Name Period Date

CHAPTER 23

INVERTEBRATE DIVERSITY

# Vocabulary Practice



| | | |
|---|---|---|
| collagen | deuterostome | radula |
| homeotic | sessile | hemocoel |
| homeobox | filter feeder | segmentation |
| vertebrate | polyp | coelom |
| invertebrate | medusa | cuticle |
| phylum | mesoglea | pseudocoelom |
| bilateral symmetry | nematocyst | ossicle |
| radial symmetry | gastrovascular cavity | water vascular system |
| protostome | complete digestive tract | |

**A. What's the Difference?** For each pair of words below, describe the difference between the two terms.

**1.** bilateral symmetry/radial symmetry

**2.** vertebrate/invertebrate

**3.** polyp/medusa

**4.** protostome/deuterostome

**5.** sessile/mobile

VOCABULARY PRACTICE, CONTINUED

**B. Who Am I?** Choose among these terms to answer the riddles below:

| | | |
|---|---|---|
| collagen | homeobox | protostome |
| deuterostome | invertebrate | vertebrate |

1. I am an animal with an internal segmented backbone: _____
2. I am a three-stranded protein unique to animals: _____
3. I am an animal without a backbone: _____
4. I have a developmental pattern in which the anus develops first: _____
5. I am a type of gene that defines the head-to-tail developmental pattern in animal embryos: _____
6. I have a developmental pattern in which the mouth forms first: _____

| | | |
|---|---|---|
| filter feeder | mesoglea | radula |
| medusa | polyp | water vascular system |

7. I eat by straining particles from the water: _____
8. I am a filelike feeding organ found in mollusks: _____
9. I am the umbrella-shaped body form of a cnidarian: _____
10. I am a series of water-filled radial canals that extend along each arm of a sea star: _____
11. I am the cylindrical-shaped body form of a cnidarian: _____
12. I am a non-cellular jelly-like material that separates the two tissue layers of a cnidarian: _____

VOCABULARY PRACTICE, CONTINUED



**C. Secret Message** Next to each definition, fill in the blanks with the vocabulary word that best fits each description. When complete, write the boxed letters in order in the blanks at the bottom of the page to discover the name of a famous zoologist.

**1.** Doesn't move ___ ___ ___ ___ ___ [ ] ___

**2.** Tiny interlocking plates that make up a sea star's skeleton ___ ___ ___ [ ] ___ ___ ___

**3.** Animal with a backbone ___ ___ ___ ___ ___ [ ] ___ ___ ___ ___

**4.** Animal without a backbone ___ ___ ___ ___ ___ ___ ___ [ ] ___ ___ ___ ___

**5.** Tough exoskeleton that must be shed so a roundworm can grow larger ___ ___ ___ [ ] ___ ___ ___

**6.** Fluid-filled space found in a roundworm ___ ___ ___ ___ ___ ___ ___ ___ [ ] ___ ___ ___

**7.** Spaces between cells within a mollusk's tissues [ ] ___ ___ ___ ___ ___ ___ ___

**8.** Major group of species defined by structure and function ___ ___ [ ] ___ ___ ___

**9.** Class of genes that control early animal development ___ ___ [ ] ___ ___ ___ ___ ___

**10.** Repeated sections of an annelid's body ___ ___ ___ ___ ___ ___ ___ [ ] ___ ___ ___ ___

**11.** Cnidarian stinging structure [ ] ___ ___ ___ ___ ___ ___ ___ ___ ___

Fill in the blanks with the boxed letters from above to name the famous zoologist:

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

VOCABULARY PRACTICE, CONTINUED

**D. Analogy Vocabulary Set** On one blank line next to each vocabulary word, write the letter and number of the definition that best matches. On the other blank line, write the letter and number of the analogy that best matches.

| DEFINITIONS | WORD | ANALOGIES |
|---|---|---|
| **D1.** Type of symmetry in which an animal has body parts arranged in a circle around a central axis | **1.** Cuticle ____ ____ | **A1.** Mirror-image |
| **D2.** Stinging structure | **2.** Bilateral symmetry ____ ____ | **A2.** Egg shell |
| **D3.** Repeated sections of an annelid's body | **3.** Radial symmetry ____ ____ | **A3.** Harpoon |
| **D4.** Type of symmetry in which an animal's body can be split evenly over one plane | **4.** Segmentation ____ ____ | **A4.** Spokes on a wheel |
| **D5.** Tough exoskeleton | **5.** Nematocyst ____ ____ | **A5.** Cars on a train |

