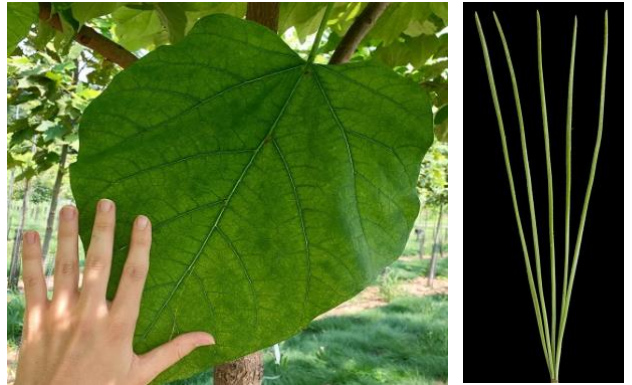


## ART + SCIENCE AT HOME

Hara Woltz and Shelly Forster

### LOOKING CLOSELY AT LEAVES

Yesterday, we looked briefly at [leaf topography](#) as part of our tree interviews. As you discovered, leaves come in a variety of shapes and sizes. Trees have evolved a diversity of leaves in order to maximize their ability to survive and perform photosynthesis within their particular environment. For example, the Northern Catalpa grows large, broad leaves that maximize the surface area for absorbing sunlight. In contrast, the Eastern White Pine has slender needles that allow the tree to retain moisture and minimize ice damage in the winter. Leaf shape, margin and vein patterns are primary clues for plant identification. Today we'll look more closely at the architecture and function of leaves.



([www.rupertnurseries.com](http://www.rupertnurseries.com), [www.northernforestatlas.org](http://www.northernforestatlas.org))

Leaves are centers of respiration, transpiration and food production for plants. They capture sunlight to fuel the process of photosynthesis and their form reflects this function. Through the chemical process of photosynthesis, chloroplasts engineer food in the form of glucose. The glucose then travels from leaves to nourish other parts of the tree, and oxygen is released through stomata into the atmosphere. If you want to see how illustrators imagine this process inside a leaf, we recommend [this short video](#) from California Academy of Scientists that shows the machinery inside the cell performing photosynthesis. For today's class we tried to research how many leaves are on a mature adult oak tree and found estimates ranging from 200,000 to 2 million! We're still not sure what the answer is, but we challenge you to try out this [tree leaf calculator](#) and let us know what you come up with.

Leaves must be sturdy, but thin enough to allow sunlight to reach their chloroplasts. Trees produce anatomically [different types of leaves](#) depending on the leaf's position in the canopy and its access to sunlight. Leaves at the bottom of a tree, where sunlight is more limited, are larger and greener than those at the top. As you observe your tree today, see if you note any differences in the leaves based on their position on the tree.

**LEAF ANATOMY** - Here are some descriptions of basic leaf anatomy to help you with your observations.

**BLADE** - Broad portion of a leaf.

This is the primary photosynthetic surface.

**PETIOLE** - Stalk that attaches leaf to stem.

Helps position the leaf for optimal photosynthesis.

**APEX** - Tip of leaf.

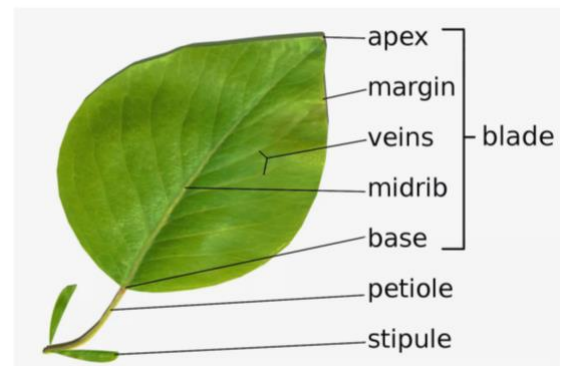
**MARGIN** - Edge of leaf.

