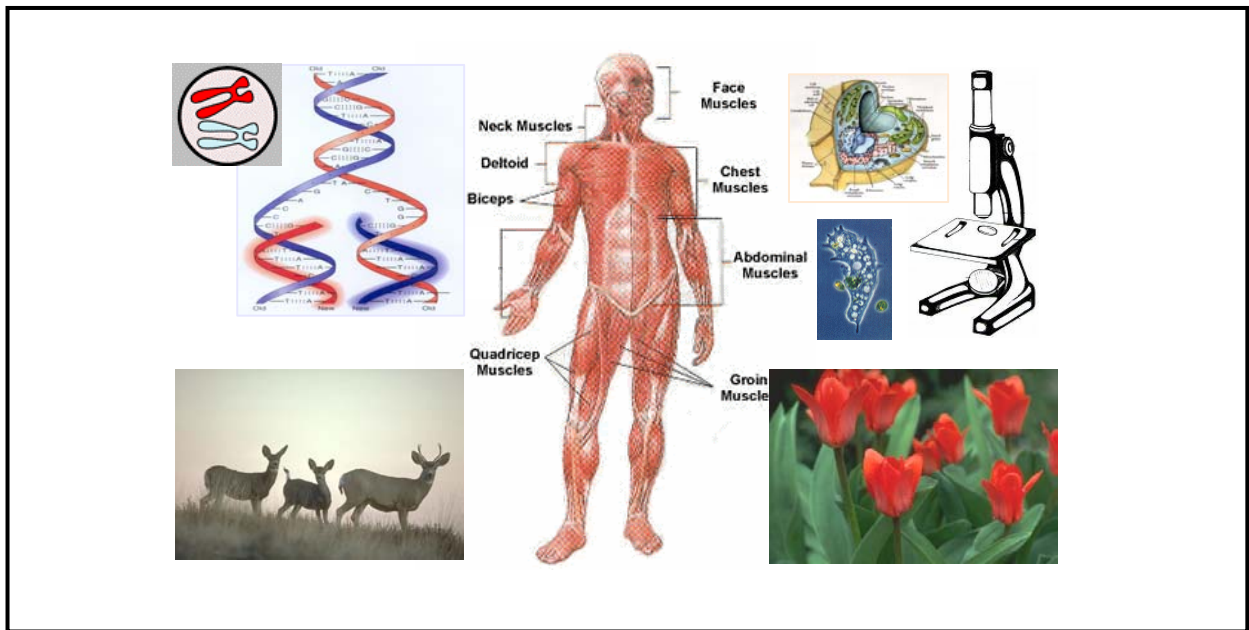


Project EASE

(Effective Alternative Secondary Education)

BIOLOGY



MODULE 17

Animals without Backbones



BUREAU OF SECONDARY EDUCATION
Department of Education
DepED Complex, Meralco Avenue
Pasig City



Module 17

Animals Without Backbones



What this module is about

This is the first module regarding **The Diversity of Animals**. This covers all the animals **without backbones**. The second module focuses on animals with **backbones**. All the modules are especially prepared to equip you with the knowledge about animals. You will see how they differ from one another in size, form, structure and habitats.

There are 5 lessons in this module:

- **Lesson 1 – How Are Animals Classified?**
- **Lesson 2 – The Sponges and Cnidarians**
- **Lesson 3 – The Flatworms, Roundworms and Segmented Worms**
- **Lesson 4 – The Soft-bodied and Joint-legged Animals**
- **Lesson 5 – The Spiny-skinned Animals**



What you are expected to learn

After going through this module, you are expected to:

1. Identify animals.
2. Give the characteristics of animals.
3. Describe how animals are classified.
4. Identify the following invertebrate animals:
 - a. sponges
 - b. cnidarians
 - c. flatworms, roundworms, and segmented worms
 - d. soft-bodied animals
 - e. arthropods
 - f. echinoderms
5. Describe the following invertebrate animals:
 - a. sponges
 - b. cnidarians
 - c. flatworms, roundworms, and segmented worms
 - d. soft-bodied animals
 - e. arthropods
 - f. echinoderms
6. Explain the habitats and importance of the different groups of animals.



What to do before (Pretest)

Test I. Multiple Choice. Choose the letter of the correct answer. Write the chosen letter on a separate sheet of paper.

- Animals show characteristics that are common to them. Which of the following is **NOT** a characteristic ability of animals?
 - ability to breathe
 - ability to digest food
 - ability to produce their own food
 - ability to move from one place to another
- Which of the following is a primary characteristic of sponges?
 - antennae
 - pores
 - suckers
 - tentacles
- In the binomial system of classification, organisms are given two names. What is it composed of?
 - family and genus name
 - genus and species name
 - order and genus name
 - local and international name
- Which among the following animals has many pores or openings in its body?
 - ascaris
 - earthworm
 - sponge
 - tapeworm
- Mollusks with two valves are also called:
 - bivalves
 - gastropods
 - trivalves
 - univalves
- Which among the following animals has different canal systems?
 - earthworm
 - sea anemone
 - sponge
 - tape worm
- All of the following are parasitic worms except:
 - ascaris
 - earthworm
 - hookworm
 - tapeworm
- Jellyfishes are noted for their powerful tentacles. What are their tentacles for?
 - for excretion
 - for digestion
 - for reproduction
 - for capturing food and defense
- The number of body regions in insects is:
 - one
 - two
 - three
 - four

10. Animals are classified based on the presence or absence of a vertebral column. Which of the following is **NOT** an invertebrate?
- a. fish
 - b. jellyfish
 - c. sponge
 - d. starfish

Test II. Matching Type. Match column A with column B. Write the letters only.

- | A | B |
|--|----------------|
| 1. The most abundant of all the animals on earth | a. insects |
| 2. Animals with backbones | b. echinoderms |
| 3. Invertebrates with spiny-skin | c. sucker |
| 4. The substance that makes the exoskeleton of insects | d. vertebrates |
| 5. Part of pearl oysters where the pearl is produced | e. hydra |
| 6. Part of the squid used to capture prey | f. mantle |
| 7. The part of sponges where water enters | g. pores |
| 8. The freshwater form of Cnidaria | h. tentacles |
| 9. The part of the tapeworm used for sucking | i. radial |
| 10. The type of symmetry with a central disc where other parts radiate | j. chitin |



Key to answers on page 35.

Lesson 1. How Are Animals Classified?

If you were asked to define what an animal is, you would probably say that animals generally breathe, move, and eat, as most animals do. Yet we cannot define animals strictly on the basis of these characteristics because not all animals inhale and exhale, even though we know that all living cells respire. Not all animals move about. Not all of them have mouths and digestive systems. In spite of our lack of a completely satisfactory definition of animals, and in spite of living examples that do not fit neatly into any informal definition, we can still categorize animals roughly as those organisms that breathe, move and eat.

Before we discuss animals further, try to reflect on the following questions: What do animals have in common? What are their differences? How are they classified or grouped? Find out the answers to these questions as you go over the modules.

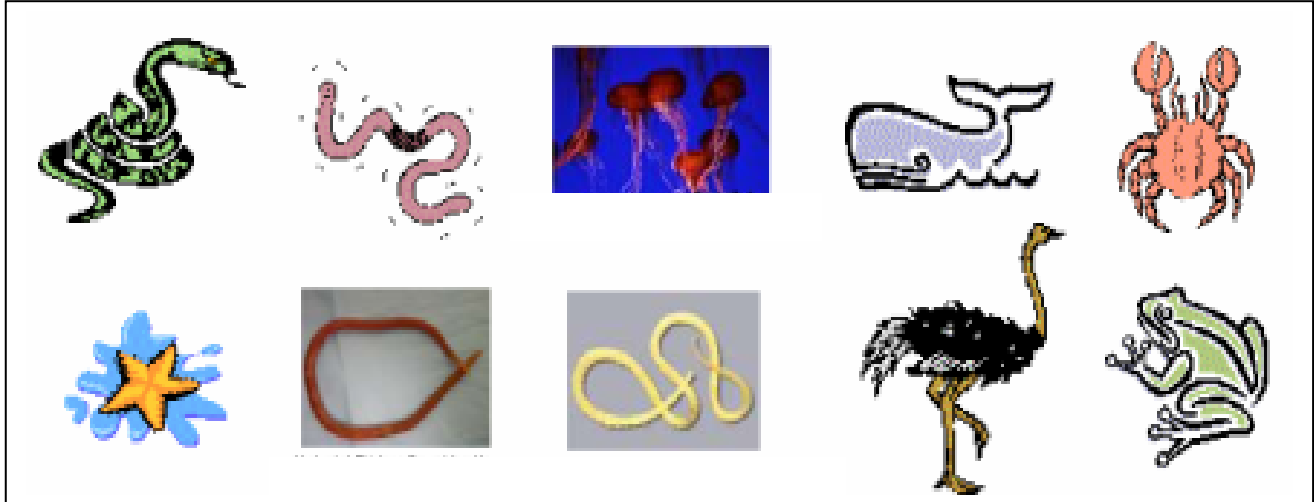
Are you ready now to explore the animal world? I'm sure you are! However, before we start, let's have a puzzle game about animals. Get set, go!



What you will do
Activity 1.1

PUZZLE: W-H-A-T --AM--I?

Here are some riddles. Choose your answer from the pictures below. Write your answer on the blank after each statement.



Microsoft Clip Art
biology.nebrwesleyan.edu/courses/.../Ascaris_image.html

W- H- A - T ---A - M ---I?

- I am a bird but cannot fly. My body is too heavy to carry. I lay eggs that are big. What am I? _____
- I am cylindrical. My home is your intestine. We share the foods that you eat. What am I? _____
- I have tentacles and can swim. I sting my prey with my poison, many animals are afraid of me. What am I? _____
- I am a reptile. I am long and can coil. I am a predator. I attack and eat chicks, frogs, birds and other animals. What am I? _____
- I am flat, segmented and very long. My home is your intestine. We eat the same foods together. What am I? _____
- My home is the sea. I look like a star. My skin is spiny. What am I? _____
- I have ten legs and a flat shell or carapace. I am your favorite food. I am reddish when cooked. What am I? _____
- My home is wet soil. My body is segmented. My best friends are farmers. What am I? _____
- I live in the sea. I love to swim. I am the biggest of them all. I am a mammal like you. What am I? _____
- My skin is soft and sticky. I can live both on land and in water. I lay eggs in the water. What am I? _____

Key to answers on page 35.

Did you enjoy answering the riddles? Did you get a perfect score? If so, congratulations for a job well done!