**E. Categorize Words** List the vocabulary words that belong in each category.

| | | | |
|---|---|---|---|
| coelom | mesoglea | polyp | segmentation |
| hemocoel | nematocyst | radula | water vascular system |
| medusa | ossicle | | |

| Cnidarian Anatomy | Annelid Anatomy |
|---|---|
| a. | a. |
| b. | b. |
| c. | |
| d. | |
| **Mollusk Anatomy** | **Echinoderm Anatomy** |
| a. | a. |
| b. | b. |

# 18
# SEA ANEMONE

The sea anemone is so named because many of its forms greatly resemble the terrestrial flower known as the anemone. Most sea anemones range from 15 to 100 millimeters in diameter, although a few species are smaller and two giant species may have diameters of over a meter.

**Color structures A, A¹, B and C, along with their corresponding titles. Then read below.**

The *oral disc* is a circular area with an oval or slit-shaped *mouth* surrounded by hollow *tentacles,* which number from a few to several hundred. When a prey animal contacts the *tentacles,* it is paralyzed by the nematocysts and drawn into the *mouth* by the tentacles. The bulk of the body below the *oral disc* is called the *column.* It contains the digestive and reproductive systems. The body wall of the *column* is lined externally with *epidermis* and internally with *gastrodermis.* The middle *mesoglea* layer is true connective tissue with motile (amoeboid) cells and collagen fibers (see Plate 66).

**Now color structures D through L and O through Q and their corresponding titles. Note the diagrammatic cross sectional views through the pharynx and gastrovascular cavity. The volume of the gastrovascular cavity is actually much greater and the septa are much thinner. The emphasis here is on the tissue arrangement of the septa rather than on realistic proportions. After coloring, read below.**

The *mouth,* with its ring-like canal or *ostium* leads into the *pharynx,* which extends from one-half to two-thirds of the way down into the *gastrovascular cavity.* The *pharynx,* composed of an outer *epidermis,* a middle *mesoglea,* and an inner *gastrodermis,* is suspended from the *oral disc* and hangs down into the *gastrovascular cavity* like a circular curtain. It is stabilized by its attachments to the *complete septa.* Depending on the species, one or both sides of the *mouth* and *pharynx* will have a longitudinal groove called the *siphonoglyph,* which is lined with cilia that beat downward to create an incoming current of water. This current brings oxygen and some small particles of food into the *pharynx* and *gastrovascular cavity.* Elsewhere on the *pharynx,* cilia beat upward to remove water from the anemone, carrying with it carbon dioxide and other metabolic wastes. The cilia reverse their direction of upward movement in the presence of food of any kind to help draw it into the *gastrovascular cavity.*

The interior of the *column* is divided up into sections by partitions called mesenteries or septa (singular: septum). At the oral end of the cavity there are paired *complete septa,* which extend all the way from the outer wall of the *column* to the centrally located *pharynx,* and between them are paired *incomplete septa.* Note the cellular arrangement of a septum: two layers of *gastrodermis* with an inner layer of *mesoglea* continuous with the *mesoglea* of the *column* and the *pharynx.* Retractor muscles (not shown in cross section but labeled M in the lowest illustration) are located in the *mesoglea.*