**VEINS** - Vascular tissues that transport nutrients and provide supportive structure.

**MIDRIB** - Main central vein.

**BASE** - Area of the leaf where blade connects to petiole.

**STIPULES** - Leaf-like structures at base.



(Evelyn Bailey)

**EPIDERMIS** - Layer on either side of leaf. Like the bread of a sandwich.

**MESOPHYLL** -The sandwich filling! Layer of parenchyma tissues.

**PALISADE PARENCHYMA** - A tightly packed layer of long tube-like tissues filled with chloroplasts for photosynthesis.

**SPONGY PARENCHYMA** - Irregular and loosely packed cells with lots of air space between them. Where most gas exchange occurs.

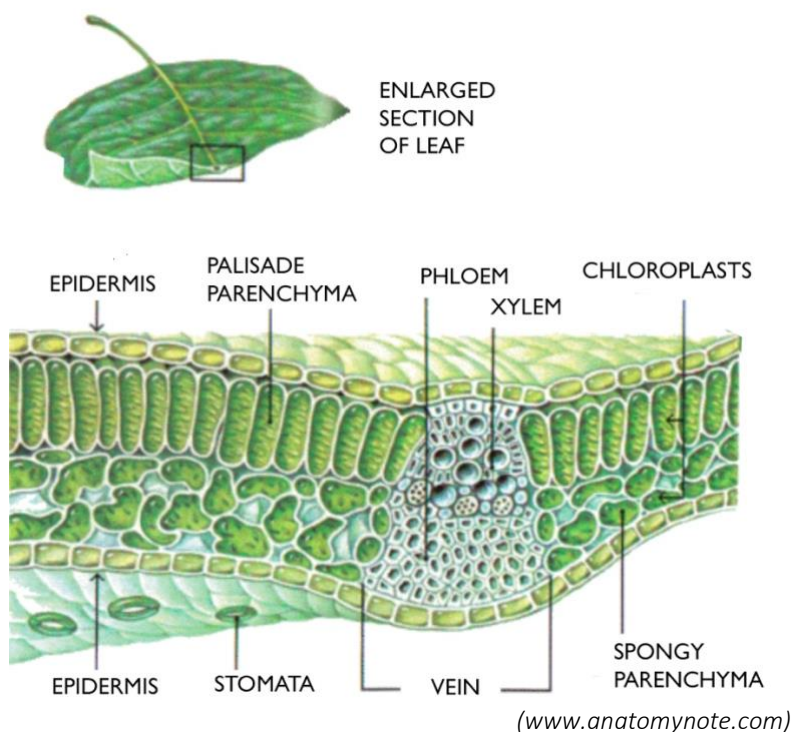
**CHLOROPLASTS** - photosynthetic structures. Contain chlorophyll, a green plant pigment that captures the energy in light and begins the transformation of energy into sugars.

**STOMATA** - Openings in leaves and stems that allow for gas exchange.

**VEIN** – Vascular tissue.

**XYLEM** –Transports water and minerals.

**PHLOEM** –Transports food.



### STEP ONE: Gather your drawing materials and head outside.

- Bring your fieldbook, a bag or other container for collecting some leaves, and drawing supplies.
- Revisit one of your trees from yesterday.

### STEP TWO: Observe the Weather.

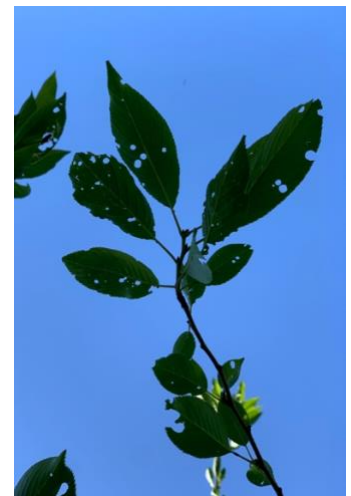
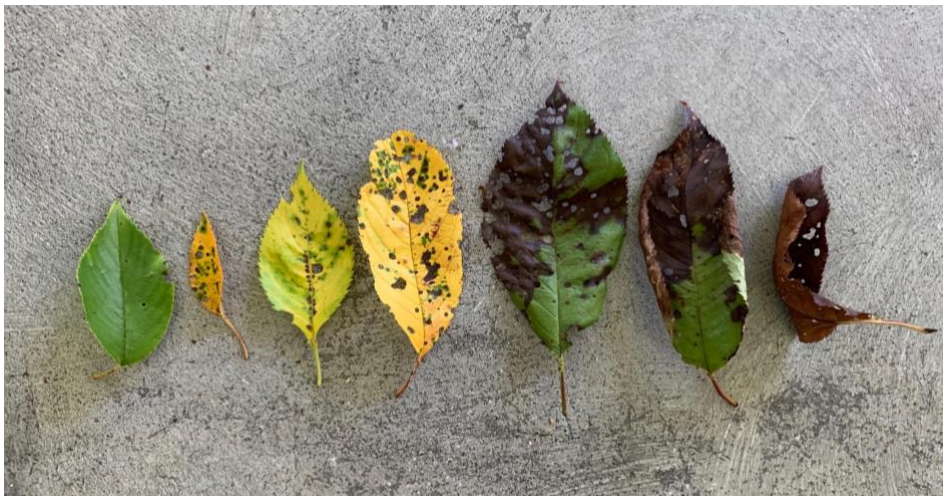
- Record some information about the day. Pick a corner of your journal page and write down your location, the date, and time. Note the temperature, the cloud situation, whether it is sunny, rainy, or snowy, and how windy it feels. You can make some general notes about what you see, and you can also look up the weather for your area online, or use a backyard thermometer if you have one. You might also want to include a note about your internal barometer. How are you feeling today? Jot that down.