You are now about to begin studying the most diverse kingdom, the **Animal Kingdom**. This lesson involves the classification of both the vertebrate and invertebrate animals. However, all the other lessons are focused on animals without backbones.

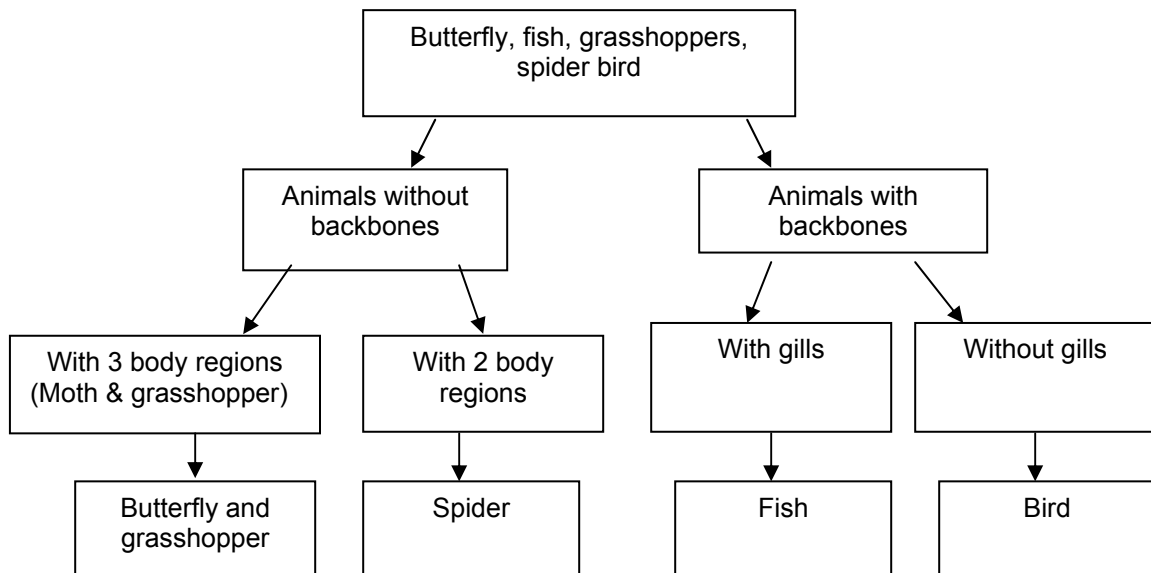
As you go over the modules on animals, always remember that they all share the following characteristics:

1. Animals cannot make their own food. They depend on other living organisms.
2. Animals digest their food. They cannot use proteins, fats and carbohydrates directly.
3. Many animals move from place to place. By moving around, they can find food, escape their enemies, find a better place to live and find mates.
4. Animals have many cells. Different cells carry out different functions such as digestion and reproduction.
5. Animal cells are **eucaryotic**. The cells have nucleus and organelles enclosed by a membrane.

How to Classify

Scientists have identified and named more or less 1 million species of animals. Some estimate that there are more or less 5 million more to identify and name. Have you ever wondered *why* and *how* animals are grouped? If you have already finished the module on the *Diversity of Plants*, I am sure that you are already familiar with classification or grouping of living things. In that module, an intensive discussion about classification is given.

In this lesson, we will discuss how animals are classified on the basis of similarities and differences of body parts. Study the diagram below and see how the different animals are grouped.



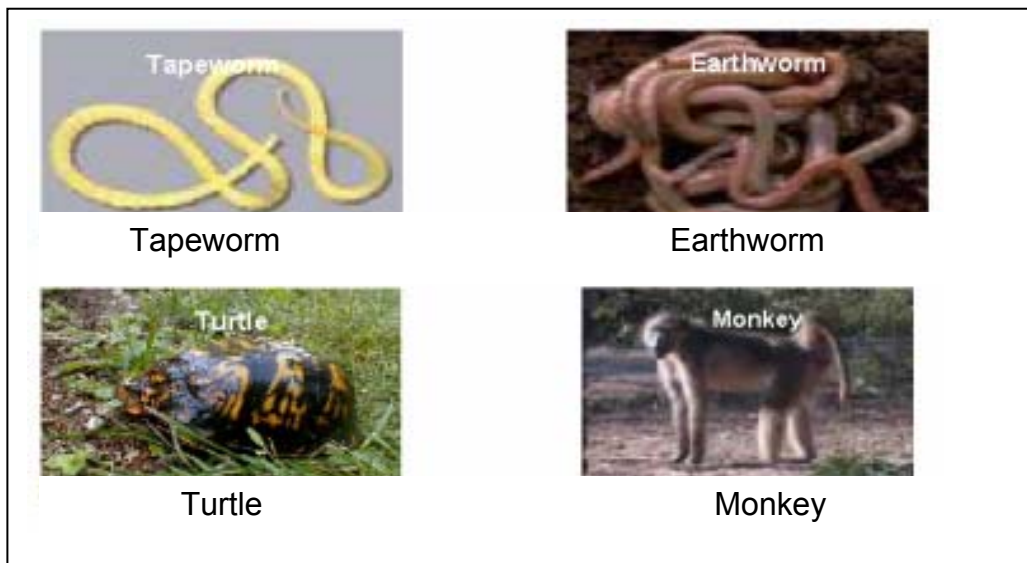
Now that you know the simple way of grouping animals let us move on to a more detailed process.

The Classification of Animals

The major phyla of the animal kingdom are Porifera, Cnidaria, Platyhelminthes, Aschelminthes, Mollusca, Annelida, Arthropoda, Echinodermata and Chordata. Members of these phyla show the characteristics that we mentioned at the beginning, but when a scientist comes across a new animal, how does he/she begin to classify it?

The first step is to examine if the animal has backbone or not. Animals with backbones are called **vertebrates**. Examples of vertebrate animals are fishes, humans, whales and snakes. About **95%** of all animals are **invertebrates**. Invertebrates are animals that do not have backbones. Sponges, jellyfish, worms, insects, and clams are all invertebrates. The next thing that the scientist will look at is the arrangement of the body parts. This is called the animal's **symmetry**. Some animals have body parts arranged in a circle around a central point. These animals have **radial symmetry**. Sea anemones and starfish have with radial symmetry. Most animals have **bilateral symmetry**. Look at the mirror. Does the right side of your body look similar to the left side? Bilateral animals can be divided into right and left halves by drawing an imaginary line down the length of its body. Some animals do not have definite shape and are called **asymmetrical** animals.

Let's see if you can now apply the principles you learned here in classification. Given the following animals, classify them using similarities in structure by completing the concept map after the diagram.

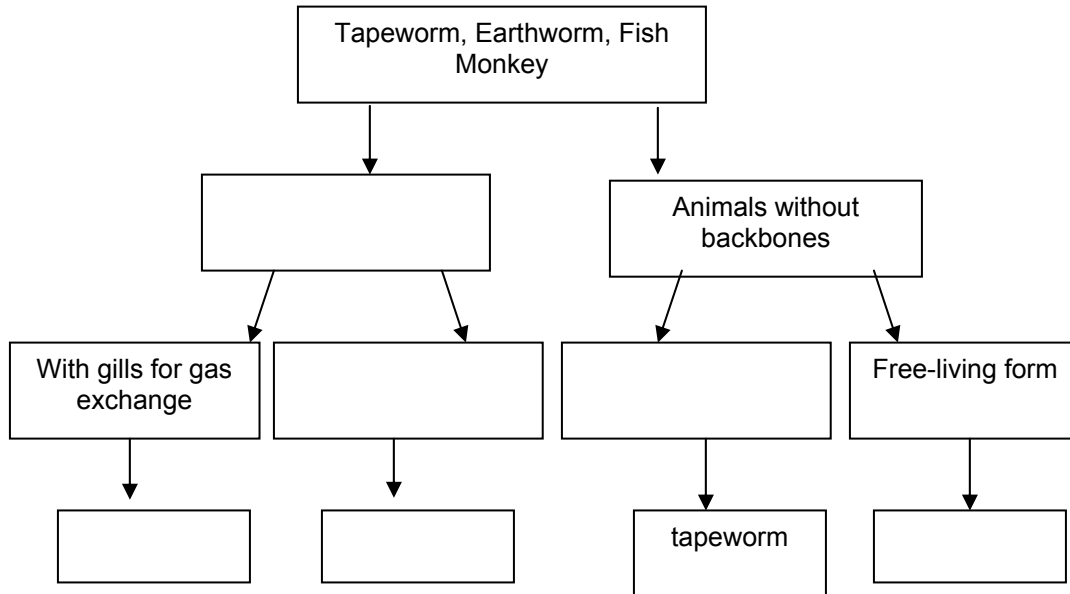


biology.nebrwesleyan.edu/courses/.../Ascaris_image.html



What you will do
Activity 1.2 Classifying Animals

Classify the different animals listed in the box by answering the empty boxes below:



Key to answers on page 36.

Levels of Classification

During the time of C. Linnaeus, he identified only 2 kingdoms, the Plant and Animal kingdoms. The system worked well until advances were made in classification. Biologists now use a six-kingdom system. In fact, an eight-kingdom system is now used in some books. The six - kingdom system includes Kingdom *Protista*, *Achaebacteria*, *Eubacteria*, *Fungi*, *Plantae* and *Animalia*. A kingdom is the largest group of classification. It is subdivided into several Phyla (phylum singular). Each *phylum* is divided into *classes*, which are further divided into *orders*. Orders are divided into *families*, and families into *genera* and each *genus* (plural genera) is divided into *species*. The species is the basic unit of classification. The lion, tiger and house cats belong to the same genus, *Felis*. Note the similarities among them.

Naming of Organisms

Can you imagine life without names? For example, if people were without names we would need to completely describe each person to identify him/her and this could be very tedious. Names give people a quick and easy way of identification.

Over two hundred years ago, a Swedish naturalist, Carolus Linnaeus, organized a simple naming system that we still follow today. He gave each animal species a scientific name. The scientific name is composed of two words, the genus name and the species name. This is called the binomial system of naming organisms. The names are in Latin words. An example of this is the scientific name of our domestic cat, *Felis domesticus*. The genus name is *Felis* and the species name is *domesticus*. The advantage of using scientific names is that there can be no confusion. A German scientist, an English scientist or a Spanish scientist will all know when they read ***Felis domesticus*** that what is referred to is a cat.

We are now through with the levels of classification including the naming of organisms. Let's see how much you learned from the discussion. Try to answer these few questions.



What you will do Self-Test 1.1

Fill-in the blanks with the correct answer.

