



**Beyond BeLeaf:
The Wonder of
Leaves**

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We don't think much about them—the green blur of the forest that forms the backdrop of our daily lives. But every tree sports thousands of leaves and each leaf tells a story of wonder—an evolutionary story that is worth sharing with our children.

The sheen of green you see in a leaf is created by special cells that contain chlorophyll (green in colour). These cells have evolved to become the food-making cells for the tree. And really their presence is nothing short of a miracle. The process by which food is made for trees bears the unwieldy name *photosynthesis*: *photo* is the Greek word for *light* and *synthesis* means *putting together*. And that is exactly what is happening. Here is one way to explain the magic of leaves and the process of photosynthesis to children.

SUN: THE “LIGHT SNACK”

Grab a handful of sunlight. Now don't let it slip through your fingers. Cram it into your mouth—chew and swallow. Now that is what you call a “light” lunch.

Okay—people can't really eat sunlight—at least not directly. But trees can! And so can other plants. Inside each leaf are little factories (chloroplasts) that take the sun's energy, carbon dioxide and water to make sugar. Every single leaf is like a mini solar oven, making food straight from sunlight. A byproduct that plants don't need is oxygen. Now let's take a moment and stop and think about this. Breathe in. The oxygen you are taking into your lungs was made by plants. Breathe out, the carbon dioxide you don't need is taken up by plants. What a cool arrangement! Trees take up carbon and give off oxygen. You take in oxygen and give off carbon dioxide. Without trees and other plants, there would be no way to capture the sun's energy and make it available to animals like you and me. Plants and trees are the miracle workers that turn solar energy into people energy. Trees also moisten the surrounding air, their roots help the soil to retain water and they provide critical sources of food and habitat for many birds, insects and animals.

As parents, we recognize that curiosity is the engine of learning. So, take your kids for a walk. Pick up fallen leaves and begin to ask a few

questions. Don't be in a hurry to provide the answers; instead, ask your children to think about what a reasonable response might be. Here are a few questions your children may ask and a few answers you can (eventually) share.

Why are leaves green?

Leaves contain an amazing chemical called chlorophyll. It is green in colour and made out of rare and precious minerals or nutrients, like magnesium, from the soil. Chlorophyll helps the tree to make sugar (see above).

Why have trees evolved to be so tall?

So they can reach the sunlight. They don't want to be shaded out by their neighbour or die from lack of sunlight.

Why are some leaves bitter or poisonous?

This is an adaptation that has evolved to protect trees from hungry insects like caterpillars, birds and mammals that might like to eat them. Ask children to rub some leaves and sniff – can they smell the bitterness?

Why are evergreen needles so waxy, small and thin?

In order to reduce water loss. This is especially important during the winter, which can be a time of drought for trees.

Why are there so many different sizes and forms of leaves?

When you have lots of small leaflets on a single leaf stem (compound leaves), the air can effectively circulate and cool them. Large leaves gather more light, and are therefore necessary in shady areas and on the lower, more shaded branches of trees (e.g. Hosta). Complex edges and lobes allow leaves to get rid of absorbed heat very rapidly, while smooth edges are more common in shade-loving plants that have an easier time shedding excess heat.

Why do so many leaves end in a point?

So that water runs off more easily.

Why do some trees not lose their leaves?

You'll have noticed that some trees keep their leaves (needles). These tend to be the conifers (cone bearing trees) like hemlock, cedar, spruce, fir and pines. Known as *evergreens*, their small, waxy needles remain attached to twigs all year long. The waxy coating helps evergreen trees to retain moisture. So these trees don't need to shed their leaves! On the other hand, deciduous trees like maples, oaks, birch, beech and ash, become dormant. They lose their broad leaves and send food down to their roots so they can survive during winter. These leaves are too thin and delicate to withstand the winter weather. Snow would accumulate and break branches and water would be lost through the pores by transpiration.

Why do some leaves change colour in the fall?

It is true...there is something indescribably magical about the colours of fall. The uniform green of the forest that is the hallmark of any summer's day slowly transforms into majestic hues of yellow, gold, mauve and crimson.

The funny thing is that many of those fall colours have been there all along. The green chlorophyll covers up other pigments like yellow and orange (carotenes and xanthophyll pigments) that are hidden from view until the days shorten and the temperature drops. During the shorter cooler days of autumn, chlorophyll breaks down and the other pigments pop out and show themselves. There are other pigments forming during this time, such as anthocyanin, which gives leaves their vibrant red and purple colours.

Reds & Purples	white ash (maroon), baldcypress, black gum, pin cherry, western crab apple, dogwoods, sugar maple, red maple, vine maple, red oak, sassafras, serviceberry, sumacs, sweetgum, tupelo, blackgum, Virginia Creeper
Yellows	white ash, Oregon ash, cottonwoods, tamarack (larch), bigleaf maple, sugar maple, red maple, silver maple, Norway maple, quaking aspen, bigtooth aspen, tuliptree, sassafras, sweetgum, birches, American beech, American basswood, Kentucky coffeetree, black walnut, American elm, spicebush, hickories, willows, ginkgo, willows
Oranges	Western crabapple, California black oak, sugar maple, red maple, black maple, bigtooth aspen, chokecherry, poison ivy, sumacs
Browns & Coppers	American beech, white ash, red oak, white oak, eastern sycamore



Photo: Christopher Elwell/shutterstock.com

**MAKE YOUR OWN
fall colours**

COLOURFUL CHROMATOGRAPHY

For this activity, you'll need a variety of green leaves from a nearby tree (maple and oak work well), a coffee filter, scissors, a pencil, rubbing alcohol, aluminum foil and paper.

Step 1: Take the coffee filter and cut one strip about 2 cm wide. Cut a point at one end of the strip.

Step 2: Tear up the green leaves into small pieces. Place in a blender with enough rubbing alcohol to cover the leaves. Grind up the leaves into a green slurry. Let stand for 24 hours. Cover the top with the blender top or aluminum foil to avoid evaporation.

Step 3: Tape your coffee filter strip to a pencil and hang it so that the very tip of the strip touches the alcohol. Leave for about an hour or so. Various pigments in the leaf should move up the filter. What colours did you notice? Those colours were in the green leaf all along. What you have created is called a chromatograph. Leave it overnight to dry. Use your chromatograph as an autumn bookmark.

MAKE A LEAF SKELETON

Here are some skeletons that are guaranteed not to frighten you! Collect a series of leaves (maple, oak and basswood work well). Leave these in a container of water for several weeks. Remove the leaves and use a small paint brush and/or a toothbrush to gently remove the soft tissue surrounding the veins. Brush from the inside towards the outside of the leaf. Rinse frequently. Soon, the delicate and lacy pattern of veining in each leaf is revealed. Allow to dry for several days by placing your skeletons inside several layers of newspaper. Glue your dried skeletons onto a white sheet of paper.

CREATE LEAF RUBBINGS

Collect a variety of fall leaves. Place them under a white sheet of paper. Secure a leaf under the paper with your fingers. Make sure the veins face up. Use the sides of crayons to rub layers of colour on. Focus on the edges and the veins. Slowly build up the colours. You'll be amazed at how lovely your creations will become.

MAKE STAINED GLASS WINDOWS

Gather the most colourful leaves you can. Slip them between a folded piece of wax paper (wax side facing inward). The next step should be conducted by parents only please. On top of folded newspaper, use a hot iron to seal the wax paper. Allow time to cool. Take your creation and tape this on the inside of a window facing the sun. When sunlight flows in, your creation will glow!