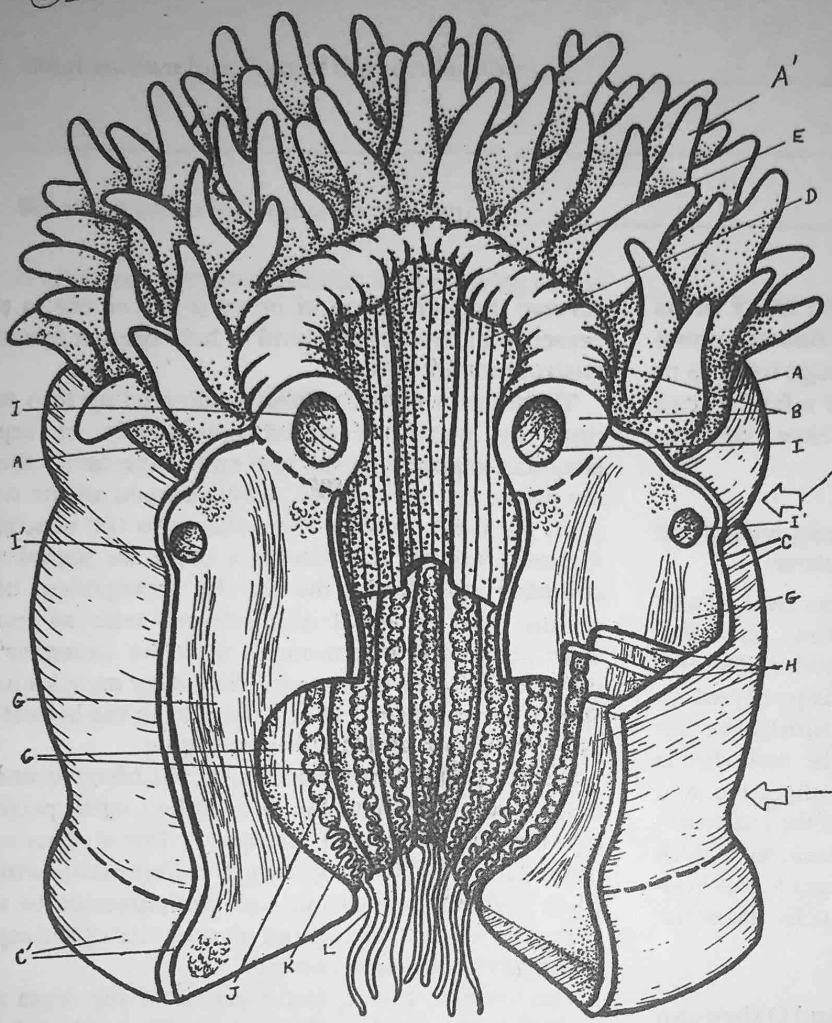
Toward the base of the anemone, the *pharynx* ends. Below the *pharynx,* only *incomplete septa* project into the *gastrovascular cavity* (see lower cross section). The septa have openings, called *ostia,* which allow water to pass from one compartment to the next. The *gonads* are located on the sides of the septa in the *gastrovascular cavity.*

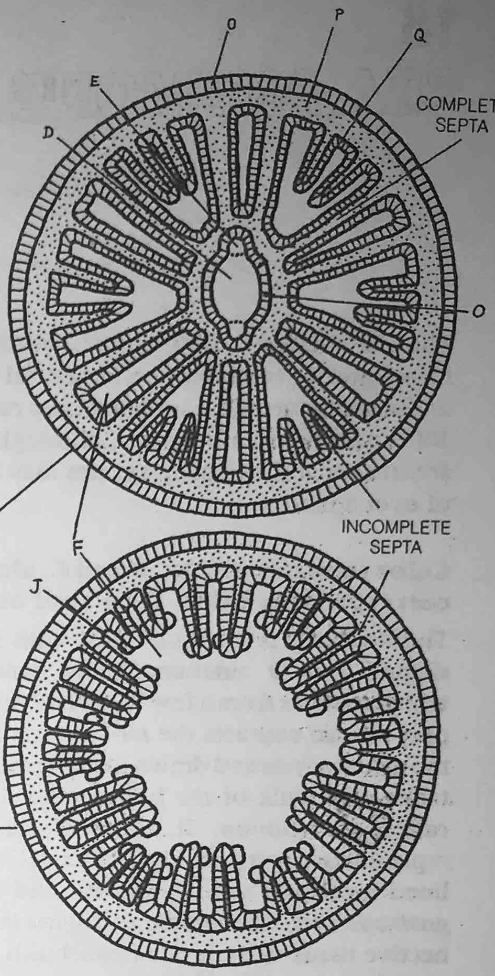
The interior, lower, free margins of the septa are modified into cords called *septal filaments,* which contain numerous digestive glands and nematocysts. In some anemones the lower ends of these *septal filaments* extend beyond the septa as free filaments called *acontia,* which also contain digestive glands and nematocysts and can be protruded out through the mouth or through pores in the *column* wall for defense or to help in the capture of prey.