- _____ 1. Who was the first scientist who classified living things?
- _____ 2. Refers to animals without backbones
- _____ 3. Percent of animals without backbones
- _____ 4. The biggest unit of classification
- _____ 5. The smallest unit of classification



Key to answers on page 36.

Lesson 2. The Poriferans (Sponges) and Cnidarians

This lesson is composed of the Sponges and Cnidarians. These are the first two lower phyla of the animal kingdom. The sponges, however, will be discussed first since they represent a lower level of organization than Cnidarians.

The Sponges (Pore-bearing Animals)

Have you ever seen sponges? Well, if you haven't seen one, try to do the activity on the next page or refer to some diagrams to be familiar with them. Many Biology books have diagrams of these animals. Or you can refer to the diagram given in this module.



What you will do

Activity 2.1 How Do Sponges Look Like?

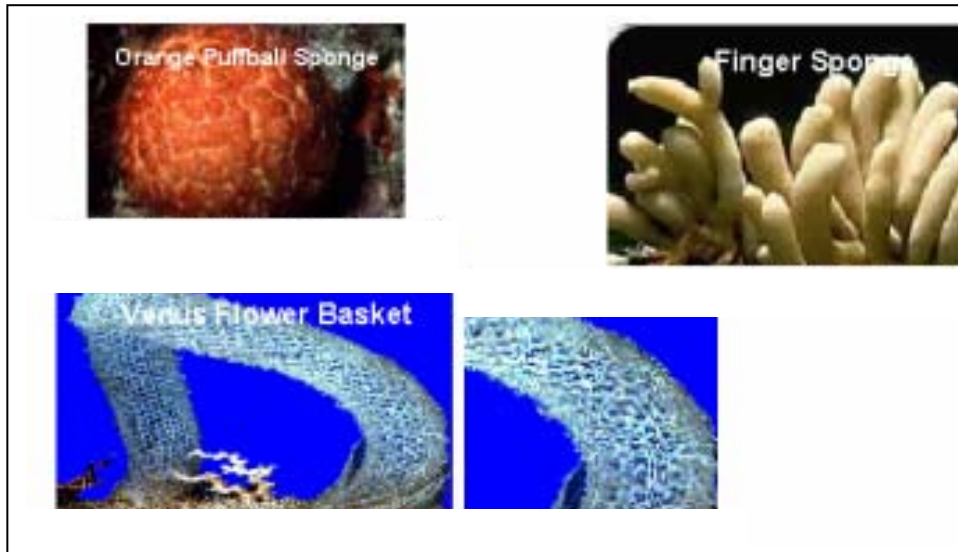
If you live close to the sea, try to observe pore-bearing animals in their natural habitat. If possible do this during low tide when the shoreline is wide. Do not forget to equip yourself with the following:

- glass bottom box or any improvised one
- trowel
- forceps or gloves

Your purpose here is to observe and not to collect. You see, we discourage collection of specimens. We want to preserve these animals in their natural habitats. Use your glass bottom box or goggles to locate the animals. Do you see pore-bearing animals? They are of different colors and with numerous pores or openings throughout the body surface. They are usually attached to a substrate and are steady in one place. They are as soft as the sponges that you use in washing you dishes. Write your observations in a notebook and try to answer the table below.

Name of specimen	_____
1. Where found	_____
2. Moving/non-moving	_____
3. Organ for movement	_____
4. Color	_____
5. Appearance / texture	_____
6. Use to man	_____

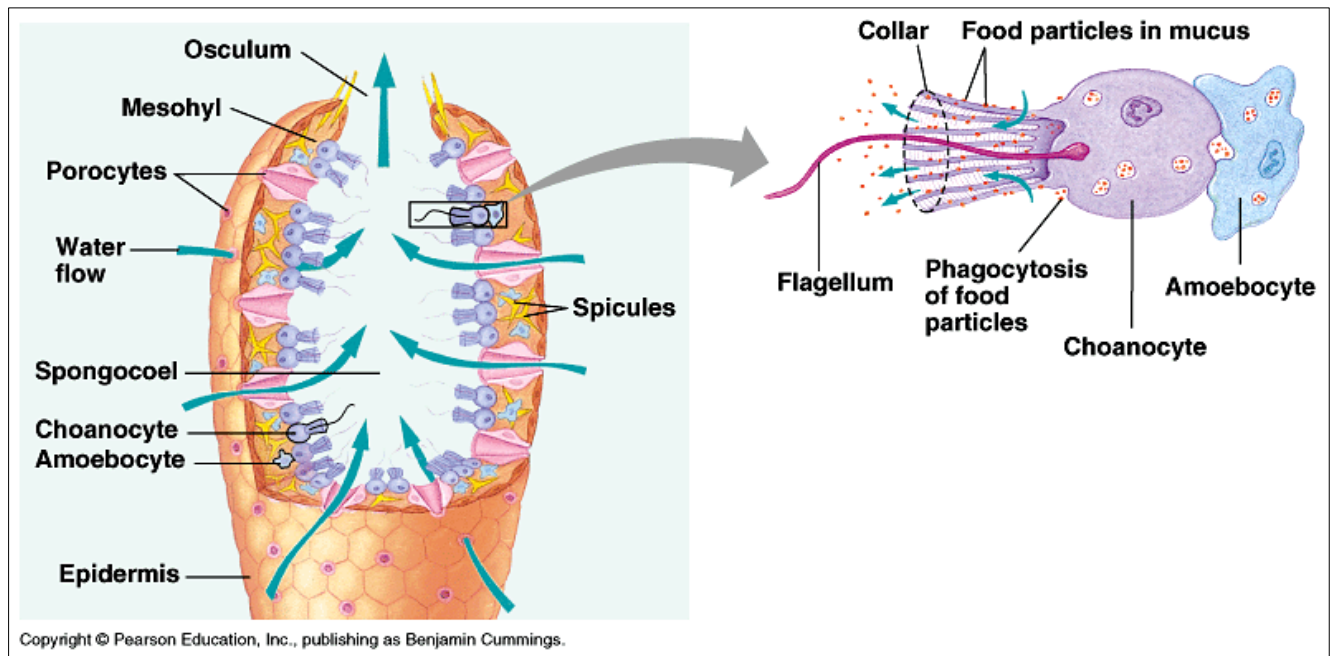
If you do not live close to the sea, refer to the diagram of the different sponges below:



www.greengabbro.net/photoblog/archives/000713.php

Figure 1a. Sponges

Years ago, scientists thought **sponges** were plants. Why do you think this was so? They appear like plants more than like animals because we often associate animals with mobility. Sponges are steady or fixed in one place and are attached to a substrate. There are around **3,000** species of sponges. Most common of these are the bath sponges. Porous animals or sponges are considered as the simplest multi-cellular animals. These animals and their relatives have a body wall with tiny holes, or **pores** - thousands of them! They are usually found in the sea. Pore-bearing animals have two layers of cells, an outer and an inner layer. The food is captured by these cells and is taken in by "engulfing". They primarily feed on particles suspended in water, planktons, and some bacteria. Notice that they have a wide opening known as the **osculum** or mouth where food passes. The food is digested in the **spongocoel** or cavity, which is equivalent to our stomach.



<http://www.anselm.edu/homepage/jpitocch/genbios/33-03-SpongeAnatomy-L.gif>

Figure 1b. Parts of a Sponge

Care should be taken in handling these animals since the body contains thousands of **spicules** or skeletons, which can cause irritations on the skin. These spicules are composed of **siliceous** materials or **calcium carbonate**. Look at the diagram of the spicules in Figure 1. This is how they look like under the microscope.

The **Venus Flower Basket** is an example of a beautiful sponge composed of siliceous spicules. Aside from these spicules, the body is also composed of collagen and fibrils of collagen collectively known as **spongin**. They all give support to the sponge and prevent it from collapsing. This makes the sponge ideal as a scrubbing material.

The Cnidarians

Just like the sponges, if you live close to the shore, you will also find the Cnidarians. In some books, they are popularly referred to as the coelenterates or bag-shaped animals. Cnidarians include many animals with brilliant colors and unusual shapes. Delicate jellyfish float in ocean currents. Brightly colored sea anemones cling to rocks, looking more like underwater flowers than animals. These beautiful and fascinating animals are found all over the world, but most species live only in the sea. Here in our country, our seas abound with this group of animals. We have beautiful sea anemones and jellyfishes.

If you live close to the sea, you can easily examine these invertebrates. However, in studying this group of animals, you have to be very careful not to provoke or intimidate the organisms. They might hurt you.



What you will do

Activity 2.2 How Do Cnidarians Look Like?

If you live close to the sea, try to observe the cnidarians in their natural habitat. If possible do this during low tide. Do not forget to equip yourself with the following:

- a. glass bottom box or any improvised one
- b. trowel
- c. forceps and gloves

Your purpose here is to observe and not to collect. You see, we discourage collection of specimens. We want to preserve these animals in their natural habitats. Use your glass bottom box or goggles to locate the animals. Do you see the beautifully colored sea anemones? They are stationary but with very movable tentacles. If you disturb the surroundings, their tendency is to retract and hide their tentacles. Do not touch them for they might hurt your hand with stinging cells. Other cnidarians that are steady or sessile are the corals. How many types of corals do you see? Try to look for other cnidarians. See if jellyfishes are available. If you see one, do not go very close to it. It might sting/hurt you. Just observe the body movement. Unlike the sea anemones, they are very motile. After your observations, fill-up the following:

Name of specimen	_____
1. Where found	_____
2. Moving/non-moving	_____
3. Organ for movement	_____
4. Color	_____
5. Appearance / texture	_____
6. Use to man	_____

Write your other observations in a notebook.