### STEP THREE: Observe and collect some leaves.

- Look around the branches of your tree, or several trees. How are the leaves growing? Are there differences in size? In color? Shape? Are there leaves on the ground?
- Find five to ten leaves to draw.
- Try to find a diversity of leaves so you will have different things to draw. This might mean finding leaves of different size, shape, or color from the same tree, or collecting leaves from different tree species.
- We try to be thoughtful about pulling functional leaves from plants, so try not to pull too many from one place. One or two is fine. Keep in mind that sometimes the dead leaves you find on the ground have the most interesting features to draw.
- Once you have collected your leaves, find a comfortable spot to sit and draw. You may remain outside or head back inside to a desk or table.
- Spread out your leaves and arrange them according to a classification scheme. You could arrange them by shape, size, color, amount of herbivory, color, etc.

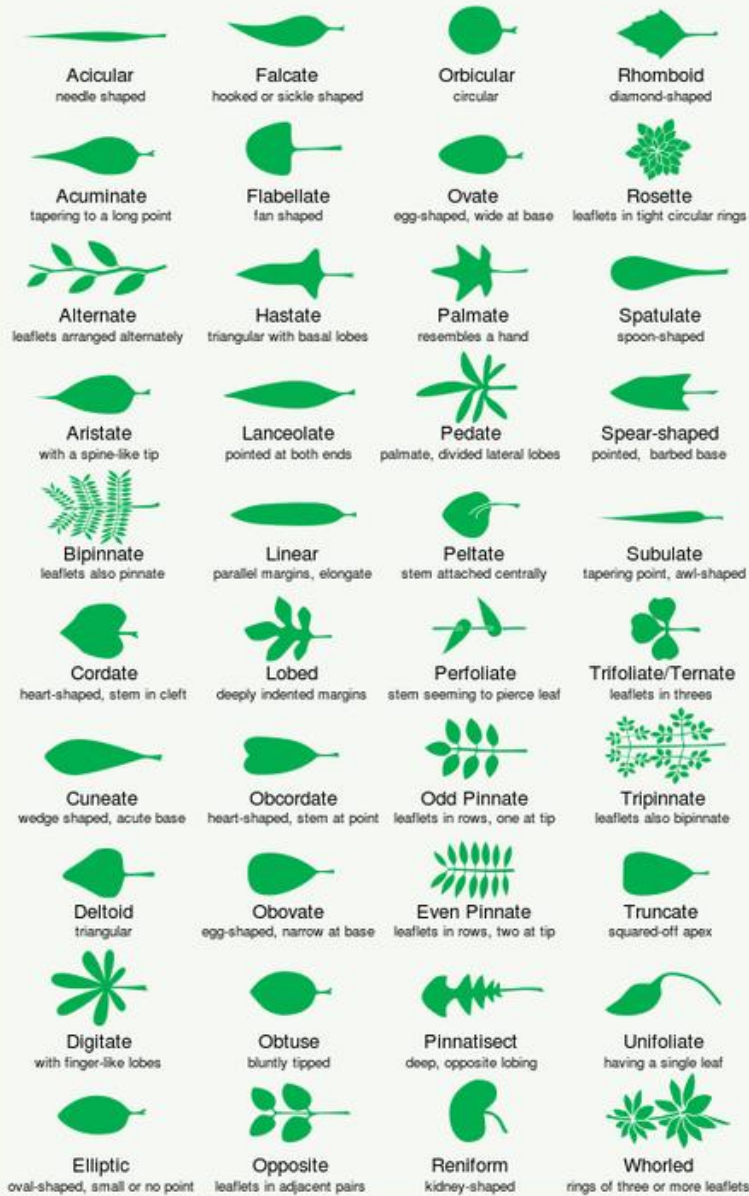
## STEP FOUR: Draw your leaves.