**Now color the remaining structures and their corresponding titles.**

The base of the anemone is called the *pedal disc.* Its gland cells secrete a slimy or sticky mucus, helping the anemone adhere to the underlying surface. The muscle arrangement includes *circular fibers* around the *mouth* to retain prey until it is digested; *circular fibers* around the upper margin of the *column* (and elsewhere) to close the margin over the withdrawn *oral disc* when the sea anemone is disturbed or is exposed out of water by an extremely low tide; *longitudinal fibers* in the septa and *column* wall, which can cause the whole animal to shorten; and muscle fibers in the *pedal disc,* which create a strong suction, allowing the *sea anemone* to attach to underlying rock or other substrate.

# SEA ANEMONE.



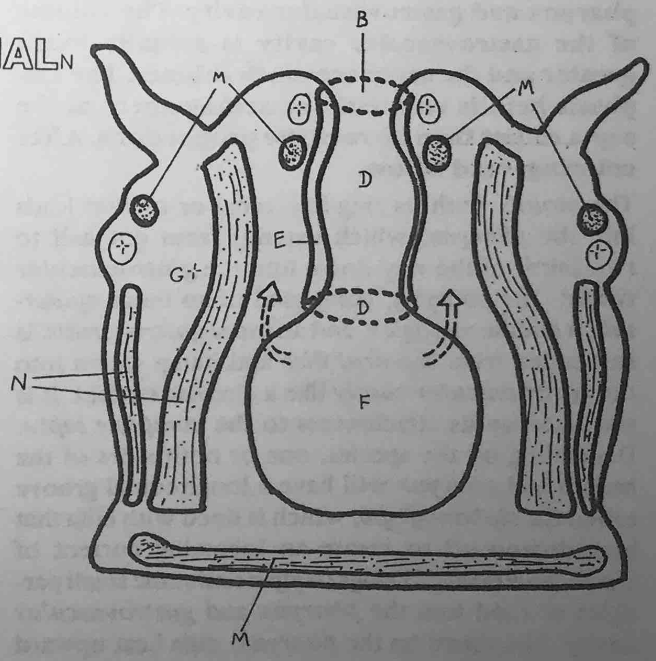

ORAL DISC$_A$
- TENTACLES$_{A'}$
- MOUTH$_B$
- OSTIUM$_I$

COLUMN$_C$
- PHARYNX$_D$
- SIPHONOGLYPH$_E$
- GASTROVASCULAR CAVITY$_F$
- SEPTA$\star$
  - COMPLETE$_G$
  - INCOMPLETE$_H$
  - OSTIUM$_{I'}$
  - GONADS$_J$
  - SEPTAL FILAMENTS$_K$
  - ACONTIA$_L$

PEDAL DISC$_{C'}$

MUSCLES$\star$
- CIRCULAR$_M$
- LONGITUDINAL$_N$

EPIDERMIS$_O$
MESOGLEA$_P$
GASTRODERMIS$_Q$



# Sea Anemone

1. How did the sea anemone get its name?_____
2. What is the range in size of the sea anemone?_____
3. What is the oral disc?_____

_____

4. What surrounds the mouth of the sea anemone?_____
5. What happens to an animal that comes into contact with the tentacles?_____

_____

6. Where are the digestive and reproductive systems found?_____
7. What are the 3 layers of the body called? Specify which is the outer, inner, and middle._____

_____

8. What are the motile cells called?_____
9. What makes up the mesoglea layer?_____
10. What is the ring-like canal of the mouth?_____
11. Describe what the pharynx is composed of and its position in the sea anemone._____

_____

12. What is the longitudinal groove found on the sides of the mouth and pharynx?_____
13. Why do the cilia beat down to create an incoming current of water?_____

_____

14. Why do some cilia beat upward?_____
15. Why do the upward moving cilia sometimes change their motion?_____
16. What are the ostia?_____
17. Where are the gonads located?_____
18. What is contained in the septal filaments?_____
19. Describe where the acontia are located and why._____