Now, look at the diagram below. These are examples of Cnidarians. Have you seen the actual specimens?



search.gallery.yahoo.com/search/corbis?p=jellyfish

Figure 2. Cnidarians

Characteristics of Cnidarians

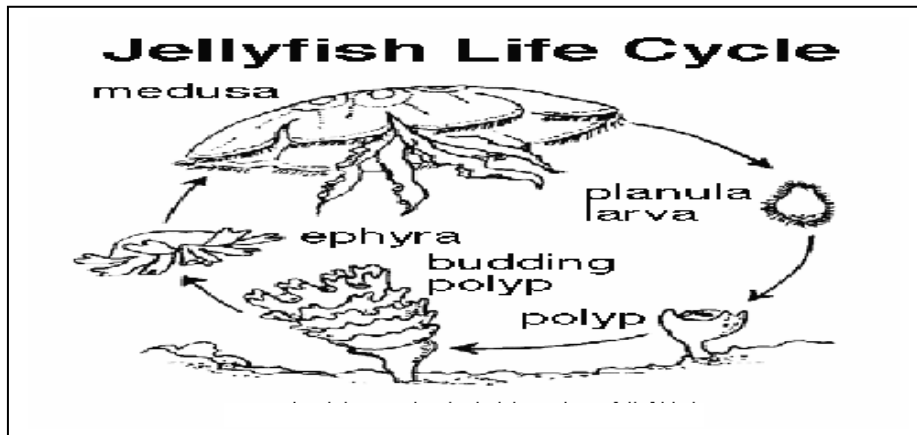
There are more than 9,000 different species of **Cnidarians**, the Latin term for **stinging cells**. Most species are marine in habitat while few are freshwater forms. The most common freshwater species is **Hydra**. This is only around 5 mm long. Some members are bag-shaped, like the sea anemones. Their bodies are hollow with one opening at the top, which is the mouth or **osculum**. Inside the body is a cavity known as the **gastro vascular** where extracellular digestion of food takes place. A ring or circular tentacles can shoot out **stingers** or **nematocysts** that can poison and paralyze another organism. The tentacles then capture the prey and break down the food with the help of digestive substances. Examples of these are the sea anemones and the polyps of the corals. Have you ever asked why corals are considered as animals? Well, the corals that you have at home are only "**secretions**" or "**skeletons**" formed by the animals that formerly occupied it. The former occupants are the **polyps**, which are already dead.

One of the most colorful members of this phylum are the **jellyfishes**. They are cup-shaped, free-swimming, and with tentacles. Some jellyfishes are harmless while others can be very harmful.

Know this:

The most harmful species of jellyfish is *Chironex flickerii*. This is a jellyfish present in the tropical seas of Australia. This species have poisonous stings that can kill man in 3 to 20 minutes after the attack.

Jellyfishes flourish during summertime when seawater is warm. They love to stay in warm places. Presence of unusual number of jellyfishes in a certain place can also indicate **thermal pollution** of the waters. To be more familiar with the jellyfish, try to examine the illustration below. It represents the life cycle of a jellyfish. The prominent part of the cycle is the **medusa**, the free-swimming form and the most familiar to us. The polyps are small and could hardly be seen.



www.dnr.state.sc.us/marine/pub/seasscience/jellyfi.html

Figure 3. Life Cycle of a Jellyfish



What you will do

Self-Test 2.1

1. What are spicules and what are they for?
2. Trace the pathway of water in the body of sponges.
3. Discuss the life cycle of a jellyfish.
4. What makes some jellyfishes dangerous?
5. What are tentacles for in polyps?



Key to answers on page 36.

Lesson 3. The Flatworm, Roundworm and Segmented Worm

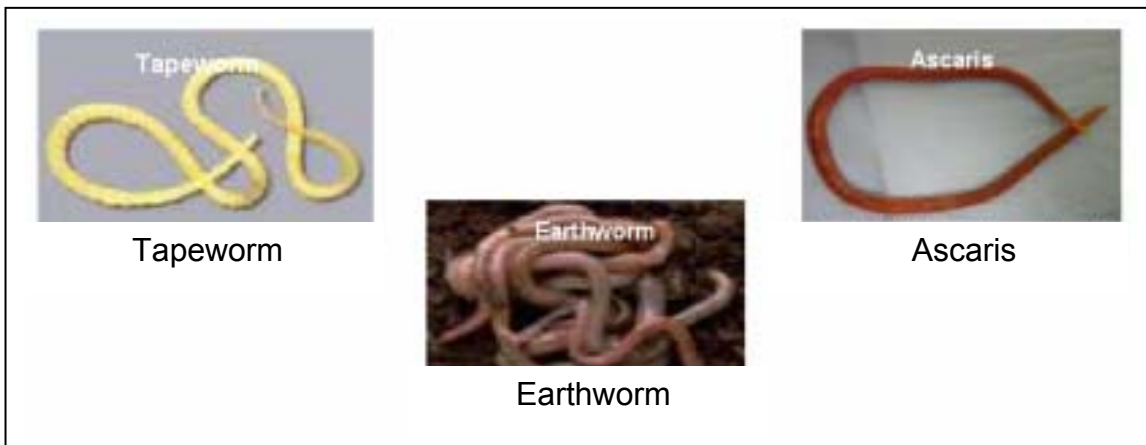
This lesson is about the three groups of worms - the **flatworm**, roundworm and the **segmented worm**. In the previous two lessons we have discussed animal **classification**, the **sponges**, and the **cnidarians**. Based on the complexity of structures, sponges and cnidarians are followed by the flatworms, roundworms and segmented worms. These invertebrates will be the next topic of our discussion.

The animals that you will most likely think of when you hear the word worm is the earthworm - the worm that you see after the rain in pavements or in the soil. Sometimes, they are even used as bait by fishermen. You probably wouldn't think immediately of tapeworms or any other types of worms. Just what is a worm? Worms are invertebrates with soft-bodies and bilateral symmetry. They have tissues, organs and organ systems. Have you ever experienced deworming a puppy? If so, you must have seen some of the worms that will be mentioned here. Not all worms are parasitic. Some are free living and some are even helpful. In this lesson, only one representative will be discussed in each group. They are the worms that may primarily affect your health.

Do this:

Look for a slaughterhouse near your place and bring forceps or gloves and bottles half-filled with 70% ethyl alcohol.

1. Ask the help of a butcher and collect the available worms in the slaughterhouse using the forceps and place them in your collecting bottles.
2. Take note of the part of the body where you got the worm.
3. Bring the specimens home and study them. Try to compare them with the diagram below. Which of these worms did you collect in the slaughterhouse?



biology.nebrwesleyan.edu/courses/.../Ascaris_image.html

Figure 4. The Three Types of Worm

The Flatworms

The first groups of worms that we will discuss are the flatworms. As their common names suggest, flatworms are flattened dorso-ventrally and soft-bodied. Some intestinal tapeworms may grow up to 100 feet (30 meters). All flat worms belong to Phylum Platyhelminthes. This phylum is divided into three classes or groups: Turbellaria (e.g Planaria), Cestoda (e.g tapeworm) and Trematoda. (e.g fluke).

Look at figure 4. It shows of the three groups of flatworms but only the tapeworms will be discussed here.

Tapeworms

To start off with our discussion about tapeworms, examine closely your specimen.



What you will do

Activity 3.1

If you were able to collect pork tapeworms from the slaughterhouse, put the tapeworm on a dissecting pan and examine its parts. Use forceps or dissecting needle in doing this.

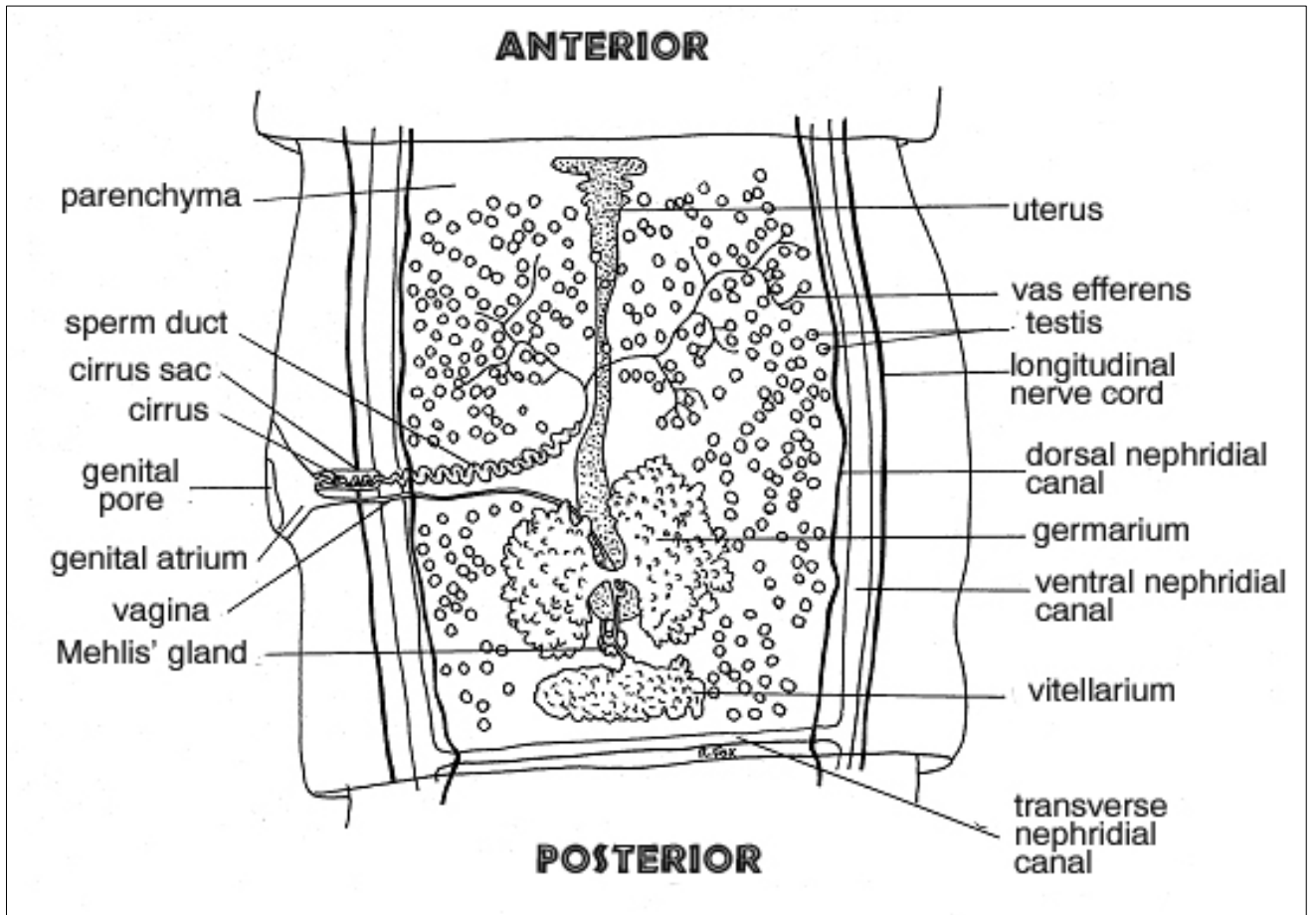
First, measure your specimen. How long is your specimen? Starting from the anterior part of the body, look for the *scolex* or head. What parts do you see in the scolex? What are they for?