- First, take a moment to really look at your leaves and their structure. Turn them over and observe both sides. What do you notice?
- Begin by doing a contour drawing of each leaf, paying particular attention to margin and/or venation. A contour drawing is a continuous drawing that focuses on the outline of structures. I like to use pen for these, but you are welcome to use whatever drawing implement you like. See example below. I focused on margins because I became interested in the variety of edges.
- As you draw, pay attention to the structures you see. What is the pattern of the veins: do they branch out from a central vein or from the petiole? What is the edge of the leaf like: wavy? Toothed? Smooth? What shape is the leaf? Use the charts on the next page to identify and label the anatomy of your leaves as you draw. If you notice evidence of munching, record it. We'll look more at this tomorrow.
- After you finish your contour drawings, pick one leaf and do a more detailed color drawing.
- When you have finished drawing, use the guide on page four to help you write some notes about your leaf margins, venation, shape, etc.

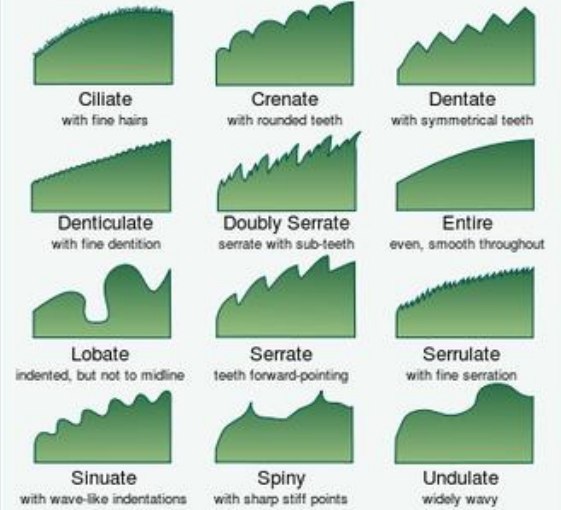




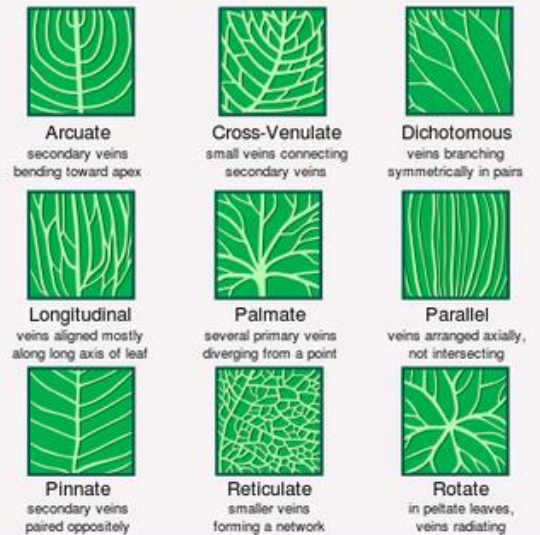
## SHAPE & ARRANGEMENT



## MARGIN



## VENATION



(McSush/Wikimedia Commons/CC BY 3.0, www.thoughtco.com)

**arts**  
**Mid-Hudson**  
*together we create*

This project is made possible with funds from the Decentralization Program, a regrant program of the New York State Council on the Arts with the support of Governor Andrew M. Cuomo and the New York State Legislature and administered by Arts Mid-Hudson.