Lasting Impressions—Counting Stomata

Introduction:

Examine impressions of plant tissues to help students learn about location and density of stomata. Ever been on a stoma hunt? Where do you find them? Are they in predictable places?

Materials:

Plant leaves	Clear fingernail polish	Clear cellophane tape
Microscope	Microscope slides	Scissors

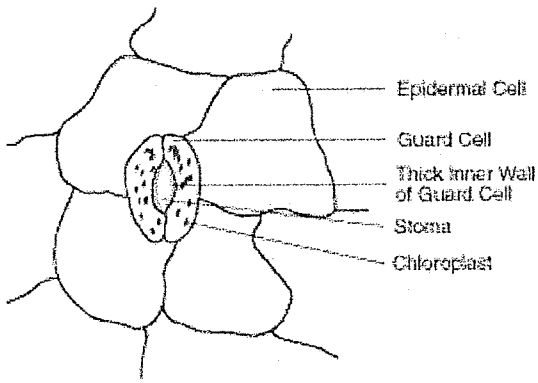

Figure 1. Leaf Stoma

Background:

Plant tissue, just like animal tissue, is composed of specialized cells to perform specific functions. Plants have an *epidermis layer*, an outer skin-like layer, just like animals. Animal skin contains specialized "holes" or pores for specific body regulatory functions. Plant epidermis likewise has "pores." A single pore in plant epidermis is called a *stoma*.

The location and density of these numerous pores is interesting and relates to plant genetics and niche adaptations. Stomata are most numerous on the leaves of plants. They occur on both the upper and lower epidermis of the leaves in some species (alfalfa, corn), exclusively on the upper epidermis in some plants (water lily), and are absent altogether on submerged leaves of aquatic plants. Stomata are very numerous, ranging from about 1,000 to more than 1.2 million per cm^2. An average-sized sunflower leaf has about 2 million stomata on its lower epidermis.

Each stoma is bordered by two sausage-shaped cells that are usually smaller than surrounding epidermal cells. These small cells are called *guard cells* and, unlike other cells in the epidermis, contain chloroplasts. See Figure 1.

The photosynthesis that takes place in the guard cells aids in the functioning of these cells, i.e., the opening and closing of the stomata openings. This regulated opening and closing of the pores permits gas exchange between the interior of the leaf and the outside atmosphere. The opening and closing of the stomata also help regulate the water balance inside the plant as water can more easily escape when the stomata are open.

Procedure:

1. Obtain a study leaf or other plant tissue.
2. Paint a thick patch of clear nail polish on the leaf surface being studied. Make a patch at least one square centimeter.
3. Allow the nail polish to dry completely.
4. Tape a piece of clear cellophane tape to the dried nail polish patch.
   (The tape must be clear. Do not use Scotch® tape or any other opaque tape. Clear carton-sealing tape works well.)
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.
   (Only make one leaf impression on each side of the leaf, especially if the leaf is going to be left on a live plant.)
6. Tape your peeled impression to a very clean microscope slide. Use scissors to trim away any excess tape. Label the slide as appropriate for your study.
7. Examine the leaf impression under a light microscope to at least 400X.
8. Search for areas where there are numerous stomata, and where there are no dirt, thumb prints, damaged areas, or large leaf veins.
9. Count all the stomata in one microscopic field. Record the number.
10. Repeat counts for at least three other distinct microscopic fields. Record all the counts. Determine an average number per microscopic field.
11. Follow the same procedures when making comparisons to other leaves or tissues.

Data:

Make drawings and observations of what you see. Record your counts in a data table.

Analysis:

Write a short paragraph comparing the number of stomata found on your different samples. What conclusions can you draw? What would you like time to further study?