

# PLANT MICROSTRUCTURES



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## OBJECTIVES

- To use Scope-On-A-Rope to improve students' observation skills and to strengthen concepts such as magnification and scale
- To help students grasp the concept of biodiversity and to gain an appreciation for adaptations under different environmental conditions

## BACKGROUND

Every living thing has characteristics, or features, that enable it to survive within a given environment. These characteristics include those that enable organisms to acquire water and nutrients, those that protect them from harsh environmental conditions, such as extreme heat, cold, or drought, or they many provide protection from predators and disease. An herbivore (plant-eater) may have flattened teeth to chew through the tough fibers of leaves or branches, an animal that lives in cold environments might have dense fur for insulation, and an organism that spends a lot of time in the water might have webbed appendages or oils on it outer covering that repel water. What else can you tell about an organism's natural environment by looking at their features?

Animals have mouths to eat and drink breath with. Mammals have hair/fur that protects them from the cold. Humans have skin pigment that helps protect them against harmful UV light. Skin can also protect against disease by preventing bacteria from entering our bodies, but we also have a built-in immune system for backup. Most animals have claws or teeth they can use in battles against enemies. Finally, animals are able to run, fly, or swim away to avoid predators or simply move around when they need better conditions in which to live. What are some other means that animals use to help them cope with some of these issues?

Plants, unlike animals, are not able to move around to acquire food and water, nor can they avoid a predator by running away or fighting. Plants cannot eat or drink they way animals are able to, and they are not able to move to a shady spot when it gets too hot. It has been estimated that the number of flowering plant species, or angiosperms (this does not include conifers, ferns, liverworts, algae, cycads, etc.), is close to 422,000. In general, plants acquire food by photosynthesizing (using the sun's energy) and they acquire water and nutrients by absorbing them from the soil through their roots. Pores, called stomata (singular = stoma) are sites for gas and water exchange. Carbon dioxide enters the plant through these pores and is converted into food (carbohydrates) using the sun's energy. Water, which is absorbed by the roots, is pulled toward the leaves through the plant's body and exits through the stomata. How can a plant prevent too much water from exiting or from pulling in carbon dioxide when there is no sun to make food with?

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This work is supported in part by a grant to Louisiana State University from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program.

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Another way that plants are able to prevent dehydration is with hairs on their leaves or stems, called trichomes, to reflect light or creating a barrier so that water does not evaporate quickly. This is important for plants that live in dry environments. Hairs can also prevent animals from eating the plant, either because they make the plant difficult to chew or because they often produce oils that are bitter or toxic to animals. Toxins can also be produced internally and thorns might be used instead of hairs to make the plant difficult to eat.

## **MATERIALS**

Scope-On-A-Rope

Copies of plant worksheet

Leaves, roots, and stems of various fresh plants (see suggestions on attached sheet)

Miscellaneous animal coverings

Copies of Plant Worksheet (attached)

NOTE: This activity can be used in conjunction with the *Animal Coverings* activity (found on the LSU-HHMI SOAR website).

## **ACTIVITY**

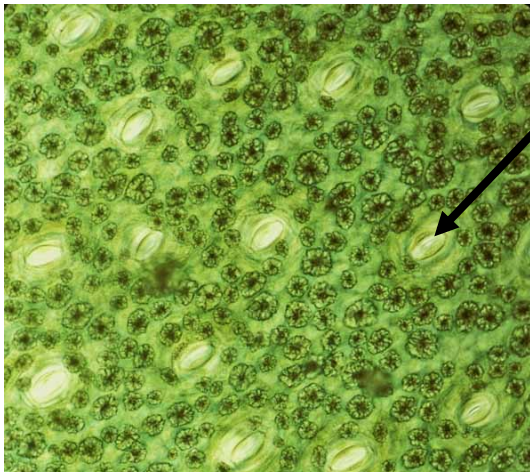
- 1) After reviewing some background information with your students, begin by examining some features on your skin and talk about how these features might help us survive. Look for structures such as hairs and pores.
- 2) Look at variety of plants adapted to different environments and compare with human and other animal structures (see examples on the following pages).

NOTE: Look for stomata in all plant leaves. Are stomata on both sides of all leaves?

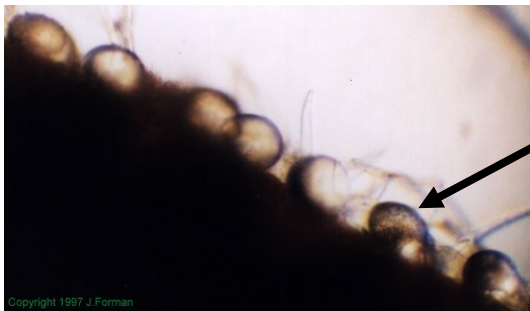
## **ACTIVITY EXTENSION**

Count and compare the number of stomata on the top and bottom of a leaf. How are the top and bottom of leaves different? How many are found per square millimeter?

