Sponge Characteristics Lab

Using Stations

Objectives:

Compare the absorbency of natural and commercial sponges.
Observe the characteristics of spicules.
Analyze the feeding mechanism of a leucon sponge.
Analyze the anatomy and physiology of grantia sponges.
Evaluate the role and significance of sponge body forms and structures.

Introduction:

This lab is designed to allow students to observe the structure and function of sponges. Students will be making observations, forming hypotheses, making measurements, and providing detailed descriptions of sponge characteristics. This lab can be used as a reinforcement activity or as a form of assessment. It is designed for almost any grade and ability level – advanced students are required to provide a more detailed explanations/hypotheses/theories demonstrating higher order scientific thinking, while life skills students are expected to provide clear and concise observations and sketches.

Management:

This lab is set up into stations. Each station will have an instruction card, and the materials necessary to complete the investigation. It is best to use a timer and create a rotation schedule to be sure each group has ample opportunity to visit each station. For a 90 minute class – 12 minute rotations seem to work well. If working with a tradition 7 period day, this lab may stretch into another period or stations could be removed from the rotation to accommodate time. Students can record their responses on notebook paper or in a lab notebook. It may be best to provide them with a standard format for which you would like the answer written for example: “Before writing your response in you lab notebook, write the title of the station and station number. In your response use complete sentences and/or labels that will identify what part of the question you are answering.” It also may be helpful to write an example of a good response and bad response on the board.

Materials:

Station 1:

Natural and commercial sponge – it is best if they are about the same size and mass
Tub full of water
2 large beakers
2 100 mL graduated cylinder
Towel – for any spills

Station 2:

Microscope
Demoslide containing spicules

Station 3:
Large leucon sponge (you may need to replace the sponge for each class period)

Station 4:
Stereomicroscope
Small grantia sponge

Station 5:
Natural sponge
Hand lens

Station 6:
Microscope
Prepare slide of grantia sponge

Discussion of Each Station:

Station 1: Commercial vs. Natural Sponge
Student Expectations:

- Form a hypothesis for which sponge will hold more water.
- Develop a procedure for testing your hypothesis
- Compare your results to your hypothesis
- What is the significance of your results?

Natural sponges are will hold more water than synthetic sponges. This is an important comparison because students often have misconceptions about sponges. The word sponge generally makes us first think of what we use to clean dishes – not an animal living on the sea floor. A synthetic sponge is exactly that – our attempt to recreate something that exists naturally. A natural sponge is made up of cells whose evolutionary design was to absorb and retain water. This lab often lead to a discussion of the need for synthetic sponges and their uses and the ecological impacts of harvesting natural sponges for human use.

Station 2: Demoslide Observation
Student Expectations:

- View and sketch the specimen in the tube
- What is it?
- How is the specimen relevant to the study of sponges?

Students should identify the structure as a spicule and describe it as a skeletal structure that occurs in most sponges. They provide structural support, as well as deterrence against predators. More advanced students may go on to say that spicules are formed by sclerocytes, which are derived from archaeocytes. The sclerocyte begins with an organic filament, and adds silica to it. Spicules are generally elongated at a rate of 1-10 µm per hour. Once the spicule reaches a certain length it protrudes from the sclerocyte cell body, but remains within the cell's membrane. On occasion, sclerocytes may begin a second spicule while the first is still in progress

Station 3: Observation of a Leucon Spongs
Student Expectations:

- Gently shake the sponge.
- Observe what happens.
- Form a theory to explain your observations

A leucon sponge has a small osculum and a heavily networked body. When skaken, dead fragments of what it consumed falls out. The remains of the undigested food particles provide evidence of filter feeding. The noticeable pores covering the body of the sponge work as inhaling pumps that have a vacuum effect on the surrounding water, pulling it into the complex series of canals inside the sponge's body. Through these canals, smaller pores act as filters to churn water through and take in nutrients to feed the sponge.

Station 4: Observation of a Small Grantia Sponge
Student Expectations:

- Observe the sponge through a stereomicroscope.
- Sketch and label the body including the pores and osculum.
- Describe the function of each structure identified.
- Describe the type of body form displayed by this specimen.
- Explain the significance of the body form.

The exact speciman found will alter the diagramed responses slightly. The function of pores should be described as the means in which sponges capture food particles suspended in water that passes through their body. The water is drawn from the pores into a central cavity, the spongocoel, and then flows out of the sponge thorugh a larger opening called the osculum. Under certain conditions, the cells around the pores and osculum contract closing the openings. Grantia demonstrates the sycon body plan in which the wall of the colony is folded into a series of internal and external canals that circulate water to bring in dissolved oxygen and prey while removing waste products.

Station 5: Observation of a natural sponge
Student Expectations:

- Observe the sponge.
- Sketch and label the body including the pores and osculum.
- Describe the function of each structure identified.
- Describe the type of body form displayed by this specimen.
- Explain the significance of the body form.

The response to this station will depend entirely on the type of natural sponge utilized. Many of the responses will be similar to those discussed in station 4.

Station 6: Microscope slide of a grantia sponge.
Student Expectations:

- Observe the sponge.
- Sketch and label what you see (be sure to indicate the location of choanocytes, ameobocytes, apopyles, spongocoel, and osculum)
- Describe the function of each structure identified.

The exact speciman found will alter the diagramed responses slightly. Choanocytes are flagellated collar cells that keep the water moving throughout the sponge. As the water is moved along by the flagella, suspended food particles are drawn through the collar and then digested through phagocytosis by amebocytes. The amoebocytes carry nutrition to other parts of the sponge colony and compensate for the lack of a circulatory system. From the radial canals, water enters the central opening or spongocoel through apopyles (small pores). The exit or excurrent canal for the sycon type sponges is a single, relatively larger opening that is often referred to as the osculum. In addition, the amebocytes secrete spicules of calcium carbonate in the gelatinous protein matrix of the sponge between the epidermis and the choanocytes.

Sources:

Campbell and Reece (2005) Biology 7th Edition. Pearson Benjamin Cummings, New York. 642

Kelly, Cynthia, Thomas J. Fellers and Michael W. Davidson (2007) Grantia Sponge http://www.olympusmicro.com/micd/galleries/darkfield/grantia.html