Now count the number of body segments or proglottids. How many are there? If you do not have the actual specimen, study the illustration of a mature tapeworm below.



Key to answers on page 36.

Focus on the diagram next page and see how the pork tapeworm, *Taenia solium* can infect man. Tapeworms use their hooks and suckers to attach themselves to the intestine of the host organism. They do not have mouth or a digestive system. Their body is composed of several segments with the *head* or *scolex* as the first anterior segment. The other segments or *proglottids* produce eggs and sperms. Most of the time, the eggs are fertilized within the same segments. After fertilization, the eggs are now called as "embryonated" eggs. Once a segment is filled with fertilized eggs, it breaks off and passes out.



<http://www.lander.edu/rsfox/310taeniaLab.html>

Figure 5. Tapeworm

One way of ensuring you won't get infected by pork tapeworm is to eat only well-cooked meat at 56 degrees centigrade and above. Other ways to control pork tapeworms include sanitary disposal of human feces, inspecting meat, feeding hogs or pigs properly, and treating people who are positive for *taeniasis*, the infection caused by tapeworms.

Challenge!

Use any Biology book or refer to a diagram and make a poster showing the life cycle of a pork tapeworm.

Cooking meat at 56 degrees centigrade and above is enough to kill the **cysticerci** in the mealy (infected with larval worms) pork or freezing it at -5 degrees centigrade for at least one week. Some of the symptoms of tapeworm infection are loss of appetite, diarrhea, dizziness, abdominal pains, headache and intestinal obstruction.

Assignment:

Go around your neighborhood or barangay and do the following:

1. To help avoid tapeworm infection, check if all houses are provided with sanitary toilets.
2. Observe if stray pigs roam around the place.
3. If so, find out the measures taken by the municipal health officer to discourage people from allowing pigs to go astray.
4. As a concerned citizen of your locality, what can you contribute to avoid infection among the citizenry?

The Roundworms

Members of this phylum are found almost everywhere. There are more than half a million species of roundworms under Phylum Nematoda. There maybe a million in a kilogram of soil! They can be found in freshwater, seawater, and in or on plants, humans and other organisms.

Before we start with our discussion, try to recall when was the last time you took a deworming medicine? Was it the other year? last year? or this year? Well, if you just had it, that's good. Getting rid of all these parasitic worms is healthful. Although there are a number of different roundworms like pinworms, hookworm, and trichina worm. We will just concentrate on the *Ascaris*. These are very common to children especially in rural areas. Poor hygiene and mishandling of food are common causes of infection. Let us now start by discussing *Ascaris*, the most common roundworm.

*What you will do***Activity 3.2**

1. Get some ascaris specimens from a near slaughter house.
2. Put the ascaris specimens that you got from the slaughterhouse in a dissecting pan and examine the parts. You will notice that their bodies are waxy. Why do you think this is so?
3. Compare the shape of the worms. Do they all have the same shape? Males are usually smaller and with a bent posterior end, while females are bigger and with a straight end. Males use the bent end for copulation or mating.
4. In case no specimens are available, you can refer to Figure 6 on the next page and compare the body parts.

**Key to answers on page 37.**

Just like the other parasitic worms that we have discussed, the roundworm can also be transferred from one host to another. Infection occurs when “embryonated” eggs are swallowed with contaminated food and water. They hatch in the duodenum of the intestine, where the young penetrate the mucosa and sub-mucosa and enter the lymphatics or venules. After passing through the right side of the heart, they enter the pulmonary circulation and breakout of the capillaries into the air spaces. Many worms get lost during this migration and accumulate in almost every organ of the body, causing acute tissue reaction. This is the reason why sometimes some worms come out from the mouth, ears or nose of children with heavy infection. Some worms that are swallowed pass through the stomach and into the small intestine, where they mature. Within 60-65 days after being swallowed, they begin producing eggs.

Look at the male and female ascaris in the diagram below. How do they differ? What is the use of the bent end or spicule in the male ascaris?



Figure 6. Male and Female Ascaris

Things to remember about ascaris worms:

1. Eggs in food and water are ingested by host.
2. Eggs hatch in the small intestine.
3. Larvae enter blood vessels and are carried to the lungs.
4. Larvae or young ascaris travel to the throat and are swallowed.
5. Adult ascaris worms live in the small intestine.
6. Eggs leave host in feces and can live up to ten years in the soil if conditions are favorable.

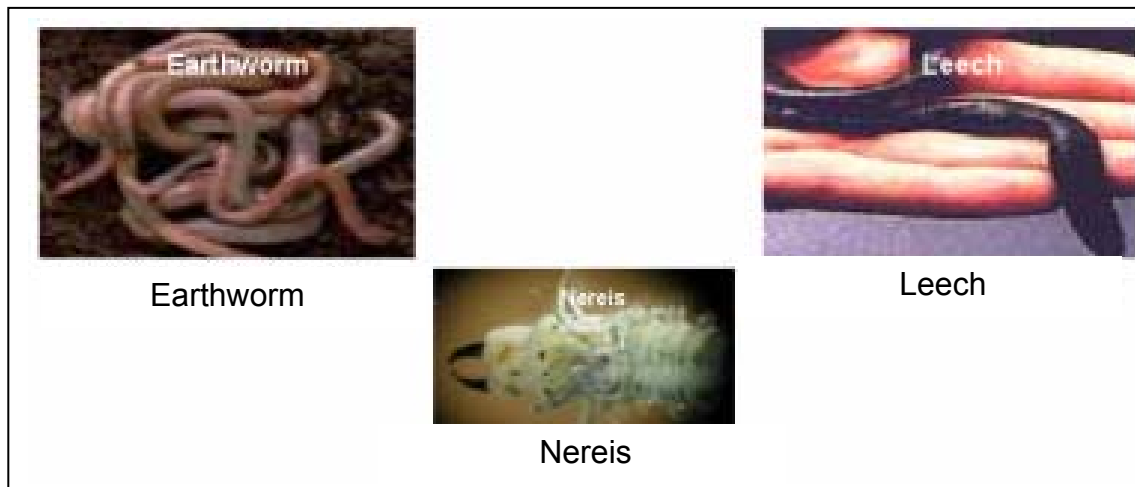
Have you heard that...?

... Ascaris eggs are resistant to chemicals. They can still be embryonated successfully in 2% formalin solution and in 50% hydrochloric acid, nitric acid, sulfuric acid, acetic acid and in other inhospitable conditions. This is due to the extraordinary chemical resistance of the lipid layer of the ascaris eggshell. Ascaris eggs can live for 10 years in the soil. Its longevity contributes to the survival of the parasite.

The Segmented Worms

The worms that you see on sidewalks and driveways after a hard rain or on the ground near the water faucets belong to **Phylum Annelida**. Most annelids are free-living. The word annelid is a Greek word meaning "little rings". There are over **6,000** species of segmented worms. Annelids are worldwide in distribution, occurring in the sea, freshwater and terrestrial soil. Some marine annelids live quietly in tubes or burrow into the bottom of mud or sand. Some feed on organic matter in the mud, others are filter feeders, while some are predators. Examples of segmented worms are earthworms, **leeches** and the beautiful **fan worms**.

In this lesson, we will discuss the different groups of segmented worms but our focus will be on the more common representative, the **earthworm**.



www.greengabbro.net/photoblog/archives/000713.php

Figure 7. Segmented Worms

The common groups are ***Polychaeta***, ***Oligochaeta*** and ***Hirudinae***. Out of these three, we will discuss only the Oligochaeta (earthworms).

The Earthworm

Go to your backyard and try to locate a moist and wet place most probably close to a water source. Do not forget to bring a small garden trowel or knife to dig into the soil.



What you will do

Activity 3.3

Materials needed:

Trowel, gloves, forceps collecting bottle and 70% alcohol or 10% formalin solution

Procedure:


1. Go to the garden and bring the materials with you.
2. Look for a place that is wet and moist all the time.
3. Use the trowel and try to dig slowly into the soil.
4. Notice that you will encounter a lot of earthworms. These are noticeable through their segmented bodies.
5. Put your earthworm specimens inside the collecting jars with 70% alcohol. Three or four medium-sized earthworm specimens will do.
6. Once at home, transfer your specimens to a bottle cap with white background and examine closely the parts. We will study only the external parts. You start from the anterior (front or head) to the posterior (back or tail) part of the body. Count the number of body segments. How many are there? Are all the segments of equal sizes?
7. From the anterior to around one third of the body, you will encounter an enlarged segment that is girdle-like. This is the ***clitellum***. Can you see it? This is used in reproduction.

Now, focus on the last segment where the anus is located. Is it similar to the other segments? What do you think this is for?

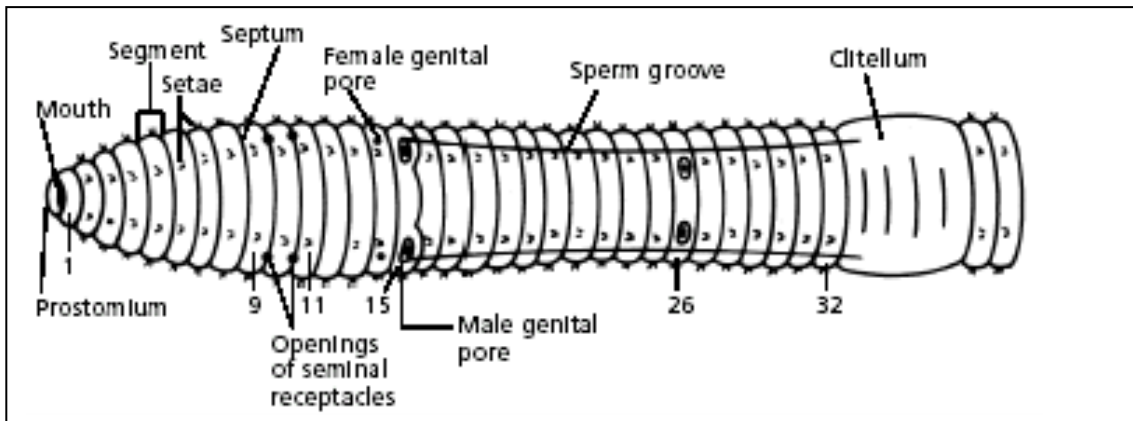
Answer the following:

1. In what part of your garden did you find the earthworms?
2. What part of the body is found in the first segment?
3. More or less, how many segments did you find in the earthworm?
4. Are the segments of equal sizes?