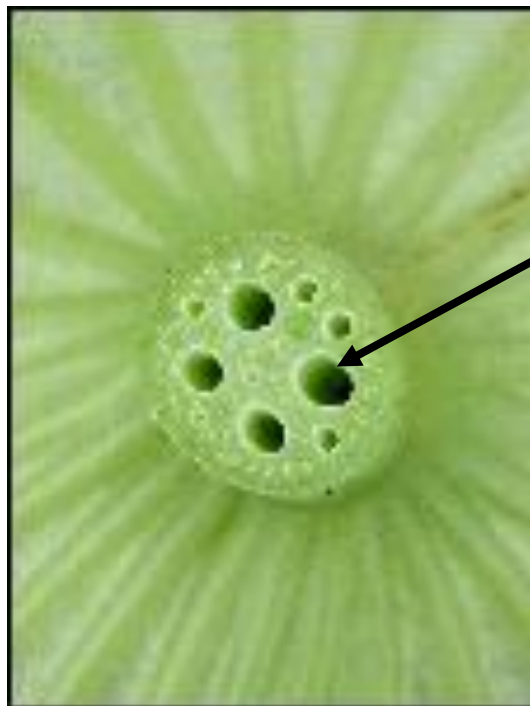
[HINT: the field of view is approximately one square mm with the 200x lens.]



Stomate (plural: stomata)



Trichomes on a young rosemary leaf producing oils from the glands



Aerenchyma from a wetland plant stem

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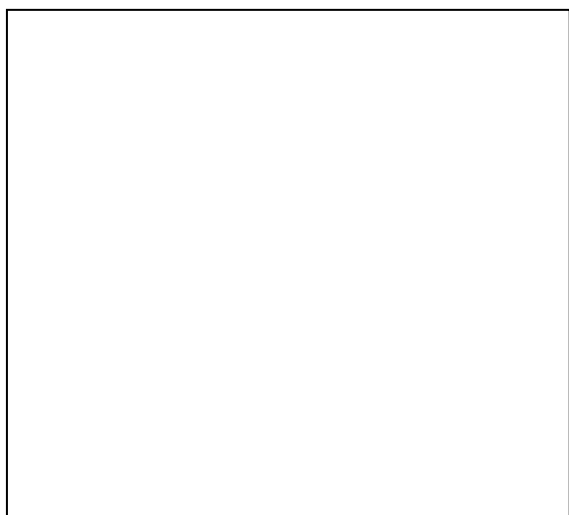
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<b>Plant</b>	<b>Questions</b>	<b>Plant Part</b>	<b>Structure to look for</b>	<b>Function of structure</b>
<b>Water Hyacinth</b>	How is water hyacinth adapted to live exclusively in water?	leaves	stomata (leaf pores)	gas/water exchange
		inside stem	aerenchyma (air channels)	store oxygen and carbon dioxide; floatation mechanism
		roots	roots are reduced and fibrous	roots are not necessary for nutrient or water absorption, because they live in a nutrient-rich environment; they are mainly for anchoring in low-water
<b>Wandering Jew</b>		leaves	stomata (leaf pores)	up to 1400 stomata per square centimeter; compare this to water hyacinth
	How are the plant hairs different from animal hairs?	leaf margins	trichomes (hairs)	main functions of trichomes or "hairs" <ul style="list-style-type: none"> <li>- reflect light/heat</li> <li>- insulation</li> <li>- prevent animals from eating plant (herbivory)</li> <li>- may produce oils or other secretions (see rosemary)</li> </ul>
<b>Rosemary</b>	Where do you see the most oil production?	leaves	trichomes, oils	oils are secreted by trichomes; oils are unpaletable to animals, therefore they avoid eating it; the oils are what makes rosemary a potent herb for cooking
<b>Spanish moss</b>	Does spanish moss have roots? How does it acquire the water it needs?	all over plant	cup-like structures (modified trichomes)	these trichomes are shaped like cups to absorb water from the air (which is why these plants live in humid environments)

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Draw what you see with the Scope-On-A-Rope and compare these features to other plants. You may also compare different parts of the same plant.



Plant \_\_\_\_\_

Part \_\_\_\_\_



Plant \_\_\_\_\_

Part \_\_\_\_\_



Plant \_\_\_\_\_

Part \_\_\_\_\_



Plant \_\_\_\_\_

Part \_\_\_\_\_

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