_____

20. What is the base of the anemone?_____

21. Why do the gland cells secrete a sticky mucus?_____

22. What are two functions of the circular fibers?_____

_____

23. What can cause the animal to shorten?_____

24. How do sea anemones attach to underlying rocks?_____

# 17
# COMMON JELLYFISH (AURELIA)

Although there is no universal agreement, members of this class (Scyphozoa) are sometimes referred to as the "true jellyfish." The medusa stage, which has been emphasized to the near or complete elimination of the polyp stage, has an extremely thick layer of the jelly-like *mesoglea* making up the major portion of the body mass. While medusae of the class Hydrozoa rarely exceed 3 or 4 centimeters in diameter, Scyphozoan medusae are usually large enough to be conspicuous. *Aurelia,* which is illustrated in this plate and which is very common on the Atlantic and Pacific coasts of the U.S., frequently reaches a diameter of more than 30 centimeters. An Arctic jellyfish, *Cyanea artica,* can reach the impressive diameter of 2 meters. Carefully compare the subject of this plate with *Gonionemus* on the previous plate.

**Color structures A through F and their corresponding titles. In the middle drawing, color the entire subumbrellar surface, including the radial canals with the color used for E (but do not include G, H, J, or K). Then continue reading below.**

The body plan is relatively simple, with a layer of *epidermis* on the upper and lower surface of the bell (or umbrella), a layer of *gastrodermis* lining the gastrovascular cavity, and a mass of *mesoglea* filling all the rest of the body. The *mesoglea* contains a number of scattered amoeboid cells, which are not found in the *mesoglea* of hydrozoans. The convex upper surface is called the *exumbrellar surface* and the concave lower surface is called the *subumbrellar surface.* Around the margin of the umbrella, the *subumbrellar surface* contains a *nerve net* and a *circular muscle* layer responsible for the swimming pulsations of the bell.

**Now color structures G through N and their corresponding titles. Then read below. The lowest drawing demonstrates the arrangement of canals. The oral arms and mouth have been deleted. Do not color the subumbrellar surface between radial canals.**

The opening to the *gastrovascular cavity* is through the centrally located *mouth.* The *mouth* is surrounded by the nematocyst-equipped *oral arms,* which are a drawn-out manubrium (see *Gonionemus*). These *oral arms* function in capturing small organisms and transferring them to the *mouth.* The *mouth* opens into the gullet, which leads to the *stomach.* The *stomach* opens into the four *gastric pouches,* which open into the many *radial canals* of the umbrella. These *radial canals* lead into the *ring canal.* Digestion occurs within the *stomach* and *canals* of the gastrovascular cavity. These *canals* assure distribution of nutrients to all parts of the jellyfish. The four U-shaped *gonads* are located in the floors of the *gastric pouches.* Gametes (sperm cells and egg cells) are released into the *gastric pouches,* from which they pass out through the *mouth.* Fertilization usually occurs in the folds of the *oral arms,* and the fertilized egg breaks free to form a larva with an independent existence.

**Now color the remaining structures (O and P) and their titles. Then read below.**

The margin of the umbrella is fringed with delicate tentacles too small to be colored in this plate. This margin is further divided into eight sections by indentations, each of which contains a projection called a *rhopalium* (pl. rhopalia). Each *rhopalium* contains a set of sensory receptors, including a light sensor, two chemical sensors, and a balance sensor. The *rhopalium* is somewhat protected by a pair of tissue flaps called *lappets,* which some investigators think may also have a sensory function.

# COMMON JELLYFISH (AURELIA).

BODY PLAN ★
- EPIDERMIS A
- MESOGLEA B
- GASTRODERMIS C

EXUMBRELLAR SURFACE D
SUBUMBRELLAR SURFACE E
NERVE NET/CIRCULAR MUSCLE F
ORAL ARMS G

GASTROVASCULAR CAVITY ★
- MOUTH H
- GULLET I
- STOMACH J
- GASTRIC POUCH K
- RADIAL CANAL L
- RING CANAL M

GONADS N

SENSORY RECEPTORS ★
RHOPALIUM O
- LAPPET P