5. What is the girdle-like band on the body of the earthworms? What is it for?

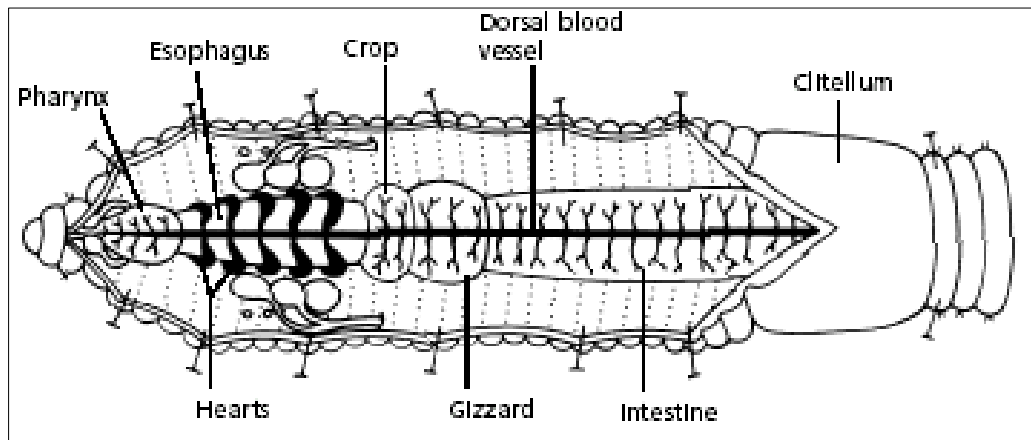
 Key to answers on page 37.

The digestive system of the earthworm is made up of **crop**, **gizzard**, and **intestine**. The soil eaten by the earthworm moves to the crop for storage. Behind the **crop** is a structure, the **gizzard**, that grinds the soil. In the intestine that follows, food is broken down and absorbed by the blood. Undigested soil and waste materials leave the worm through the anus.



http://sps.k12.ar.us/massengale/earthworm_dissection.htm

Figure 8a. External Parts of an Earthworm



http://sps.k12.ar.us/massengale/earthworm_dissection.htm

Figure 8b. Cross-section of an Earthworm

Do you know?

... that earthworms eat soil? While they burrow through the soil they are actually eating it. Earthworms get their energy from the bits of leaves and other plant and animal materials mixed with the soil.



What you will do

Self-Test 3.1

1. What are parasitic worms? Free-living worms?
2. Which one has more hosts-tapeworms or ascaris?
3. What do earthworms eat?
4. How could you be infected with Ascaris?
5. What part of the digestive tube of earthworms functions for grinding food?



Key to answers on page 37.

Lesson 4. The Soft-Bodied and Joint-Legged Animals

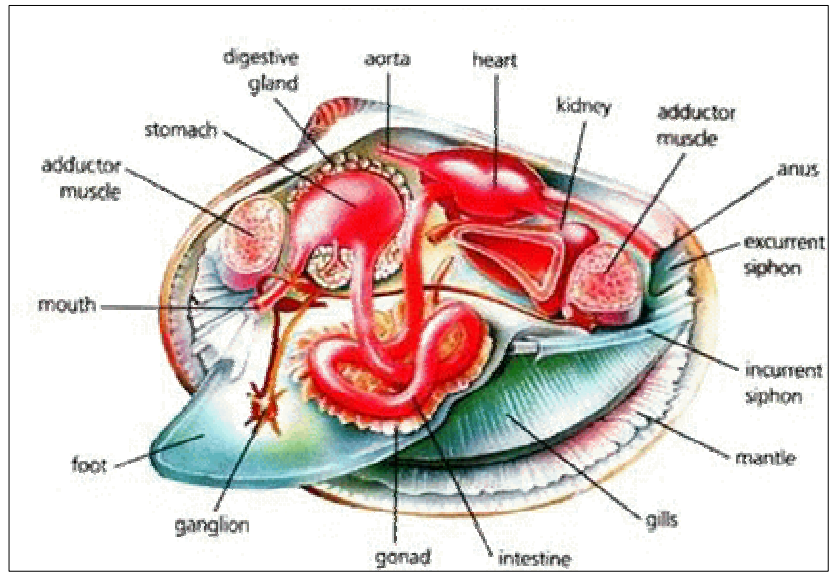
This lesson includes two groups of animals, the **soft-bodied** animals and the **joint-legged animals**. The soft-bodied animals are also called **molluscs**. They have soft bodies, some of which are protected by one or two shells while other members do not have valves. The joint-legged animals are those with joint appendages and segments known as the **arthopods**.

The Soft-Bodied Animals

Have you ever collected shells, watched a snail crawl, or had squid for dinner? Then you must be familiar with mollusks. The word **mollusk** is a Greek word meaning "soft". Mollusks are soft-bodied invertebrates that usually have shells. They are found on land, in freshwater and in salt-water habitats.

In our study of soft-bodied animals, we will just limit our discussion to the three most common types such as the **univalves**, **bivalves** and **cephalopods**. However, the diagram will include all the other members such as chiton, squid, and octopus. Most molluscs have soft bodies covered by a hard shell. Covering the soft body is the mantle. The **mantle** is a thin layer of tissue that secretes the shell, or protects the body if the mollusk does not have a shell. Between the soft-body and the mantle is the space called the **mantle cavity**. Inside it are the **gills**, organs that exchange oxygen and carbon dioxide with water. The

body organs of mollusks are located in an area called the visceral mass. The mantle covers the visceral mass. Finally, all mollusks have a **muscular foot** used for movement.



<http://sps.k12.ar.us/massengale/wpe8.gif>

Figure 9a. Parts of a Soft-bodied Animal (Clam)

Look at the diagram that follows. It includes all the other members of **Phylum Mollusca**.



www.medinavalleycentre.org.uk/limpet_grazing.htm

Figure 9b. Molluscs

To be more familiar with these soft-bodied animals, do this simple activity:

FIND OUT!

Use a hand lens (if necessary) to observe a clam. You can get the clam in the market near your place. Count the number of rings or bands on the shell. Count the large top point called the ***crown*** as one ring. Are all the bands of the same width? Can you tell what the width of the bands may indicate?

Get actual specimens of clams, oysters and mussels (tahong). What is common to all of them? If your specimens are alive, notice how they close and open their shells. Except for the oyster, how do they move from one place to another?

If you answered:

- No, because each band signifies the abundance of food during the growing season.
- They all have 2 valves (bivalves).
- They move by using their foot.

Congratulations! All your answers are correct

Have you heard?

...that pearl oyster produce pearls? Pearls are formed in many bivalves. Pearls are secreted by the mantle in layers around a grain of sand or other particles trapped between the mantle and the shell of pearl oysters.



What you will do

Activity 4.1

Prepare the following materials:

Squid, forceps, scissors, chopping board

Procedure:

1. Get a fresh specimen of a squid and study its external parts.
2. Notice that it has two eyes on the lateral sides.
3. Examine the tentacles. They have suckers with teeth. Two of the tentacles are larger than the others. This holds the victim and brings it to its mouth.

4. Locate the mouth with the teeth. The tentacles bring the captured food into the mouth.
5. Notice the fins. These are useful in swimming. The mantle covers most of the body.
6. When you prepare squid for cooking. One thing that you remove is the elongated cellophane-like part inside. Do you know what this is? It is called as the **pen**. This serves for buoyancy.
7. Notice the presence of the ink sac. What is this for?

Answer the following:

1. How do squids capture their food/prey?
2. Why do squids and octopuses release ink into their surroundings?



Key to answers on page 37.

Do you know?

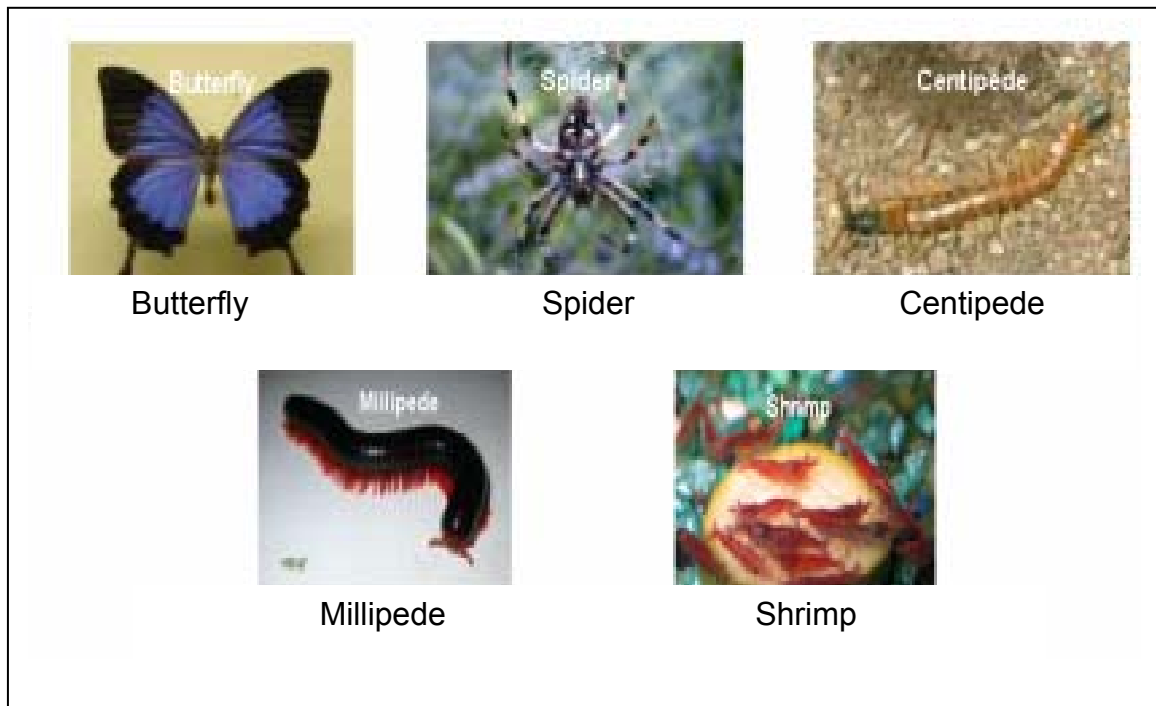
...that squids can swim at more than 60 meters per second? They can move faster than an octopus.

They also have the longest nerve fiber. It is 50-100 times longer than any nerve fiber found in man.

