plants grow the best?

What kind of conditions do you think they need to thrive?

What kind of conditions do you think plants will grow poorly in?

Okay, now go outside and find 2 plants, one growing in the shade and one growing in the sun. Fill in the chart below with some observations.

	Shade Plant	Sun Plant
How many green leaves does the plant have?		
What sort of plant is it? Is it a flower? A vegetable? A weed?		
Draw a picture of the plant		
Describe the plant in as much detail as possible		
What do you think would help this plant grow better?		

Now that you have observed some plants in their natural environments, where photosynthesis is constantly occurring, we are going to conduct an experiment to look for evidence of photosynthesis.

You will need:

2 leaves
2 small bowls of water
a few small pebbles or small gravel
a dark place and a bright place
a timer

It is important that you collect the leaves off of one plant that is definitely alive and that both of the leaves are green.

1. Take each leaf and put it in a bowl of water.
2. Use some small rocks to hold the leaf at the bottom of the bowl.
3. Put one bowl in a dark room and one in direct sunlight.
4. Set your timer for 30 minutes and leave the bowls alone.

While you wait answer the questions below based off of the information you learned earlier about the reactants and products of photosynthesis.

1. Is there anything you might be able to see in the water that will tell you if photosynthesis is occurring? Think back to the products of photosynthesis.
2. Do you think photosynthesis will occur better in the dark room or in direct sunlight? Why?
3. Now, go collect your samples. Notice anything in the water that wasn't there before?
4. There should be oxygen bubbles in the water; the leaf that was in the sun should have more oxygen bubbles than the one in the dark room.

How many oxygen bubbles were in each bowl?

