

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
Partner's name: \_\_\_\_\_

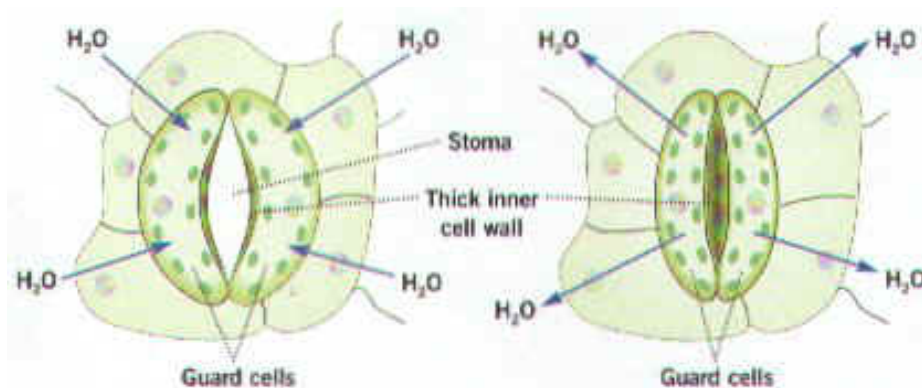


## Stomata Safari!!

### Exploring Stomata in Different Environments

#### Introduction

Plants and animals both have an outer layer of tissue called the **epidermis**. In many animals, this layer is the skin and it protects the tissues beneath. In plants, this layer protects the mesophyll tissue within, where photosynthesis takes place. The plant epidermis has special pores called **stomata** that allow passage of material (water and gases) from the environment into/out of the plant. The stomata are surrounded on both sides by jellybean shaped **guard cells**. Unlike other plant epidermal cells, the guard cells contain **chlorophyll**, which is the pigment that makes the plant green and allows photosynthesis. These cells are filled with water and inflate/deflate to open or close the stomata. When **dehydrated**, guard cells deflate and **close the stomata**. This keeps water from escaping from the plant when the air is dry. Guard cells inflate to allow the stomata to be open when the plant is hydrated (see the diagram below). The opening or closing of guard cells can be viewed with a microscope.



Most stomata are found on the **lower epidermis** of leaves. This adaptation allows the stomata to be somewhat shaded, even when the plant is exposed to full sunlight. The number of stomata on the epidermal surface can tell you a lot about a plant. Usually, a large number of stomata on a leaf indicate that it lives in a wet and cool climate. Smaller numbers of stomata indicates that it is adapted for a dry and hot environment.

Where is the epidermis found in plants?

What is the function of the stomata?

What is the function of the guard cells?

What causes stomata to open and close?

Where are most stomata found on the leaf?

What can the number of stomata tell you about the type of climate the plant is adapted to?

### ***Purpose:***

On you stomata safari you will view and compare the number and location of stomata from leaves of several species of plants. Once you have learned how to sample stomata, you will be able to investigate how plants distribute their stomata depending on the environment.

### ***Materials:***

Leaves from different species of plant, compound light microscope, microscope slides, clear nail polish, clear tape, pencil.

## Procedure:

### Part 1: Learning the Technique

1. Obtain a leaf provided by your teacher.
2. Paint a thick patch of clear nail polish on the underside of the leaf surface being studied. This patch should be at least one square centimeter.
3. Allow the nail polish to dry.
4. Place a piece of clear tape to the dried nail polish patch and rub to eliminate any air bubbles.
5. Gently peel the nail polish patch from the leaf by pulling on a corner of the tape. This piece of tape has the leaf impression you will examine.
6. Place your peeled impression on the tape to a very clean microscope slide. Use scissors to trim away any excess tape. Label the slide with plant name.
7. Examine the leaf impression under a light microscope at 400X.
8. Search for areas where there are numerous stomata, and where there is no dirt, thumbprints, damage to the leaf, or large leaf veins. Draw the leaf surface with stomata.
9. Count all the stomata in one microscopic field. Record the number on your data table.
10. Repeat counts for at least three other distinct microscopic fields on the same slide. Record all the counts in the data table. Determine an average number per microscopic field.



|   |  |
|---|--|
| <b>Plant name</b>                                 |  |
| <b>Drawing in 400x<br/>(with several stomata)</b> |  |
| <b>Stomata in field 1</b>                         |  |
| <b>Stomata in field 2</b>                         |  |
| <b>Stomata in field 3</b>                         |  |
| <b>Average Stomata in field</b>                   |  |

## ***Part 2: Applying the Technique***

Now that you know how to count stomata, obtain 2 different leaves from your teacher. On this next leaf of your safari, your job will be to see if they have different numbers of stomata.

|   | <b>Leaf 1</b> | <b>Leaf 2</b> |
|---|---------------|---------------|
| <b>Plant name</b>                                 |               |               |
| <b>Drawing in 400x<br/>(with several stomata)</b> |               |               |
| <b>Stomata in field 1</b>                         |               |               |
| <b>Stomata in field 2</b>                         |               |               |
| <b>Stomata in field 3</b>                         |               |               |
| <b>Stomata/ mm<sup>2</sup></b>                    |               |               |
| <b>Type of environment<br/>(tropical, desert)</b> |               |               |

How do the plant environment affect the density of stomata?

### Part 3: Investigation

Now that you know how to count stomata and have done so for different types of leaves, you will be able to ask your own. On this last leaf of your safari, your job will be to answer your own question about leaves and environment using leaves and the technique that you learned above to collect data to answer your question. You will make at least 4 different samples to answer your question. You may choose to look up to 4 different species or just one from different parts on the leaf, or from different parts of the plant, or from different locations. Your teacher may allow you to collect your own plants to complete this part of the activity, or you might use plants provided by your teacher.

QUESTION: \_\_\_\_\_

|  | Leaf 1 | Leaf 2 | Leaf 3 | Leaf 4 |
|--|--------|--------|--------|--------|
| Name of Leaf or location on leaf       |        |        |        |        |
| Drawing in 400x (with several stomata) |        |        |        |        |
| Stomata in field 1                     |        |        |        |        |
| Stomata in field 2                     |        |        |        |        |
| Stomata in field 3                     |        |        |        |        |
| Average Stomata in field               |        |        |        |        |

What is the answer to your question based on the data that you collected?

## ***Analysis/Conclusion:***

1. Which leaf had the most stomata?
2. What could the density of stomata indicate about the type of environment this plant is adapted to?
3. How does water play a role guard cells opening and closing stomata?
4. At what time of day would you expect most stomata be closed? Why?
5. Why does the lower epidermis have more stomata than the upper epidermis of a leaf?
6. Aquatic plants with floating leaves have stomata on the top rather than on the bottom. Why would this be an adaptation for their environment?
7. What gases move in and out of the leaf stomata (name 2 that are important to the plant's survival)?
8. What does a larger number of leaf stomata indicate about the climate that the plant is adapted to?

9. Would you expect desert plants to have more or fewer stomata than the leaves from plants that live in a Rain Forest? Why?

10. In deciduous plants (those that lose their leaves during the winter), how might stomata density change from year to year depending on the weather?

11. How can the study of stomata density over a 50-year period be able to tell scientists if a climate change is occurring? Explain.

12. Would evergreen plants (those that do not lose their leaves during the winter), be more OR less able to live in places where change is occurring? Why?

13. Would deciduous or evergreen leaves be better to use for a long-term (50 year) study to determine if climate change is occurring? Why?

14. What other data would you need to collect to get a more reliable answer to the question that you asked in the last leaf of your safari?

15. Propose another question that you can answer using this technique to sample stomata.

