# Red Leaf, Green Leaf: Exploring Plant Pigments

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## Session Goals:

1. Provide visual aids for visitors to connect plant physiology and seasonal change through changing leaf color
2. Provide a guided marker color chromatography experiment
3. Provide visitors their own leaf chromatography kit to take home
4. Provide a visual aid for visitors to understand the inputs and outputs of photosynthesis

## Activities

### Activity #1 – Colors in the Visible Light Spectrum

Desired Learning outcomes:

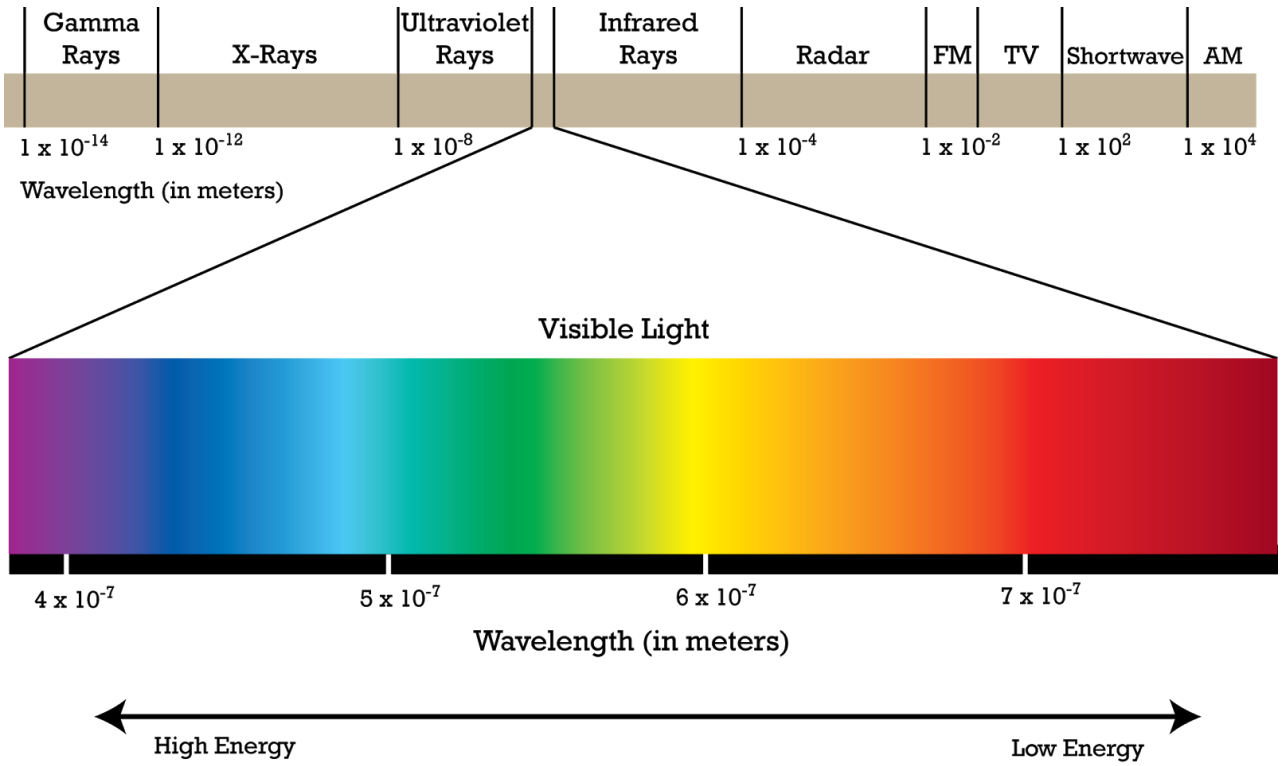
1. Visitors will understand the difference between the light we can see on plants and the light that those plants absorb.

Materials:

1. Poster board with electromagnetic spectrum
2. Examples of colorful plants (sunflower, red flowers, green leaves)
3. Prisms

Lesson:

Green leaves, red roses, yellow petals on sunflowers. The colors we see on plants are actually reflected light. What does that mean? To understand color, we have to first look at the spectrum of visible light waves. There are many other types of waves (You've heard of microwaves?), but we will focus on the light waves we can see. The rainbow on the poster (see attached images) represents different waves of light that we see reflected on different surfaces. These surfaces absorb waves too. An object that absorbs one or more types of light will reflect the color light that we see as color. For example, a leaf absorbs blue and red light, and reflects green, showing the color that we see on leaves. Visitors can use a prism to bend white light into its component colors to see the visible light spectrum.




http://blog.luxexcel.com/printed-optics/light-spectrum/

## Activity #2 – Chromatography with Markers

Desired Learning outcomes:

1. Visitors will understand that leaves contain different pigments, much like colored markers contain primary colors within secondary colors.
2. Visitors will learn the importance of chlorophyll in photosynthesis and that the other pigments are present, but not visible until senescence in the fall.