Dark room: _____

Direct sunlight: _____

5. Now that the experiment has ended, what is a conclusion you can draw about where photosynthesis occurs best?

3. Food Webs

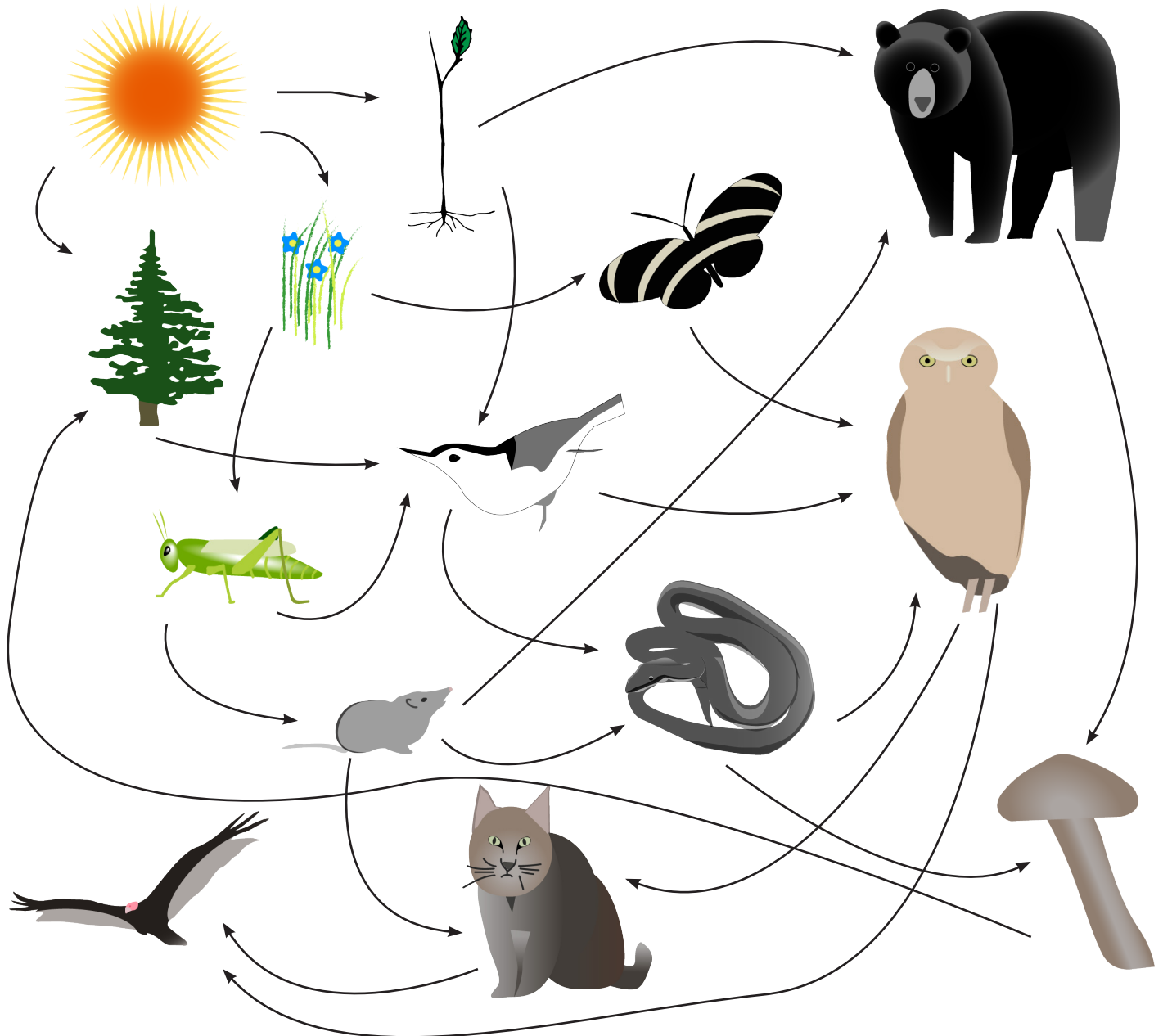
EXPLAIN

A food chain shows how energy moves from producers to consumers. A food web can do that too, but it goes into greater detail illustrating the many complex relationships that exist within an ecosystem and how the energy flows between multiple species. Food webs give a bigger picture of how an ecosystem functions by illustrating how species interact with each other in many different ways. For, example sometimes an owl is a predator but other times it can be prey.

One way to think about the difference between food chains and food webs is this:

A food chain would tell us that Abby eats a peanut butter & jelly sandwich every day. But everyone knows that Abby does not only eat peanut butter & jelly sandwiches, she also likes pizza and apples.

A food web tells us that Abby also eats tacos, lettuce and blueberries. A food web gives us a bigger, more complete picture of Abby's diet.



Where does the energy in a food chain originate from?

How is this related to photosynthesis?

All food chains are connected in some way or another because they all get their energy from the same place: the sun. Your food chain will connect or overlap with those of your classmates. If you combine multiple food chains you get a food web. Draw a food chain that includes the sun. Use at least 5 different plants and animals.

Name at least 3 ways, other than the sun, that your food web might overlap with others. Be prepared to share your food web and these connections with your classmates.

After seeing all of your classmate's food webs, what are 3 connections that you can make with another web?

4. The Earth Breathes

EXTEND

Read this article about the effect trees have on the earth's atmosphere.

<https://www.nationalgeographic.com/science/phenomena/2016/03/09/the-earth-has-lungs-watch-them-breathe/>

Explain how a tree helps clean the earth's atmosphere. What does the process look like?

Where does excess carbon dioxide come from? Name 3 sources.

Why is most of the cleaning happening in the Northern hemisphere?

5. How do WE transfer energy?

EVALUATE

In an ecosystem energy in the form of food is transferred through predator/prey relationships. How is energy in the form of attitudes and emotions transferred between humans? We as humans pass energy onto each other and the people we surround ourselves with will pass their energy on to us.

List 3 different ways your energy can be 'contagious' to others.

What are 3 different ways that you pass energy onto other people like your siblings or friends? Is it negative or positive?

6. Vocabulary

Consumers: organisms that must consume food

Ecosystem: a biological community that shares a habitat

Food Chain: a linear representation of energy being transferred from producers to apex or tertiary predators in an ecosystem

Food Web: a complex representation of the predator/prey relationships that exist within an ecosystem

Palisade Cells: specialized cells in leaves that carry out most of the photosynthesis in a plant

Photosynthesis: the process that plants use to make food; occurs in the green parts of plants

Producers: organisms that are able to produce their own food

Products: the end result of a chemical reaction. In the case of photosynthesis the products are oxygen and glucose

Reactants: the ingredients of a chemical reaction. In the case of photosynthesis the reactants are carbon dioxide, sunlight and water

Stomata: tiny openings in plant's leaves that allow carbon dioxide to be taken in and oxygen to be released.