The Joint-Legged Animals

Have you ever been attacked by arthropods? If so, I'm sure they could be insects, crabs, centipedes, millipedes, spider or maybe a scorpion. All of these mentioned are arthropods or joint-legged animals. Arthropods make up around 75% of all animals in the animal kingdom. They are well adapted to almost every environment on Earth.

Appendages are structures that grow from the main body. Your arms and legs are appendages. The jointed appendages of arthropods include the legs, the antennae, the claws and the pinchers. In this lesson, you will be introduced to the different groups of joint-legged animals. To be more familiar with all its members, study the diagram on the next page. The organisms shown are all members of Phylum Arthropoda.



www.dannedjur.com/einsect20.shtml

Figure 10. Arthropods

For a start, try to acquaint yourself with the arthropods in the field. A meadow or grassland would be ideal for this activity. If no grassland is nearby, the backyard of your house will do.



What you will do **Activity 4.2**

Prepare the following materials:

insect net
forceps
trowel
wide-mouthed bottle or small plastic bags

The purpose of this activity is to observe and not necessarily to collect (except for some). Therefore, you are not supposed to damage or destroy the animals. You can release them later. Try also to look for specimens in the soil. Use a trowel for this purpose. Take note of the arthropods that you collect and list them in your notebook.

After you are through, fill the blank spaces below:

Name of specimen	_____
1. Symmetry	_____
2. No. of body regions	_____
3. No of legs	_____
4. Interesting features	_____
5. Where found	_____
6. Locomotory organs	_____

Answer the following questions:

1. How many types of arthropods did you observe?
2. What is the most common among the arthropods that you observed?
3. Where did you find them?
4. Are your specimens moving or not?
5. What organs do they use?



Key to answers on page 37.

Now, let us start our discussion of the arthropods. Aside from the presence of appendages, arthropods also possess an external covering called the **exoskeleton**. The exoskeleton covers, supports and protects the body. This exoskeleton is a non-living structure that cannot grow as the animal grows. This is periodically replaced by a new one and the process is called **molting**. The cast-off integument is called the **exuviae**, and the arthropod undergoing molting is called an **instar**. The new skeleton is soft and takes time to harden. You must have observed a crab with soft shell. It has just molted and the new shell hasn't hardened yet. The old exoskeleton has been replaced. Molting indicates growth among arthropods.

Insects

You must be very familiar with *insects*. Insects are the most abundant and most widely distributed member of the phylum. No other group of animals has as many members as *class Insecta*. More than *700,000 species* of insects have been described and about *300,000* of these alone are beetles! Scientists describe thousands more each year. Let's look at the features that distinguish insects from other arthropods and also find out what make them so diverse among all the animals on earth. Insects have three body regions, the *head, thorax and abdomen* (please refer Figure 11). They are also provided with three pairs of legs (hexapod).

Have You Heard?

A honeybee colony sometimes contains 30,000 – 40,000 workers.

The capacity of insects to survive is due partly to its high chance of **adaptability** and great variations in lifestyles. Insects live in almost every habitat, from tropical forests to frigid areas. Their **ability to fly** has also allowed them to transfer to new, unexploited habitat, and to escape from predators. It has also helped them to disperse and enabled them to have greater access to food and more desirable environment. Some insects can **multiply** rapidly. Take the flies, for example. Some flies can produce new generation every eight to ten days just like the *Drosophila* flies. In the case of certain insects, like the termites, the female can lay more than one million eggs during her life time. A queen bee on the other hand, can lay more or less one million eggs during her life time. That's about 1000 eggs per day.

Have You Heard?

One of the differences between social ants and termites is that termites depend on “child labor”. In a termite colony, nymphs work. In an ant colony, the larvae are cared for by the adult workers.

If you can collect a grasshopper nearby, you can study the parts of an insect using the guide below:



What you will do Activity 4.3

Get the following materials: dissecting pan, etherized grasshopper and dissecting needle

Put the etherized grasshopper in a dissecting pan and locate the following parts:


- | | |
|-------------|------------|
| a. antennae | e. legs |
| b. eyes | f. wings |
| c. head | g. abdomen |
| d. thorax | |

1. Count the number of body regions. How many are there?
2. Starting from the head try to look at the appendages. How many antennae do you see? How many eyes? Insects' eyes are called **compound eyes**. The

mouthpart is composed of several appendages. They have mandibles, and other parts, which we will not discuss in detail.

3. The second body region, the thorax has 3 pairs of legs and two pairs of wings.
4. The abdomen is segmented in insects, but there are no appendages similar to those of the thorax.

As you go over the parts, you can refer to the Figure 11.

 Key to answers on page 37.

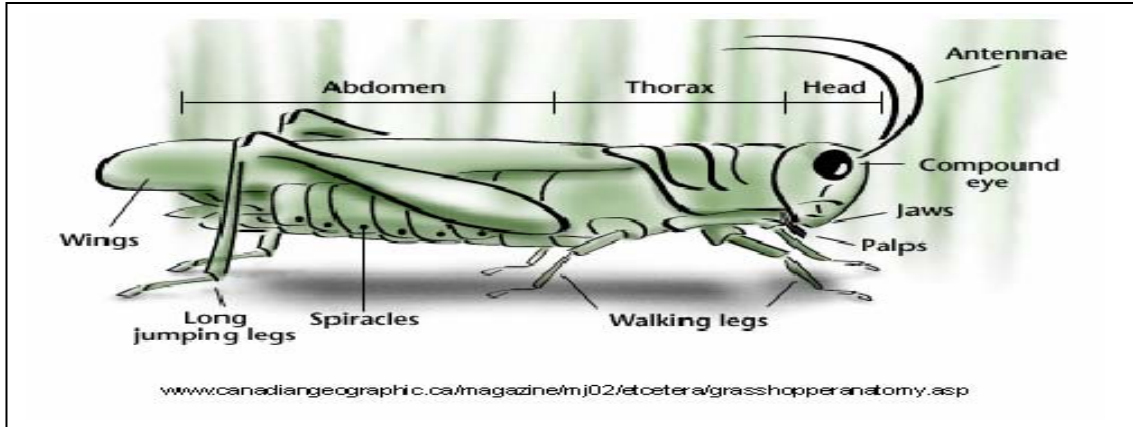



Figure 11. External Parts of a Grasshopper



What you will do
Self-Test 4.1

True or False. Write the answer on the blank.

- _____ 1. A squid can swim faster than an octopus.
- _____ 2. Tahong is a univalve.
- _____ 3. Legs and wings are examples of appendages.
- _____ 4. All insects molt.
- _____ 5. Insects have two body regions.

 Key to answers on page 37.

Lesson 5. The Spiny-Skinned Animals

You may be familiar with the spiny-skinned animals, the **echinoderms**. These are found along the coastal area and in school laboratory or natural museums. Most echinoderms are marine animals. Examples of echinoderms are starfish, sea urchins, sand dollar, sea cucumber and sea lilies. Some of their remains maybe washed up on the beach. **Echin** is a Greek word meaning **spiny** and **derm** means **skin**. So, echinoderm means **spinny -skinned animals**.

The spiny part refers to the spines that cover the outside of these animals. Their bodies are supported and protected by an internal skeleton made of calcium plates. The plates are covered by a thin, spiny skin. They are very colorful. There are about **5,000** species of echinoderms. Some echinoderms are edible just like the sea cucumber which are converted into **trepang**, a Chinese delicacy. The gonads of some sea urchins are also used for food.



What you will do

Activity 5.1

For a start, if you live close to the shore, try to do this:

1. First make sure that it is low tide so that you can have an access to the deeper (knee high) part of the shoreline.
2. From here, try to observe invertebrates that are spiny-skinned. The most familiar you could probably see are the starfishes. They have 5 arms radiating from the center.
3. Try to lift one live starfish and observe the tube feet at the ventral side of the animal. The tube feet are used for movement of the animal. Observe other echinoderms like the sea urchin. Be very careful in handling this animal. They are spiny and some are with poisonous spines.
4. Other echinoderms that you will encounter along the sandy-rocky side of the shore are the brittle stars and sand dollars.
5. Look for sea cucumbers. These have leathery skin and are soft.

Based on your observations from this simple activity, try to answer the following:

1. How many types of echinoderms did you see?
2. What features do all echinoderms have in common?
3. How do echinoderms move and get their food?



Key to answers on page 38.

Now, in case you have doubts with your answers, try to study the diagram below. These are examples of echinoderms. Are you familiar with them?

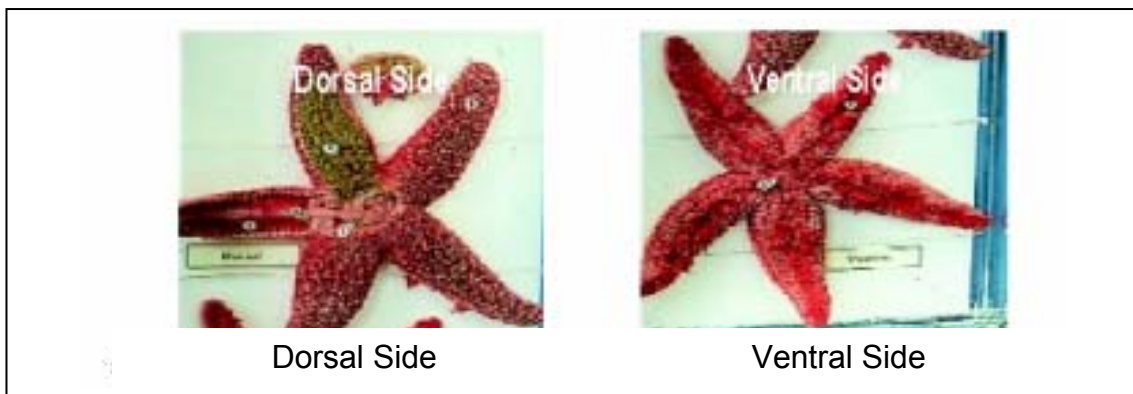


www.greengabbro.net/photoblog/archives/000713.php

Figure 12. Echinoderms

Starfishes

Seastars or starfishes demonstrate the basic features of echinoderms' structures and functions. Sea stars are widely distributed along the intertidal zones. Sometimes large numbers of them may group together on rocks. They also live among muddy or sandy bottoms and coral reefs. Their color varies. Some are orange or red, while others are blue. Are you familiar with the seastar on Figure 13?



www.fishprofiles.com/interactive/forums/thread.asp?id=21662

Figure 13. Dorsal and Ventral View of a Starfish

The dorsal and ventral sides of a starfish are shown on Figure 13. Note the radial symmetry and five arms. Most starfishes are **pentamerous** or with five arms. The arms have **tubefeet** on the ventral side that help in movement through action of the water vascular system (WVS). The **mouth** is located on the ventral side, at the center. Opposite to this, on the ventral side is the **anus**. They are mostly carnivorous and feed on mollusks like clams and oysters.