Materials:

1. Markers
2. Chromatography paper
3. Water
4. Isopropyl alcohol
5. Glass beakers
6. Zebrina leaves or other brightly colored petals/leaves
7. Chromatography kits: 20 mL plastic vials, chromatography paper, instructions and Ziploc baggies

Lesson:
Chromatography is the separation of a mixture by passing it through a solution so that the components separate at different rates. We will perform chromatography with markers to observe secondary colors separating into primary colors. Leaves contain different colors, or pigments, too. Because leaf chromatography can take up to one hour, market-goers will see the process with markers and actually do the experiment with leaves at home with their kit.

A colored dot on a piece of chromatography paper will be placed in a beaker of water. Through capillary action, the water will bring out the primary colors in the marker dot. To prepare for the take-home leaf chromatography experiment, market goers will mash up leaf bits from a Zebrina plant, place the bits in a plastic vial, and cover with alcohol. With the kit, market-goers will receive one piece of chromatography paper and instructions on how to observe leave pigments in their Zebrina sample. The end result of leaf chromatography will show the red anthocyanin, green chlorophyll, and yellow xanthophyll (see below).

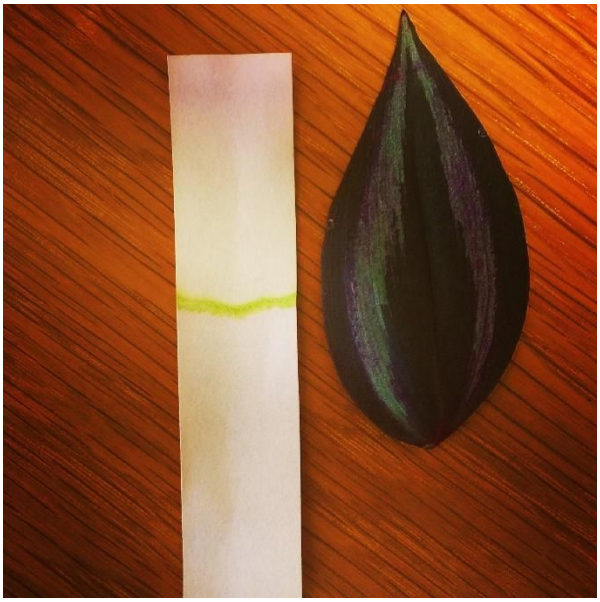


Photo taken by Laura Nelson

## Activity #3 – Photosynthesis Felt Board

Desired Learning outcomes:

1. Visitors (targeted at children) will understand that the green pigment chlorophyll is important in photosynthesis. They will be able to identify the inputs and outputs of photosynthesis

Materials:

1. Felt board
2. Felt elements of photosynthesis

Lesson:

The green that we see on leaves during the summer comes from the pigment chlorophyll. Chlorophyll is important in photosynthesis, which is a biological process that we can thank for the oxygen we breathe and the sweet treat maple syrup. Chlorophyll allows the plant to absorb sunlight, which is the energy that drives photosynthesis. A plant also needs water and carbon dioxide to carry on the process. The outputs of photosynthesis are atmospheric oxygen and sugar in the form of plant starches. Visitors will place the elements of photosynthesis on the felt board and use arrows to indicate inputs (water, carbon dioxide, sunlight) and outputs (plant sugar and oxygen).

# Pre-session trivia:

1. What is the name of the plant pigment that aids in photosynthesis? *Chlorophyll*
2. Which color has the longest wavelength – blue, red, green, or purple? *Red*
3. What color is the plant pigment xanthophyll? *Yellow*
4. Why do leaves turn color in the fall? *As the season progresses, so do the "lives" of leaves. On deciduous trees, when leaves get old, the green pigment chlorophyll breaks down into smaller components and trees absorb these component nutrients to be recycled. When chlorophyll breaks down, other pigments like yellow and brown (xanthophylls), orange (carotenoids), and red (anthocyanins) are visible in leaves.*

## Links to references or background materials

http://www.scientificamerican.com/article/ive-heard-several-differe/

## Recommended age range

All ages

## Recommended citation for this lesson plan:

Nelson, Laura. 2016.Red Leaf, Green Leaf: Exploring Plant Pigments. marketsci.org