**How do plants “breath”?**



**Objectives:** Participants will…

* Investigate how plant leaves exchange gas
* Practice skills by using a microscope and making
a slide mount
* Applying their knowledge of photosynthesis

Time to complete activity: 30 minutes

Skill level: Intermediate (grades 6-10)

**Background/Setting the Stage:**

 Plants and animals both have a layer of tissue called the epidermal layer. Plants have special pores called stomata to allow passage of material. The stomata pores are surrounded on both sides by jellybean shaped cells called guard cells. Unlike other plant epidermal cells, the guard cells contain chlorophyll to do photosynthesis. This allows the cells to expand/ contract to open or close the stomata. Guard cells also close when dehydrated. This keeps water in the plant from escaping. The opening or closing of guard cells can be viewed in a microscope by adding different water concentration to the leaf tissue. Most stomata are on the lower epidermis of the leaves on plants (bottom of the leaf). The number of stomata on the epidermal surface can tell you a lot about a plant. Usually, a high concentration of stomata indicates fast growth and wet climate. Lower concentrations of stomata indicate lower rates of photosynthesis and growth or adaptations for dry weather.

**Stomata Printing**

 Scientists make prints of stomata in order to easily see the surface of a leaf under the microscope. The nail polish is used of the surface of the leaf to make an impression of the leaf surface. The nail polish is just like plaster poured into a footprint in sand. Some leaves work better than others for making prints. We find that smooth, sturdy leaves work well. We run into difficulty if leaves are very delicate or are covered by lots of hair. For this reason we suggest that you try your leaves out first or let students know that the method may not work for every leaf. You can also try this method with dried leaves.

**Materials:**

* Foldscopes
* Clear nail polish
* Clear tape
* Microscope slides

**Methods:**

1. Obtain a fresh leaf from a plant
2. Paint clear nail polish on the underside of the leaf surface being studied
3. Allow the nail polish to dry completely
4. Tape a piece of clear tape to the dried nail polish patch
5. Gently peel the nail polish patch from the leaf by pulling on a corner of the tape and ”peeling" the fingernail polish off the leaf.  This is the leaf impression you will examine.
6. Tape your peeled impression to a microscope slide. And label the tape with plant name and side of the leaf.
7. Examine the leaf impression under a microscope
8. Search for areas where there are numerous stomata. Avoid areas where there are dirt, thumbprints, damaged areas, or large leaf veins.  Draw the leaf surface with stomata.

Optional:

1. Count all the stomata in one microscopic field. Record the number on your data table.
2. Repeat counts for at least three other distinct microscopic fields. Record all the counts. Determine an average number per microscopic field.
3. Follow procedures 2 – 11 with the other leaves if times allows or the topside of the leaf.

**Reflection Questions:**

1. What is transpiration?
2. What time of day would stomata be closed and why?

1. What gases move in and out of the leaf stomata?
2. What does a larger number of leaf stomata indicate about the growing climate of that plant? What does a lower number of leaf stomata indicate?

Optional:

1. Which leaf had the most stomata? Why do you think this was so?
2. Which side of the leaf (top or underside) have the most stomata? Why do you think that is?

**Bottom of Form**

**Supplemental Information:**

**Plant structure and Adaptation video** (8: 39 minutes)- <https://www.youtube.com/watch?v=DGpPHrLF-5M>

**Vocabulary:**

**Carbon Dioxide**- a colorless, orderless gas that is present in the atmosphere, breathed out during animal respiration, pursued by decaying organic matter, used by plants in photosynthesis, and formed when burning organic matter or fossil flues.

**Photosynthesis**- Is the process through which plants use water, light, and carbon dioxide to create their food in the form on the sugar molecule glucose and releases oxygen into the air.

**Stomata-** a structure on the surface of a leaf that modulates gas exchange between the plant and its environment.

**Reference:**

“Leaf Stomata Lab -.” Biology Tests and Procedures, www.biologyjunction.com/leaf\_stomata\_lab.htm.

“Stomata Printing: Microscope Investigation.” California Academy of Sciences, California Academy of Sciences, www.calacademy.org/educators/lesson-plans/stomata-printing-microscope-investigation****