Congratulations! At last you are through with the module. I hope you enjoyed your journey to the invertebrate world.



What you will do

Self-Test 5.1

Matching Type. Match the sentences in column A with the words in column B.

A

1. Term used for echinoderms with 5 arms
2. Meaning of **echinos**
3. Also called the crown of thorns
4. A Chinese delicacy
5. The groove where tubefeet stick out

B

- a. ***Acanthaster planci***
- b. spiny-skinned
- c. Trepang
- d. Ambulacral
- e. Pentamerous



Key to answers on page 38.



Let's Summarize

1. There are more or less 1 million different species of animals.
2. There are seven major units or levels of classification with the kingdom as the largest unit and the species as the basic unit of classification.
3. Originally, there were only two kingdoms established by Linnaeus now, some books use the eight- kingdom system.
4. There are nine major phyla of the animal kingdom. The simplest groups are the pore-bearing animals and the most complex are the mammals.
5. C. Linnaeus introduced the binomial system of classification. In this system, he gave two names to an organism, the *genus* and the *species* name.
6. Sponges are the simplest group of animals. Only tissues are present. The osculum serves as their mouth. This is a large opening on top of the sponges. Sponges produce skeletons in the form of spongin and spicules.
7. Cnidarians are soft- bodied animals with stinging tentacles arranged in circle. They are mostly marine in habitat with only a few like the Hydra that is terrestrial.

- They have tentacles to capture their prey. They use stinging cells to paralyze their prey.
8. Flat worms are soft and dorso-ventrally flattened. Planaria is an example of a free-living form. Tapeworm and flukes are parasitic flatworms. Pork tapeworm involves two hosts, man and pig. The adult tapeworm is found in man while the larvae are found in the pig.
 9. The male ascaris has a bent posterior part while the female ascaris has a straight posterior end.
 10. *Ascaris lumbricoides* involves two hosts, man and pigs.
 11. The adult lives in the intestine of man while eggs and larvae are found in the intestine of pigs. These larvae will later on migrate to the muscles of the pig.
 12. Earthworms love to live in wet and moist places because they use their wet skin for gas exchange.
 13. Earthworms feed on soil and other decaying waste materials.
 14. There are four groups of mollusks: the monoplacophorans, univalves, the bivalves and the cephalopods. Some bivalves like the oyster pearl produce pearls from the foreign materials that get inside the mantle of the animal squids. They also have the longest nerve fiber. It is 50-100 times longer than any found in man.
 15. Cephalopods produce ink for body defense against enemies.
 16. Arthropods are characterized by an exoskeleton of chitin, jointed appendages, and a segmented body.
 17. In order to grow, arthropods must periodically remove/change its old exoskeleton, the process is called molting.
 18. Insects are the most abundant of all the arthropods. They are also widely distributed because of their ability to fly.
 19. Insects have three body regions - the head, the thorax and abdomen.
 20. Echinoderms are spiny-skinned animals.
 21. They move by means of the tube feet propelled by the water vascular system.
 22. Sea cucumbers look different from the other groups due to the absence of hard covering or hard ossicles.



Posttest

Test I. Multiple Choice. Choose the letter of your answer and write it on your answer sheet.

1. Which among the following animals is **NOT** spiny-skinned?

a. bivalve	c. sea cucumber
b. brittle star	d. sea urchin
2. Which of the following is a primary characteristic of sponges?

a. antennae	c. suckers
-------------	------------

- b. pores
d. tentacles
3. In the binomial system of classification, organisms are given two names. What is it composed of?
a. family and genus name
b. species and genus name
c. order and genus name
d. local and international name
4. Which among the following animals has many pores or openings in its body?
a. Ascaris
b. earthworm
c. sponge
d. tapeworm
5. What is another name for mollusks with two valves?
a. bivalve
b. gastropod
c. trivalve
d. univalve
6. Which among the following animals has different canal systems?
a. earthworm
b. sea anemone
c. sponge
d. tape worm
7. All of the following are parasitic worms except:
a. ascaris
b. earthworm
c. hookworms
d. tapeworms
8. Jellyfishes are noted for their powerful tentacles. What are their tentacles for?
a. for excretion
b. for digestion
c. for reproduction
d. for capturing food and defense for excretion
9. The number of body regions in insects is:
a. one
b. two
c. three
d. four
10. Animals are classified based on the presence or absence of a vertebral column. Which of the following is **NOT** an invertebrate?
a. fish
b. jellyfish
c. sponge
d. starfish

Test II. Matching Type. Match column A with column B. Write the letters only.

- | A | B |
|--|----------------|
| 1. Presence of two valves | a. grasshopper |
| 2. The cavity found inside the sponges | b. spongocoel |
| 3. A freshwater group of Cnidarians | c. Hydrozoa |
| 4. Attaches tapeworms to the intestinal wall | d. Ascaris |

5. Presence of tube feet
6. Where eggs are hatched in earthworms
7. Male worm with spicule
8. Causes the disease called taeniasis
9. With three body regions
10. With two body regions

- e. Spider
- f. Tapeworms
- g. Starfish
- h. Clitellum
- i. Hooks
- j. bivalvia



Key to answers on page 38.



Key to Answers

Pretest

Test I. Multiple choice

- | | |
|------|-------|
| 1. c | 6. d |
| 2. d | 7. a |
| 3. b | 8. d |
| 4. c | 9. c |
| 5. c | 10. b |

Test II. Matching Type

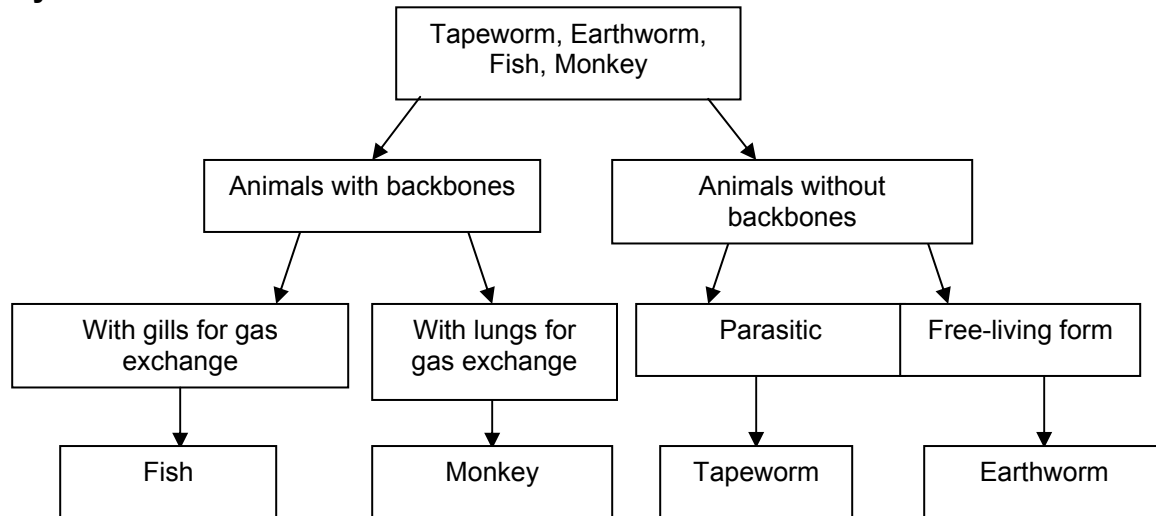
- | | |
|------|-------|
| 1. a | 6. h |
| 2. d | 7. g |
| 3. b | 8. e |
| 4. j | 9. c |
| 5. f | 10. i |

Lesson 1

Activity 1.1

- | | |
|--------------|--------------|
| 1. Ostrich | 6. Starfish |
| 2. Ascaris | 7. Crab |
| 3. Jellyfish | 8. Earthworm |
| 4. Snake | 9. Whale |
| 5. Tapeworm | 10. Frog |

Activity 1.2



Self-Test 1.1

1. Linnaeus
2. Invertebrates
3. 95%
4. Kingdom
5. Species

Lesson 2

Self-Test 2.1

1. Spicules are for defense/protection.
2. Pores, and ultimately to the osculum
3. It starts from a zygote, then the zygote becomes a ciliated planula larvae, which later on becomes a polyp. The polyp undergoes strobilation forming the young medusa which later on will become either a male or female jellyfish.
4. Nematocytes are provided with stinging cells.
5. For catching the prey/food

Lesson 3

Activity 3.1

Probable answers:

1. Approx. 2 meters
2. Scolex is provided with hooks and suckers. The hooks are for attachment, while the suckers are for sucking nutrients.
3. Approx. 200 segments

Activity 3.2

In case your answer in question no. 2 is: as protection for the acidic environment inside the digestive tube, you are correct! In question number 3 the answer is: No, the male has a bent posterior part while female a straight end.

Activity 3.3

1. damp soil
2. mouth or prostomium
3. 75 segments
4. yes
5. clitellum, for hatching eggs

Self-Test 3.1

1. Parasitic worms depend on the host, while free-living looks for their own food.
2. Tapeworms
3. Soil mixed with dried leaves and other materials
4. Improper sanitation and eating infected food
5. Gizzard

Lesson 4

Activity 4.1

1. The arms or tentacles sweep the food / prey towards the mouth.
2. They release ink for defense purposes against their predators.

Activity 4.2

Possible answers:

1. I observed four groups of arthropods.
2. The most common ones are insects.
3. I found them attached to trees, under stones and some in the soil.
4. They are very mobile.
5. They have legs for locomotion.

Activity 4.3

1. 3 body regions
2. 1 pair
3. 1 pair of compound eyes

Self-Test 4.1

1. True

2. False
3. True
4. True
5. False

Lesson 5

Activity 5.1

Possible answers:

1. More or less 5 groups
2. Spinny-skinned and radial symmetry
3. Through the water vascular system (WVS) and tubefeet

Self-Test 5.1

1. e
2. b
3. a
4. c
5. d

Posttest

Test I. Multiple choice

- | | |
|------|------|
| 1. d | 6. d |
| 2. d | 7. a |
| 3. b | 8. d |
| 4. c | 9. c |
| 5. c | 10.b |

Test II. Matching Type

- | | |
|------|------|
| 1. j | 6. h |
| 2. b | 7. d |
| 3. c | 8. f |
| 4. i | 9. a |
| 5. g | 10.e |

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