Biology II  Lecture Notes  Porifera

References (Textbook - pages 520-521, Lab Manual pages 160-162)

Characteristics

1. Sponges are the only animals that lack true tissues. *They only possess the cellular level of organization.* Remember the *levels of organization* that make up the body of living organisms (*cells - tissues - organs - organ systems - organism*) from Biology I. See page 596 in our textbook if you need to refresh your memory.

2. In a way you can think of a sponge as a colony of protozoans. They are essentially a colony of specialized cells. There are no nerve cells or other means of coordination between cells.

3. Sponges have a *sac body plan.*

4. Most have *radial symmetry* but some may be *asymmetrical.*

5. The body wall is *diploblastic,* meaning it has two layers.

6. The body wall is also pierced by numerous pores through which water enters. The name Porifera means *pore bearing.*

7. For most sponges, the skeleton is internal and is made of *spicules* (some made of calcium carbonate and others silica), or *spongin fibers* (protein fibers), or both. Provides support for the soft body. A few species of sponges have no skeleton at all.

8. The central body cavity is lined with *collar cells* called *choanocytes.*

9. Sponges reproduce asexually by *budding* or sexually by *fertilization.* Does everyone know the difference between sexual and asexual reproduction?

Classification

1. Our lab manual lists three classes of sponges. However, we will not discuss these and you will not be responsible for this material on exams.

2. The grouping and classification of sponges is based on the type, complexity, and arrangement of spicules.
Anatomy and Physiology (*Leucosolenia* as a representative type)

We will overview the anatomy and physiology of sponges using *Leucosolenia* as an example. This is a very simple member of the phylum. To help with our discussion of anatomy, refer to the handout from page 162 of our lab manual.

1. **Structure and Water Flow**

   - Sponges are usually slimy to the touch and some may have an unpleasant odor.
   
   - Some like *Grantia* are vase shaped with an outer layer of flattened cells called the (2) *epidermis* and a single large central cavity, the (7) *spongocoel*, which is lined with (8) *choanocytes*.
   
   - Choanocytes are specialized cells that collect food.
   
   - At intervals there are special cells called (3) *porocytes*, which contain an intracellular pore (4) *ostium* that connects the spongocoel with the outside. Porocytes are contractile and may close if unfavorable conditions develop in the water.
   
   - Water enters by way of the porocytes and is passed through the spongocoel and out through a large opening, the (1) *osculum*.
   
   - The beating of the *flagella* of the choanocytes produces the currents that result in water flow through the organism.

2. **Typical Cells**

   - *Epithelial cells* - flattened cells that make up the outer layer of the body wall the epidermis.
   
   - *Choanocytes* - collar cells with flagella that make up the inner layer of body wall. Actually look like protozoans.
   
   - *Amebocytes* - Amoeba like cells found wandering around in the fluid matrix between the epidermis and inner layer of choanocytes.

3. **Feeding, Digestion, and Excretory Functions.**

   - Sponges are *sessile filter feeders* and attach to the bottom substrate of aquatic habitats.
• Choanocytes collect food from water currents passing through the porous body.

• Food particles are digested by choanocytes or are passed on to the amebocytes for digestion.

• Amebocytes also act as a primitative and simple circulatory device to transport nutrients from cell to cell.

• Remember that sponges have no organ systems, so there are no digestive system or excretory system and every cell is responsible for digestion and releasing excretory products.

4. Reproduction

• May reproduce sexually or asexually by budding.

• Budding is a type of asexual reproduction where a bump or protuberance appears on the body wall and grows to form a new individual. Large colonies of sponges are formed this way.

• There are no sex organs, but sperm and eggs can be formed in the body by specialized cells called archecocytes. Sponges are hermaphroditic in that they produce both male and female sex cells in the same individual organism.

• After fertilization the zygote develops into a larva with flagella that is free swimming.

• Larvae leave their parent body cavity, swim to new areas, attach to the bottom, and form new colonies. This strategy helps disperse an otherwise stationary organism.

5. Regeneration

• Sponges are noted for their powers of regeneration.

• Their bodies can be shredded and strained through a cloth and the cells will regroup and reassemble themselves into a functional animal.

• Shades of the Terminator !!

Ecology

1. Most sponges are marine (live in the salt water), but a few live in freshwater.
2. There are an estimated 5,000 different species of sponges in the world, only 150 of which occur in freshwater.
3. Sponges come in all sizes, shapes, and colors including green, yellow, orange, red, and purple.
4. About 17 species are of commercial value. Because of the ability to absorb water, skeletons of sponges are used by man for washing, bathing, and mopping.
5. Commercially processed sponges bear little resemblance to the living sponge because all of the living tissue has been removed and only the skeleton remains.

6. In the US, the commercial sponge industry is centered in Tarpon Springs on the Gulf Coast. Sponges are gathered by divers in fairly deep water.

7. The taste of sponges is so unpleasant that few animals eat them. Sea slugs and hawks bill turtles have been reported to eat them.

8. However large sponges can provide habitat for a wide variety of animals. As many as 16,000 different species of animals have found in one loggerhead sponge (a sponge that can reach 6 feet in diameter)

Other Examples

1. Finger Sponge, Vase Sponge, Bath sponge, Glass sponge, Freshwater Sponge, Basket Sponge